Comments from Referee #2

Interactive comment on "Direct or indirect recharge on groundwater in the middle-latitude desert of Otindag, China?" by Bing-Qi Zhu and Xiao-Zong Ren, Anonymous Referee #2, Received and published: 6 June 2018.

Groundwater availability in arid and semi-arid regions is one of the key issues in hydrogeology and is becoming even more important because of the expected climate changes. Within this context, the contribution by Zhu and Ren provides an interesting analysis on the possible recharge supporting the availability of significant groundwater resources in the Otindag desert, north-eastern China. The analyses have been carried out using hydrogeochemical tracers and isotopic measurements on water samples collected from groundwater, surficial (river, lake, and spring) waters, and precipitation water, as well as in-situ records of temperature, pH, conductivity, and TDS concentration. The various steps implemented by the authors to reject possible hypotheses on the groundwater origin (e.g., water flowing from another nearby arid area, precipitation, paleo-water resources) are presented in detail and discussed. Zhu and Ren concludes that, based on the available evidences, the groundwater resources in this region are recharged by the leakage through the bed on incise rivers bounding the desert to the east and conveying downward the waters originated from the precipitation on Daxinganling Ranges. Hence, an "indirect" recharge is the main mechanism supporting the water availability in the study arid lands.

Two are the main weaknesses of this ms: 1) the chemical/isotopic investigations seem not supported by a (at least minimum) knowledge of the hydrogeological setting. This is likely one of the reasons why the analyses carried out by the authors are mainly able to exclude recharge mechanisms, but not definitely explain from where this water is originated. The last part of Section 5.5 provides a list of speculative mechanisms (lines 614-652): how the Xilamulun river can recharge the Dali lake when Fig. 15 shows that the bed of the former is less elevated than that of the latter? What support the "speculation" about the "flash floods" in the southern portion of the desert? How you only "theoretically estimate" the isotopic firm of the precipitation on the Yinshan Ranges? 2) the contribution is over-long. The introduction addresses the topic with a too-wide perspective, concepts are repeated, with verbose descriptions. There are also too many figures that can be fruitfully combined. The English form must be improved too. Moreover, the location of the study area is unclear: Fig 1a is obscure, the various portions of the desert are not provided in the maps shown in Figs. 1b and 2, a large part of the toponymy cited in the text is not added to the maps. Because of this, the ms need a major revision.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2018-71, 2018.

The authors' responses to the comments from Referee #2

Dear Dr/Professor Referee #2:

On behalf of my co-authors, we thank you very much for giving us an opportunity to revise our manuscript. We appreciate you very much for your positive and constructive comments and suggestions on our manuscript (hess-2018-71). We have read your comments carefully and have made revision which marked in red in the revised manuscript. We tried our best to revise our manuscript according to your comments and suggestions one by one. Attached please find the revised version, which we would like to submit for your kind consideration. Thank you and best regards.

1) The chemical/isotopic investigations seem not supported by a (at least minimum) knowledge of the hydrogeological setting. This is likely one of the reasons why the analyses carried out by the authors are mainly able to exclude recharge mechanisms, but not definitely explain from where this water is originated. The last part of Section 5.5 provides a list of speculative mechanisms (lines 614-652): how the Xilamulun river can recharge the Dali lake when Fig. 15 shows that the bed of the former is less elevated than that of the latter? What support the "speculation" about the "flash floods" in the southern portion of the desert? How you only

“theoretically estimate” the isotopic firm of the precipitation on the Yinshan Ranges?

Our response: AGREE AND CHANGES MADE.

We thank you very much for this comment. Yes, any chemical and isotopic investigations need to be supported by knowledge of the regional- and local-scale hydrogeological settings. According to this comment, we have added the specific information about the hydrogeological, geological (tectonic, lithological, sedimentological and structural), geomorphological, stratigraphical settings of the study area in the revised manuscript. Detailed changes and the added information can be seen from the section “2. Regional settings” and the section “4.5 remote water recharge on groundwater in the Otindag: mountains waters” in the revised manuscript (pages 2-4 lines 103-188 and pages 8-9 lines 441-483). Besides, two newly-built figures about the geological and hydrogeological maps of the study area are also provided as auxiliary instructions to illustrate the hydrogeological characteristics of the Otindag Desert in the revised manuscript. These figures are Figs. 2 and 3 in the revised manuscript. With the help of these newly-added materials we believe that we can definitely and logically explain from where the groundwater in the Otindag is originated.

About the Fig. 15 in the original manuscript (at present it is Fig. 11 in the revised manuscript) and the question “how the Xilamulun river can recharge the Dali lake when Fig. 15 shows that the bed of the former is less elevated than that of the latter?”, our explanation is that: actually, the elevation of the Xilamulun river channel is not lower than the Dali lake. The recent elevation of the Dali Lake is 1,226 m above sea level (Xiao et al., 2008, J Paleolimnol, 40, 519-528). The elevations of the river samples collected from the Xilamulun River in this study ranges between 1360 and 1374 m (Table 1). The real elevation data (measured by handheld GPS in the field) for the river samples l1, l2, l3, l4, l5, l6 in this study are 1368 m, 1368m, 1365 m, 1366 m, 1360 m and 1374 m (Table 1), respectively. Thus, the elevation of the Xilamulun river channel is about 140 m higher than that of the Dali Lake. In Fig. 15 (Fig. 11 in the revised manuscript), it shows the variation of the topographical elevation along the section S1 (see Fig. 1b) from the upstream of the Dali Lake to the location site of the spring water samples s2. It does not show the elevations of the river samples from the Xilamulun River. Strictly speaking, however, this sketch map (Fig. 15) is likely to cause misunderstanding if we think about the river water but not the spring water. So we specially stated that “Note that no river water samples are shown in this figure” in the figure caption of Fig. 11 in the revised manuscript.

About the question “What support the “speculation” about the “flash floods” in the southern portion of the desert?”, we have added specific information about the hydrological settings of the flash foods derived from the Yinshan Piedmont in the section “2. Regional settings” in the revised manuscript (see pages 3-4 lines 157-188).

About the question “How you only “theoretically estimate” the isotopic firm of the precipitation on the Yinshan Ranges?”, we use the words “theoretically estimate” because we have not obtained the precipitation water samples from the Yinshan Mountains in this study. Thus the isotopic firm of the precipitation on the Yinshan Ranges is calculated based on the altitude effect of mountain temperature on stable isotopes fractionation in the original manuscript. It is thus a theoretical estimation. In order to avoid ambiguity, we deleted the discussion of this “theoretically estimation” in the revised manuscript.

2) The contribution is over-long. The introduction addresses the topic with a too-wide perspective, concepts are repeated, with verbose descriptions. There are also too many figures that can be fruitfully combined. The English form must be improved too.

Our response: AGREE AND CHANGES MADE.

We thank you very much for this comment. Yes, according to the comment that “the contribution is over-long”, we have rewritten the manuscript and made an intensive compression on the length of the paper. At present the number of text words in the revised manuscript has been greatly decreased compared with the original manuscript.

According to the comment that “The introduction addresses the topic with a too-wide perspective, concepts are repeated, with verbose descriptions”, we have rewritten the introduction section of the manuscript to make the topic being specific and not being too broad in its perspective. We tried our best to avid repeat and verbose descriptions in the revised manuscript whatever on the concept or the context of this section. The detailed changes can be seen in pages 1-2 lines 32-101 in the revised manuscript.

According to the comment that “There are also too many figures that can be fruitfully combined”, we reduced the number of figures in the revised manuscript by putting some figures together and deleting several figures. At last the revised manuscript has 11 figures compared with the original manuscript that including 15 figures. For example, the Figs. 5, 11, 13, 14a in the original manuscript are deleted in the revised manuscript, and the Figs. 7 and 8, the Figs. 10, 12 and 14a are combined, respectively. In addition, two newly-built figures are added into the revised manuscript according to the first comment from the you (the detailed content of this comment can be seen above). The specific changes and the final results of these figures can be seen in the newly submitted revised manuscript.

About the comment that “The English form must be improved too”, we are very sorry for our poor and incorrect English writing in the original manuscript. For the shortcomings of the English presentation and the grammatical edit in the first paper, we have checked and revised the whole manuscript carefully to avoid language errors, and finally we have got the help of a native English speaking professional to check and improve the English quality of the revised manuscript. We believe that the language is now acceptable for the publishing purpose.

Moreover, the location of the study area is unclear: Fig 1a is obscure, the various portions of the desert are not provided in the maps shown in Figs. 1b and 2, a large part of the toponymy cited in the text is not added to the maps.

Our response: AGREE AND CHANGES MADE.

We thank you very much for this comment. According to this comment, we have revised the Fig. 1a and 1b and Fig. 2 (now it is Fig. 4 in the revised manuscript) to make them clear and make sure that the various portions of the Otindag Desert are provided in the corresponding maps. We tried our best to add each of the toponymy cited in the text to be included in these maps. The specific changes and the final results of these figures can be seen in the newly submitted revised manuscript (Figs. 1-4).

Finally, we want to say that special thanks to you for your good comments. We have tried our best to improve the manuscript and made specific changes in the revised manuscript according to the comments from you one by one. These changes will not influence the content and framework of the paper. And here we did not list the changes but marked in red in the revised paper. We hope that the correction will meet with approval. Once again, thank you very much for your comments and suggestions.

Direct or indirect recharge on groundwater in the middle-latitude desert of Otindag, China?

Bing-Qi Zhu[1*], Xiao-Zong Ren[2], Patrick Rioual[3]

[1]KLWCRESP, IGSNRR, CAS, Beijing, China
[2]SGS, TYNU, Jinzhong, China
[3]KLCGE, IGGCAS, Beijing, China

Correspondence to: Bing-Qi Zhu (zhubingqi@sina.com)

Abstract. The Otindag Desert is essential to livestock-economy and ecoenvironment of northern China. Although surface water is the traditional source for China's socio-economy in arid areas, the groundwater resources underlying the desert are increasingly burdened by groundwater pumping, which increases interest in the status of the groundwater resources. Widespread fresh groundwater deep to 60 m was found at the eastern part of the Otindag Desert. The occurrence of this massive fresh groundwater raises doubts on the often-made assumption in the literature that regional atmospheric precipitation or palaeowater, namely the direct recharge, is the source of water in the middle-latitude desert aquifers of northern China and makes further investigation necessary. Knowledge on the origin and recharge of this fresh groundwater is key in assessing the possibility of groundwater exploitation and utilization. In this study we conducted hydrogeochemical and isotopical analyses to assess possible origin and recharge of these groundwaters. It is concluded that the fresh groundwater can neither originate from regional atmospheric precipitation derived from the Asian Summer Monsoon system, nor from palaeowater that formed during the last glacial period. Our results indicate that with groundwater dating it is possible to originate from remote mountain areas via the faults of the Solonker Suture zone, including the Daxing'Anlin and Yinshan Mountains. Furthermore, it is deduced that the hydrological connection between desert aquifers and mountain systems through the suturezone is crucial to the hydrogeological functioning of the Otindag aquifer.Thissuggests that the modern indirect recharge mechanism, instead of the direct recharge and the palaeo-water recharge,is the most significant for groundwaterrecharge in the Otindag Desert. This study provides a new perspective into the origin and evolution of groundwater resourcesin the middle-latitude desert zone of Asian continent.

Keywords: fresh groundwater recharge; atmospheric precipitation; direct recharge; indirect recharge; palaeowater recharge; fault hydrology; middle-latitude desert; Otindag Desert.

1. Introduction

In a semi-arid to arid region where rainfall is insufficient to supply the needs of a growing population and a higher standard of living, the deficit is normally made up by extracting groundwater. Many areas in the middle-latitude desert zone of northern China such as the Badanjilin Desert, the Mu US sandy Land and the Hobq Desert (Chen et al., 2012a; Chen et al., 2012b), are unexpectedly rich with large groundwater resources although they have been under arid or hyper-arid climate for a long time (Sun et al., 2010). How these groundwaters originated and how they are recharged in these deserts are thus fundamental scientific questions. Until now, however, no consensus has been achieved in academic circles.

The Otindag Desert is one of the largest sandy lands located at the monsoon margin of northern China and is the geographical centre of the northeastern Asian Continent (Fig. 1), which can be regarded as a significant repository of information relating to the groundwater recharge in the arid Inner Asia. At present, the eastern Otindag is also a typical case for its unexpected groundwater resources, because there is abundant groundwater in this desert land and even rivers originate there due to the spillover of spring water, such as the tributaries of Xilamulun River in its north and the Shandian River in its south (Fig. 1). Climatically, the monsoon margin of northern China refers to a strip along the present East Asian Summer Monsoon (EASM) limits and is considered to be sensitive to climate change (Wang and Feng, 2013). Geologically, the Otindag Desert lies in a tectonic depression of the central Solonker suture zone with a few faults stretching east and west (Fig. 2), with its northern margin along a fault marked by a series of lake basins. Thus, the large-scale hydrogeological conditions of the Otindag Desert belong to a fault zone under the influence of the EASM climate.

Until now, however, whether the climate or other factors affected the groundwater recharge in the Otindag are still not known. Little data about the groundwater and its origin is available in the literature, and knowledge and reliable data on various hydrogeological characteristics of the desert such as the catchment extent, input/output, the hysteretic hydraulic functions, the transient hydraulic conditions, in-homogeneities, and on transfer functions to overcome scale problems are also missing. Under such conditions, conventional methods such as water balance and hydraulic methods sometimes fail in determining groundwater recharge, particularly in extreme environments (arid, semi-arid, or cold) (Drever, 1997). Because pristine aquatic conditions may significantly differ from managed conditions in arid environment, and thus groundwater recharge is not a fixed number, but may vary with the boundary conditions of the recharge system (Seiler and Gat, 2007).

Groundwater recharge can be broadly classified into two categories: the direct recharge by native water resources and the indirect recharge by external water resources (Herczeg and Leaney, 2011). Water infiltration of atmospheric precipitation through the unsaturated zone to the groundwater is hydrologically defined as the direct recharge, and the indirect recharge is defined as recharge from mappable features such as rivers, canals, lakes and originates from remote areas (Scanlon et al., 2006; Healy, 2010). It is well known that groundwater recharge can be influenced by environmental factors, including climate change, underlying soil and geology, land cover and the growth in human population that affects withdrawal and economic development (Zhu et al., 2015, 2017). Among these environmental factors, climate and land cover largely determine precipitation and evapotranspiration, whereas the underlying soil and geology dictate whether a water surplus (precipitation minus evapotranspiration) can be transmitted and stored in the subsurface (Doll, 2008, 2009; Giordano, 2009).

For some earth scientists, the direct recharge is thought to be very important for groundwaters in the wide desert lands of north China due to the lack of surface runoffs (Yang et al., 2010; Yang and Williams, 2003; Zhao et al., 2017). They argued that although the amount of atmospheric precipitation is small, the vast catchment area in the desert region could concentrate the rainfall into large inland basins, creating an aquifer with large storage capacity and great thickness. However, some hydrologists estimated by the chloride mass balance method that the direct recharge was 1.4 mm/year, which represents approximately only 1.7% of the mean annual precipitation in a cold large desert (Badanjilin) in northern China (Gates et al., 2008). A similar estimation of 1 mm/year was given for Gobi deserts from the Hexi Corridor to the Inner Mongolia Plateau in northwestern China (Ma et al., 2008). Consequently, they thought that heavy potential evaporation and little precipitation make it difficult for direct recharge to meet the supply of groundwater in these desert areas. Thus, the indirect recharge is considered to be an important mechanism for groundwater recharge in these desert areas. For example, Zhao et al. (2012) suggested that little precipitation had recharged into groundwaters in the Badain Jaran Desert. Chen et al. (2004) argued that the groundwaters in the Badanjilin Desert were recharged by palaeo-glacial melt water through faults and deep carbonate layers far away from the local desert. Many studies also suggested that palaeowaters stored in an aquifer during wetter climate periods could recharge to groundwater under certain conditions in arid lands (Edmunds et al., 2006; Ma and Edmunds, 2006). Other kinds of indirect recharge, such as mountain front recharge from adjacent mountain blocks, are also proposed to offer an important inflow to aquifers within arid to semiarid catchments (Blasch and Bryson, 2007).

In this paper, we focus to answer the question that whether groundwater recharge in Otindag is mainly direct or indirect, using hydrochemical and isotopic indicators as tracers to offer a valuable support for identifying the contributions of preicipitation recharge on groundwater, since these indicators reflect the composition of water molecules and are sensitive to physical processes such as mixing and evaporation (Sultan et al., 2000; Guendouz et al., 2003; Petrides et al., 2006; Scanlon et al., 2006; Zhu et al., 2007, 2008; Jobbágy et al., 2011). The detailed objectives are: (1) to recognize the major sources of groundwater in the area, and (2) to identify the key mechanism of groundwater recharge in the desert.

2.Regional settings

Geographic setting. The Otindag Desert lies between latitudes 42° and 44°N and longitudes 112° and 118° E (Fig. 1). It forms a part of the great middle-latitude desert belt in northern China which stretches from the Taklamakan Desert of northwestern China to the Kelqin Desert of northeastern China, near the west coast of the Pacific Ocean. The desert has an area of approximately 21,400 square kilometers located in the eastern Inner Mongolia and at the monsoon margin of northern China (Fig. 1). It is the fourth largest sandy lands in China (Yang et al., 2012) and is bordered by a flat steppe terrain of Dali Basin to the north, the Yinshan Mountains and mountainous loess landscape to the south, and the the Greater Khingan (Daxing'Anling) Mountains to the east (Fig. 1). The Otindag Desert is essential to livestock-economy and ecoenvironment of northern China. Settlements in this desert are restricted to areas to permanent springs, shallow groundwater and oases to areas where irrigation is possible. Some nomads continue to eke out a precarious existence grazing livestock in the desert.

Topography and geomorphology. The Otindag Desert has a varied relief, combining extensive dune fields with rugged mountains along the eastern, southern and southeastern rims. In the east, the

Daxing'Anling Mountains stretch from the Heilong River Valley into the upper reach valleys of the Xilumulun River from northeast to southwest, gradually increasing in height northwards from about 180 m near Huma to Huanggangliang, where the highest peaks reach 2,029 m with an average elevation range from 1,100 to 1,400 m. In the south and southeast, the Yinshan Mountains decline gradually near Duolun and Zhenglanqi, and in some areas leave wide alluvial plains. The terrain of the Otindag Desert is less rough and elevations decrease from ca. 1300 m in the southeast to ca. 1000 m in the northwest. Over the greater part of this desert the ground cover consists of fixed and semi-fixed sandy dunes, with a few mobile dunes in area of little vegetation. The dominated dune types are represented from parabolic to barchans, linear and grid-formed types, ranging from a few meters to over 40 m in height (Zhu et al., 1980; Yang et al., 2008).

Climate, vegetation and soil. The climate of the Otindag Desert was not uniform in geological period, with much sand movement, occasional rainy years, and several wetter intervals during the Holocene (Yang et al., 2015; Tian et al., 2017). At present the whole desert belongs to the arid and semi-arid temperate zone, with a meanannual temperature of 2 °C in the north and 4°Cin the south (Liu and Yang, 2013). At the regional scale, the climate of the desert is typically controlled by the East Asian Monsoon system, characterized by a warm summer, with precipitation transported by the EASM, and by a cold and dry winter under the influence of the East Asian Winter Monsoon (EAWM). The rainfall in the desert exhibits a wide variation in space and time. Influence of the EASM changes from southeast to northwest in the desert, and varies with latitude and distance from the Pacific Ocean, leading to the mean annual rainfall decreasing from ~450 mm in the southeast to ~150 mm in the northwest (Yang et al., 2013). This uneven distribution of precipitation has a major influence on the availability of near-surface moisture, consequently on the distribution of vegetation, soil and the animal husbandry potential of local communities. The basic soil cover consists of grey desert soil in the west and changes to sierozems and chernozem or chestnut soil in the east. Through the desert, vegetation is sparse in the west and relatively abundant in the east. The natural vegetation is characteristic of desert or semi-deserts, with scrub woodland in the east and steppe in the west. Due to the scarcity of surface water, the growing season is affected by temperature, rainfall and elevation, and hence cultivation is restricted mainly to flood plains.

Geology. The Otindag Desert is located in a tectonic depression of the Solonker Suture Zone (Jian et al., 2010) bounded by the Northern Early to Mid-Paleozoic Orogen Zone and the Hatug Uul Block to the north, the Southern Early to Mid-Paleozoic Orogen Zone and the North China Craton system to the south (Fig. 2). A few faults such as the Xar Moron Fault and Chifeng-Bayan Obo Fault stretch east and west, with its northern margin along the Solonker Suture Zone marked by a series of lake basins (Figs. 1 and 2). The tectonostratigraphic units and overall structural trends are mainly oriented NE–SW (Fig. 2), which may be interpreted as resulting from overall compressive stresses oriented principally in the NW–SE quadrants during orogenesis (Jian et al., 2010; Zhang et al., 2015). Diverse rock types from unlithified and lithified clastic sediments through to carbonate, crystalline, and volcanic rocks are distributed in and around the Otindag Desert (Zhang et al., 2015) (Figs. 2 and 3). Tertiary and Quaternary sandstones and mudstones are the common basement rocks under the dunes of the Otindag, and extensive volcanic basalts forming flat terrains are to the north (Zhu et al., 1980; Li et al., 1995).

Hydrology and hydrogeology. The Otindag Desert originated during the Late Quaternary (Yang et al., 2015) and various alluvial fans formed at the margins of this desert during the early to middle Holocene. These are composed of conglomerate and sand deposits, where major periodic steams or wadis debouched into the Otindag. At present two rivers run through the eastern margin of the Otindag Desert, i.e. the Xilamulun River in the north and the Shandian River and its two tributaries, the Shepi River and Tuligen River in the south. Both stem from the eastern and southeastern parts of the Otindag (Fig. 1). The Xilamulun River, 380 km in length and 32.54×10^3 km^2 in area, is a neighboring river both to the northeastern Otindag and the southeastern Dali Basin, the northern catchment of the Otindag Desert. The Xilamulun River flows to the east and finally goes into the Xiliao River, with an annual mean runoff of 6.58×10^8 m^3 (Wu et al., 2014). The Shandian River is the upper reach of the Luan River, with a length of 254 km and a catchment area of 4.11×10^3 km^2 (Yao et al., 2013). Along the low, flat and sandy shorelines of some lakes in the Otindag, salt flats or sabkhas have formed in shallow depressions. Due to the high rate of evaporation, salt crusts develop which have been locally exploited where the salt is relatively free from sand. During rainy season, some rain and floodwaters (generally coming from the Yinshan piedmonts) are retained in low-lying areas, which may temporarily recharge shallow aquifers. Under storm conditions, occasional heavy, short rainstorms cause floods in soil-rich wadi channels. Under other conditions, sand dunes and sand sheets bury the ground and sabkhas.

The Otindag Desert can depend on several water-bearing formations and units (aquifers) for their groundwater resources (Fig. 3). Coarse- to fine-grained sedimentary rocks, magmatic rocks and metamorphic rocks of the Inner Mongolia-Daxing'Anling Orogenic Belt (Zhang et al., 2015) form the major regional aquifer unit (Fig. 3). They are composed mainly of alluvial sediments (mid-Permian Zhesi Formation), melange (Solonker suture zone), A-type granite (early Permian), bimodal volcanic rocks with sedimentary intercalations (early Permian Dashizhai Formation), diorite-quartz diorite-granodiorite rocks (Carboniferous-Permian) and metamorphic complex (predominantly gneiss, early Paleozoic) (Fig. 2). The aquifer is generally unconfined in dune fields of the Otindag Desert, unconfined to semi-confined in the Yinshan Mountains' piedmont, and semi-confined to confined in the Daxing'Anling uplands (Fig. 3). Water-level measurement in June 2010 indicated that the general depth of unconfined groundwater level ranges between 10 to 70 m in the Otindag Desert (Fig. 3). Local granular aquifers in the central desert are composed of coarse fluvial, lacustrine and aeolian sediments, but their extent and thickness vary throughout the watershed (Zhu et al., 1980; Li et al., 1995). The generally coarse-grained texture of the unconsolidated rock formations provides primary porosity in terms of groundwater flow in the desert.

3.Methods

The hydrochemistry of natural water in the Otindag Desert, as related to the prevailing EASM climate, as well as, the dominant topographical, geological (tectonic) and hydrogeological conditions, are discussed here and interpreted, using chemical and isotope analyses of water samples from rain, springs, shallow aquifers and deep aquifers, rivers and lakes, and are represented on relevant graphs and diagrams. Fieldworks took place during the summer season of 2011 and the spring season of 2012. Water samples were mainly retrieved from shallow and deep wells located over a wide area in dune fields of the study regions. The detailed locations of the sampling sites are shown in Fig. 4.

Two groups of parameters are measured to characterize the chemistry of any water analysis: field-measured parameters and lab-measured parameters. The filed-measured parameters include temperature (°C), hydrogen-ion concentration (pH), electrical conductivity (EC in micro-Siemens per centimeter or μS/cm) and total dissolved solid (TDS, mg/L). The values of these parameters change when they are not directly measured in the field. The number lab-measured parameters depend on the purpose of study. However, the measurement of major cations (F^-, Cl^-, NO_2^-, NO_3^-, $SO_4^{2-}$$HCO_3$-, $CO_3^{2-}$and $H_2PO_4^-$) and anions (Li^+, Na^+, NH_4^+, K^+, $Mg^{2+}$and Ca^{2+}) are determined in most chemical analyses. Analysis for stable (^2H and ^{18}O) and radioactive isotopes (^3H) in rain and groundwater are also included. The analytical data of the physiochemical parameters and the stable and radioactive isotopes of the water samples collected in this study are listed in Tables 1, 2 and 3, respectively.

4.Results and Discussions

4.1.Hydrochemical characteristics of natural waters

The natural water samples collected in this study are generally neutral to slightly alkaline, with the pH values varying between 6.26 and 9.44 (except the precipitation sample p1, 4.61) (Table 1) and a median value of 7.27. The TDS values range between 67 and 660 mg/L (average 211 mg/L) (Table 1), all belonging to fresh water(TDS < 1000 mg/L) in the salination classification of natural water (Meybeck, 2004). The variations in ion concentrations of the major cations and anions in the studied water samples were displayed in a fingerprint diagram with a semi-logarithm y-axis (Fig. 5). The rain water sample is the most depleted in ions among these samples. The groundwater samples have the highest concentrations of cations and anions and the lake, river and spring waters had intermediate values. The calcium concentration is the highest among cations in almost all of the water samples, and the HCO_3+CO_3 concentration (bicarbonate + carbonate, alkalinity) is the highest among anions in most of the water samples. For several groundwater samples (g3, g4, g5, g6 and g11), spring sample (s1) and precipitation sample (p1), they have higher SO_4 concentrations than alkalinity (Fig. 5).

Two chemically distinct water types are recognized for the studied waters via a Piper diagram (Fig. 6), calcium bicarbonate and calcium sulphate. No Chloride-type and sodium-type waters occur in the study area (Fig. 6). Based on more than 10,000 chemical analyses of groundwater samples from the world, Chebotarev (1955) observed that the global groundwater tends to evolve chemically towards the composition of seawater. He also observed that this evolution is associated with regional changes in dominant anions but not cations, as the concentration of cations may exhibit a wide range of fluctuations in groundwater and is not as steady as the changes in anion dominance. Freeze and Cherry (1979) illustrated the Chebotarev's (1955) general evolution of groundwater as a anion evolution line: $HCO_3^- \rightarrow HCO_3^- + SO_4^{2-} \rightarrow SO_4^{2-} + HCO_3^- \rightarrow SO_4^{2-} + Cl^- \rightarrow Cl^- + SO_4^{2-} \rightarrow Cl^-$, which travels along the flow paths and increasing ages. On this evolution line, bicarbonate water is generally characteristic of low salinity, renewable water resources and low residence time, while sulphate waters predominate in groundwater passing through gypsum and anhydrite aquifers, and is usually associated with intermediate salinity in unconfined aquifers (Clark, 2015). The distribution pattern of water chemical types occurred in the studied area indicates a primary stage of groundwater evolution in the Otindag Desert.

The δD values of the groundwater samples collected in this study varied from -63.42‰ to -75.92‰ (Table 3), with an average -69.53‰. The $\delta^{18}O$ values ranged between -8.64‰ and -11.26‰ (Table 3), with an average -10.17‰. The spring water samples were relatively concentrated in δD and $\delta^{18}O$ and were greatly similar to those of the groundwater samples (Fig. 7). The δD and $\delta^{18}O$ values in the river water samples were slightly more variable and were also similar to those of the groundwater (Fig. 7). The lake water samples were enriched in δD and $\delta^{18}O$ by comparison to the groundwater samples (Fig. 6). The precipitation sample p1 was also enriched in δD and $\delta^{18}O$ by comparison to the groundwater samples (Fig. 7). The content of radioactive isotope of tritium (^3H) measured in seven well groundwater samples with 6-60 m depth ranged from 1.86 to 24.35 TU (Table 3), with an average 14.95 TU, higher than the mean tritium concentration (9.8 TU) of groundwater in the Vienna Basin, Austria (Stolp et al., 2010), the seat of the International Atomic Energy Agency (IAEA).

If we plot the relationships between oxygen and hydrogen isotopes of groundwater, spring, river and lake water samples, we observed that the regression line that fits all data points can be described by the equation: $\delta D = 4.09\delta^{18}O - 28.31$ (R^2=0.93, n=24) (EL1 in Fig. 7). This local groundwater line (LGWL) is different from the Global Meteoric Water Line (GMWL, $\delta D = 8\delta^{18}O + 10$) and the Mediterranean Meteoric Water Line (MMWL, $\delta D = 8\delta^{18}O + 20$) estimated by Craig (1961), but it is similar to the local groundwater lines established for other deserts in northern China and central Asia with a same slope but different Y-intercepts, such as $\delta D = 4.17\delta^{18}O - 31.3$ for the Badanjilin Desert (Jin et al., 2018), $\delta D = 4.8\delta^{18}O - 15.2$ for the Ejina Desert in China (Wang et al., 2013), and $\delta D = 4.26\delta^{18}O + 9.23$ for the Rub Al Khal Desert in the United Arab Emirates (Rizk and El-Etr, 1997). The scatter of stable isotope data points for the lake water samples (Fig. 7) in the Otindag suggests that the lake waters are affected by evaporation, but the other waters in the desert are not so.

4.2. Local precipitation recharge on groundwater in the Otindag

To incorporate the isotopic analysis of precipitation with similar areas in the studied area, local data (p1) was plotted with those of Baotou (Fig. 7). The isotopic composition of rainfall in Baotou, the nearest long-term station to the Otindag Desert, was monitored for the period 1986-2001 within the scope of the International Atomic Energy Agency/World Meteorological Organization (IAEA/WMO) global survey. The stable isotope data available from this station was used to provide basic characteristics of the stable isotopic composition of the present-day meteoric water, especially in the westward inland areas of the Otindag Desert (Fig. 1). Stable isotope data of the Tianjin station was also used to characterize precipitation of the eastern coastal areas of the Otindag Desert (Fig. 1).

Based on the isotopic data from the Baotou station, the local meteoric water lines can be statistically expressed as the isotopic regression equation of $\delta D = 6.36\delta^{18}O - 5.21$ (LMWL-B). It can also be expressed as $\delta D = 6.57\delta^{18}O + 0.31$ (LWML-T), based on the data from the Tianjin station (Fig. 7). The precipitation sample p1 collected in this study fell onto the GMWL (Fig. 7). It also showed similar δD and $\delta^{18}O$ values to those of the precipitation collected in the GNIP stations of Baotou and Tianjin (Fig. 7).

Compared to the precipitation data from the GNIP stations and from the local precipitation (p1), the groundwater, spring, and river water samples were evidently depleted in heavy stable isotopes in the Otindag (Fig. 7). Except for the lake water samples, most of the groundwater, river water and spring water samples in the Otindag fall on or lay between the LMWL-B and the LMWL-T lines, and are located at the lower left area of the precipitation points (Fig. 7).

Because the isotopic evolution of δD and $\delta^{18}O$ in water illustrated in the Craig line represents a one-way and irreversible process, the water bodies distributed at the upper right area of the Craig line can not be recharge sources for the water bodies distributed at the lower left area of the line. Such results indicate that the groundwater, river water and spring water in the Otindag are not recharged by the regional precipitation, namely no significant modern direct recharge has taken place for groundwater in the Otindag.

Dogramaci et al. (2012) documented that only intense and remarkable rainfall events >20 mm could recharge groundwater in the semi-arid Hamersley Basin of northwest Australia, while the rainfall events <20 mm had limited influences on groundwater recharge. Chen et al. (2014) described that rainfall events ≤5 mm in the arid and semi-arid region of northern China would be evaporated into the atmosphere rapidly before it is infiltrated into the groundwater system. Based on the analysis on the data records from two meteorological stations around the Otindag, i.e.the Duolun and Xilinhaote stations (see Fig. 1a), we observed that rainfall events >20 mm on average only occur 2.5-3.4 times per year (Table 4). In some years (e.g. from 2005 to 2007 at the Xilinhaote Station), no rainfall events >20 mm even occurred. It further indicated the limited contribution of regional precipitation on groundwater recharge in the Otindag.

In addition to groundwater, the river and spring water samples from the Otindag also deviated from the local precipitation in the Craig diagram (Fig. 7).These water samples came from the Xilamulun, Shepi and Tuligen rivers. They shared the same evaporation line (EL1) with the groundwater and lake water samples (Fig. 7). Generally speaking, natural waters that have a same recharge source are distributed on a same line of evaporation in the δ^{2} and $\delta^{18}O$ diagram (Chen et al., 2012b). This indicates that the recharge sources of groundwater, river water, spring water and lake water in the Otindag are genetically associated each other and differ from the local precipitation.

4.3. Winter precipitation and palaeowater recharge on groundwater in the Otindag

Since the groundwater samples in the Otindag are depleted in their δD and $\delta^{18}O$ values even more than those of the local rainfall (Fig. 7), they must be sourced from other waters characterized by similar or more depleted signals in their stable isotopes compositions. Due to the temperature effect (such as evaporation) on isotopic fractionation, only the waters issued from colder environments can be more depleted in their δD and $\delta^{18}O$ values even more than those of the local rainfall.

Because the Otindag Desert is under the control of the EASM climate (Fig. 1), the local rainfall in the desert is maily sourced from summer precipitation. This can also be illustrated by the seasonal distributions in annual mean precipitation (Fig.8a), in annual mean air temperature (Fig. 8b) and in annual mean water vapor pressure (Fig. 8c) over the last forty years at the two surrounding GNIP weather stations in Baotou and Tianjin. The seanonal distributions of stable isotopes in the two stations

(Fig. 8d-e) show that the summer rainfall is evidently positive in its signals of δD and $\delta^{18}O$ by comparison with those of the winter rainfall, further suggesting that the waters issued from cold environments can be more depleted in their δD and $\delta^{18}O$ values than those of the summer rainfall. Thus we speculate that groundwater in the Otindag can be potentially derived from (1) modern precipitation in winter, (2) palaeowater formed in the past glacial period, or (3) remote/mountains waters that emanate in colder and wetter conditions.

The annual mean values of δD and $\delta^{18}O$ over the last forty years are more depleted in winter precipitation than in summer precipitation at the Baotou and Tianjin stations (Fig. 8d-e). This isotopic signal qualifies the regional winter precipitation to be a potential souce of groundwaters in the Otindag. However, the precipitation amounts and the water vapor pressures (effective moisture) in winter months are much lower than those in the summer months at both the Baotou and Tianjin stations (Fig. 8a and 8c). It indicates that the winter seasons in these regions are relatively colder and drier but not colder and wetter. A colder-wetter winter season is a necessary condition for winter precipitation to be a water source for the formation of groundwater under a summer monsoon climate. This is because the bigger amounts of summer precipitation will easily remove or weaken the depleted isotopic signals of winter prepicitation in groundwater. In this regard, modern winter precipitation is unlikely to be an important source of groundwater in the Otindag.

As to the palaeowaters formed in colder and wetter periods such as the last glacial, it has been proposed to be a potential water source for groundwaters in the wide arid lands of the world. The depleted signals of stable isotopes (δD and $\delta^{18}O$) in groundwater have been recognized in global arid and semi-arid regions, such as the Sinai Desert in Egypt (Gat and Issar, 1974), Israel (Gat, 1983), South Australia (Love et al., 1994, 2000), northern China (Ma et al., 2010), Saudi Arabia (Bazuhair and Wood, 1996) and North Africa (Guendouz et al., 2003). These signals are very often explained as palaeo-groundwater that recharged by precipitation during past wetter and colder periods (Love et al., 1994, 2000; Herczeg and Leaney, 2011).

Here we use the tritium data as a environmental tracer to estimate the groundwater age in the Otindag. The tritium data at the GNIP stations of the Baotou and Tianjin are also referenced as the background values in precipitation of recent years. The residence time of groundwater in aquifer and the residual tritium of a water body can be calculated by $N = N_0e^{-\lambda t}$ (Yang and Williams, 2003). Where N = content of residual tritium in water sample, λ = 0.0565, the radioactive decay constant, N_0 = content of tritium at the time of rainfall and t = years after precipitation. Based on this equation, the residual tritium was theoretically calculated and the standard for tritium dating was established for seven groundwater samples in the Otindag Desert (Table 3). As a result, ages of 0-60 years were obtained for these groundwater samples (Table 5). This indicates that recent recharge took place several decades after the peak in global nuclear tests. We thus conclude that groundwater is generally not older than 70 years in the study area. It means that groundwater in the Otindag are not palaeowater recharged.

Both the modern summer and winter precipitation recharge and the palaeowater recharge can be refuted, indicating that direct recharge is not a major mechanism controlling the groundwater recharge in the Otindag.

4. 4. Remote water recharge on groundwater in the Otindag: Dali Basin

The third hypothesis that "remote/mountains waters emanate under colder and wetter conditions" is further considered here. In essence, it is an indirect recharge mechanismas as water originates from remote areas (Healy, 2010; Herczeg and Leaney, 2011).

It is worth noting that the values of deuterium and oxygen-18 for groundwater in the north part of the study area are more depleted in δD and $\delta^{18}O$ than those in the south part (Table 3). It suggests that the Otindag groundwater might be potentially recharged by water resouces coming from the northern neighboring catchment, such as the Dali Basin.

Recently published data of δD and $\delta^{18}O$ in groundwater, lake water, river water and spring water sampled from the Dali Basin (e.g., Chen et al., 2008; Zhen et al., 2014) were compiled in this study and were co-analyzed with the data from the Otindag. About 70 natural water samples from the Dali and Otindag with δD and $\delta^{18}O$ values are shown in a Craig diagram (Fig. 9). All of these samples fell on or lied near the evaporation line EL2 in the Craig diragram (Fig. 9), with a regression equation of $\delta D = 4.81\delta^{18}O - 21.55$ and a high correlation coefficient (R^2=0.98, n=70). Compared to the groundwater samples in the Otindag, water samples from the groundwaters, rivers and springs from the Dali Basin are more depleted in $\delta^{18}O$ and δD (Fig. 9). Such results further indicate that, in terms of itsisotopic signature, the groundwater in the Otindag has a close relationship with the natural waters in the Dali Basin.

The similar signals of δD and $\delta^{18}O$ between the groundwater in the Otindag and the river water in the Dali (Fig. 9) point towards the idea that the groundwater in the Otindag might be sourced from the river water in the Dali Basin, since the Dali has more depleted isotopic signals in water than the Otindag (Fig. 9). Considering the topographical gradient of elevations between the two regions, however, river water in the Dali Basin cannot flow into the eastern Otindag, because the terrain elevation of the Dali Basin is lower than that of the Otindag (Fig. 1). This is also the reason why the huge Dali Lake that lies in the Dali Basin has no equivalent in the Otindag (Fig. 1). If there is a hydraulic linkage between the two regions, water should flow from the Otindag into the the Dali, but not conversely.

In view of the hydraulic gradient, river water in the Dali Basin could not be a recharge source for groundwater in the Otindag. However, in view of the isotopic gradients, groundwater in the Otindag could not conversely be the source of river water in the Dali (Fig. 9). Thus, the similar isotopic signals between the river water in Dali and the groundwater in Otindag indicate that these waters might be recharged from a common source.

Similar isotopic signals also occurred in the groundwaters between the Otindag and the Dali Basin (Fig. 9). In order to understand the linkage of groundwaters between the two regions, the potential movement of groundwater in the transition zone of the two regions need to be known. In this study, a groundwater-sampling project was designed in the field along a N-S section of a palaeo-channel located at the transition zone between the Dali and Otindag (Figs. 1, 2). The channel was named "PCSX" in this study, with its north part named "NPCSX" and the south part named "SPCSX".

The GPS elevation of the northernmost sampling site in the NPCSX (g11, about 1317 m a.s.l.) was much lower than that of the southernmost site in the SPCSX (g1, 1396 ma.s.l.) (Fig. 2 and Table 1). Regarding to the topographical gradient in the channel, there is a drop of about 80 m between the NPCSX and the SPCSX. Under such slope, the underground hydraulic gradient for groundwater flow can be roughly parallel with that of the surface water flow, namely that the groundwaterflow should move downwards from the SPCSX area into the NPCSX area. Thus we can speculate that groundwater in the NPCSX would have higher salinity than those in the SPCSX under such flowing direction. In order to verify this speculation, actual variations of water salinity (chloride and TDS) were detected along the PCSX section. The sampling site g1 was defined as the initial point and the distances between g1 and other sampling sites along the PCSX section were calculated, based on their GPS geographical coordinates measured in the field. The results are shown in Fig. 10a-b. It is clear that the variations of chloride and TDS concentrations in groundwater do not increase along the palaeo-channel from south to north (Fig. 10a-b). On the contrary, both the values of chloride and TDS are lower in the NPCSX area than those in the SPCSX area. Such kind of spatial variations in the chloride and TDS values contradict the speculated patterns abovementioned, suggesting that the hydraulic gradient of groundwater flowing path in this region is not controlled by the topographical gradient between the NPCSX and SPCSX areas.

Compared between the NPCSX and SPCSX regions, the stable isotopic values ($\delta^{18}O$ and δD) of groundwaters in the SPCSX region vary greatly with a large amplitude, while those in the NPCSX are relatively constant (Fig. 10c-d). The constant variations indicate that the recharge source of groundwater in the NPCSX is relatively unitary. The isotopic values in the SPCSX are much lighter than those in the NPCSX along the distance section from south to north (Fig. 10c-d). The heaviest values occurred in the sample g11 collected from the NPCSX (Fig. 10c-d), indicating a water being earlier recharged. The spring water sample s2, a representation of discharge water, is characterized by medium values of δD and $\delta^{18}O$. These results indicate that the groundwaters in the SPCSX area, with relatively enriched isotopic signals in δD and $\delta^{18}O$ by comparison with those in the NPCSX area, are composed of a mixture of the groundwaters in the NPCSX with other waters.

The tritium contents were broadly and positively related to the values of deuterium excess in the groundwater samples in the PCSX (Fig. 10e). For water that experiences an evaporation process, the d-excess value will increase in the evaporated water vapor, but will decrease in the residual water body (Dansgaard, 1964; Merlivat and Jouzel, 1979). In this study, except for sample g11 (a sample very close to the riverhead area), the positive relationship between the tritium and the deuterium excess generally shows that the d-excess values are higher in the groundwaters collected from the NPCSX, but are lower in those from the SPCSX (Fig. 10e). This distribution pattern indicates that the groundwaters in the NPCSX are relatively younger and experienced a lower degree of evaporation than those in the SPCSX. The d-excess gradient, increasing from south to north in the PCSX, further suggests that groundwater does not flow from the SPCSX area to the NPCSX area, namely out of the topographical control.

Many studies (e.g., Boronina et al., 2005; Kazemi et al., 2006) have demonstrated that groundwater flows in the direction in which it gets older. In view of this point, groundwaters in the PCSX region should flow from the NPCSX area to the SPCSX area, in opposition to the S-N topographical gradient between the Otindag and Dali regions. Thus groundwater in the Dali are not the source of groundwater in the Otindag. The similar isotopic signals between groundwaters in the two regions indicate that these waters might be recharged from a common source in other place.

4. 5. Remote water recharge on groundwater in the Otindag: mountains waters

The discussions above revealed that both the groundwaters in the Otindag and DaliBasin might be recharged from a common source derived from another place. Considering the third hypothesis abovementioned that "remote/mountains waters emanate under colder and wetter conditions", we propose that this "common source" of the two regions are from mountians areas surrounding the Otindag and Dali Basin.

There are two large permanent rivers and lots of small intermittent streams entering the Dali Basin (Xiao et al., 2008), including the Xilamulun River to the south and the Gongger River to the north, both of which are stemming from the Greater Khingan Mountains (Daxing'Anling Mountains in Chinese pinyin, 1,100-1,400 m above seal level) (Fig. 1). The Xilamulun River carries a large amount of water (about 6.58×10^{8} m^{3}/y) from the Daxing'Anling Mountains flowing through the east margins of the Dali and Otindag (Wu et al., 2014). This is an important clue linking natural waters between the Otindag and Dali Basin.

Variation in the elevation from the Dali Lake to the riverhead of the Xilamulun River can be clearly found along a land surface topographical section (Fig. 11). The channel of the Xilamulun River is located in the Xar Moron Fault (Fig. 1), which is a part of the Solonker Suture Zone (Eizenhöfer et al., 2014) or the Xilamulun-Changchun-Yanji plate suture zone (Sun et al., 2004) in the regional tectonical settings (Fig. 2). Outcrop observations indicate that fault zones commonly have a permeability structure suggesting they should act as complex conduit–barrier systems in which along-fault flow is encouraged and across-fault flow is impeded (Bense et al., 2013). Thus the hydraulic grediant of groundwater flow in the Eastern margins of the Otindag and Dali Basin must be controlled by the fault zone hydrogeology. This may be the reason why the hydraulic gradient of groundwater represented by the isotopic and hydrogeochemical gradients of groundwater samples in this study is not consistent with the local topographical gradient in the Otindag Desert. On the other hand, the regional aquifer is generally unconfined in dune fields of the Otindag Desert but semi-confined to confined in the Daxing'Anling uplands (Fig. 3), thus the thick unconsolidated aquifers in the study area (Figs. 3 and 11) will be favourable conditions for groundwater storage and transportation along the Solonker Suture Zone. When rivers stem from the Daxing'Anling Mountainsand flow downward to the marginal areas of the Dali and Otindag, leakage water from these rivers can recharge the desert land through thick unconsolidated aquifers. A strong isotopic evidence is that the lake and river waters in the Dali Basin share the same evaporation line (EL2) with the groundwaters in the PCSX area.

Although groundwaters in the SPCSX area are different from those in the NPCSX area, their isotopic data points still fell onto the EL2 (Fig. 9), which further indicates that the groundwaters in the SPCSX are a mixture of waters from the Daxing'Anling Mountain and other sources. Another source for groundwater recharge in the SPCSX could be represented by remote water such as flash floods coming from the north Yinshan Mountains, because it can be clearly observed from digitial maps that many transient rivers or streams originated from the Yinshan Mountrains flow into the south and southeastern Otindag (Fig. 1). Supportive evidence for this idea can also be observed in the summer rainy season. During rainy days or under storm conditions, occasional heavy, short rainstorms cause floods in soil-rich wadi channels and low-lying depressions in the unconfined to semi-confined areas of the Yinshan Mountains' piedmont. These waters may temporarily recharge shallow aquifers in the SPCSX area.

5.Conclusions

In the middle-latitude desert zone of northern China, many deserts such as the Otindag and Badanjilin Deserts, are unexpectedly rich in groundwater resources, although they have no surface runoff and have been under an arid or hyper-arid climate for a long period of time. How groundwaters originated and recharged in these deserts are thus key questions that are still under debate. For some earth scientists, the direct recharge is thought to be very important for groundwaters in the wide desert lands of northern China, due to the lack of surface runoffs. However, groundwater availability is very much a function of the local- and regional-scale geological and climatic settings. To achieve an integrated understanding of the groundwater recharge and its controlling mechanisms is of great significance. In this study, groundwater recharge was explored using multiple environmental tracers in the Otindag Desert of northern China, a region that is under the influence of the East Asian Summer Monsoon (EASM) climate. Compared to modern summer precipitation, the groundwaters, river waters and spring waters are depleted in δD and $\delta^{18}O$. All these waters shared a same Craig line, indicating a genetic relationship on their recharge sources. The stable isotopic signals of the groundwaters is more depleted than those of the modern summer precipitation and this suggests that the groundwaters studied could only be sourced from cold water different from the EASM precipitation. In general, the analyses revealed that the highland remote water resources from the Daxing'Anling and Yinshan Mountains were isotopically and geochemically traced to be a major source for the groundwater in the Otindag. It suggests that the modern indirect recharge mechanism, instead of the direct recharge and the palaeo-water recharge, is the most significant for groundwater recharge in the eastern Otindag. This study provides a new perspective into the origin and evolution of groundwater resources in the middle-latitude desert zone of northern China.

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Figure Captions:

Fig. 1. The Geographical location of the Otindag Desert in northern China. (a) The study area shown at a large scale, and (b) the study area shown at a smaller scale, with detailed information about the boundary and tectonic settings of the desert land. 1, the palaeo lake area of the megalake Dali; 2, the boundary of the Otindag; 3, the modern lake area; 4, the boundary of Fig. 2; 5, the boundary between the westerlies and the East Asian Summer Monsoon (EASM) climate systems. ①, the Xilamulun River. ②, the Gonggeer River. ③, the Shepi River. ④, the Tuligen River. The boundary between the westerlies and the EASMin (a) and (b)is modified from Chen et al. (2010). The palaeo lake area of the megalake Dali and the palaeo channel in (b) is modified from Yang et al. (2015). The location of the Xar Moron Fault is referenced from Eizenhöfer et al. (2014). Section S1 is an elevation section starting from the upstream of the Dali Lake and ending with a spring sample (s2) in the riverhead of Xilamulun River.

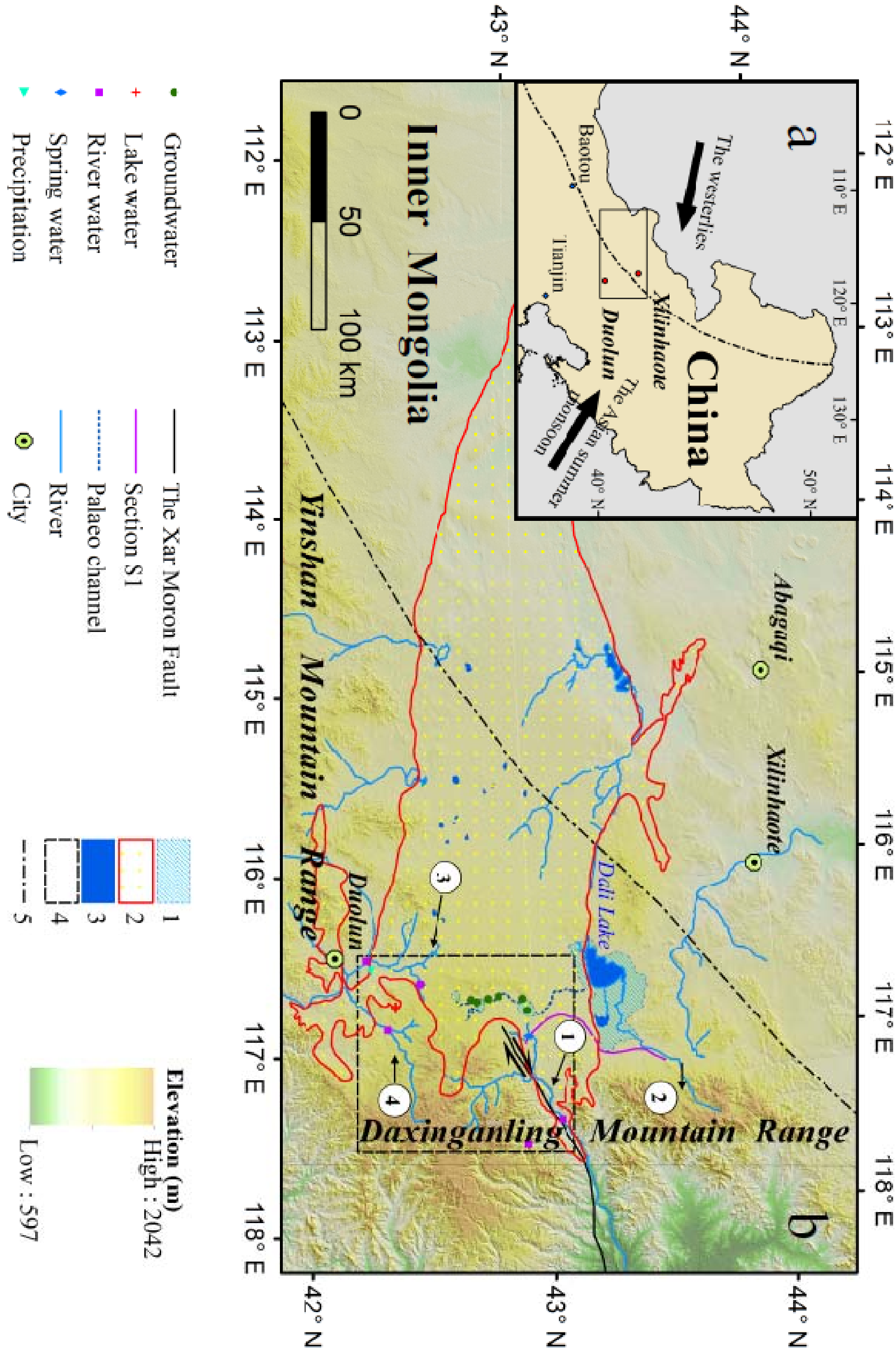

Fig. 2. (a) Tectonic framework of the north China-Mongolian segment of the Central Asian Orogenic Belt (modified after Jahn, 2004). (b) Geological sketch map of the northern China-Mongolia tract (modified after Jian et al., 2010). The Solonker suture zone represents the tectonic boundary between the northern (Hutag Uul Block-Northern orogen) and the southern (southern orogen-Northern margin of North China craton) continental blocks. Note that the red line marks the early Permian paleobiogeographical boundary (Wang and Liu, 1986; Li, 2006), which coincides with the northern boundary of the suture zone.

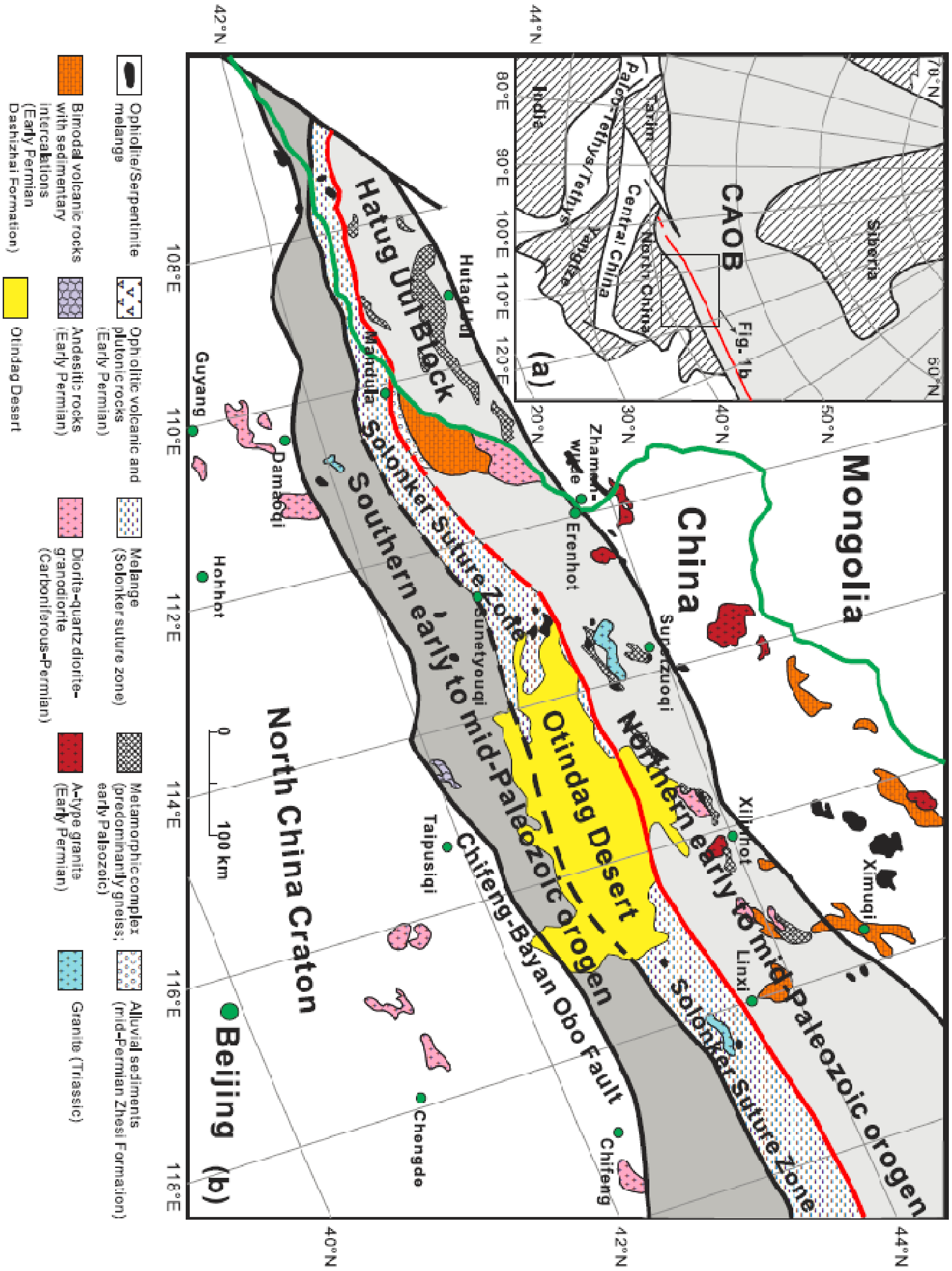

Fig. 3. The hydrogeological division map of the Otindag Desert.

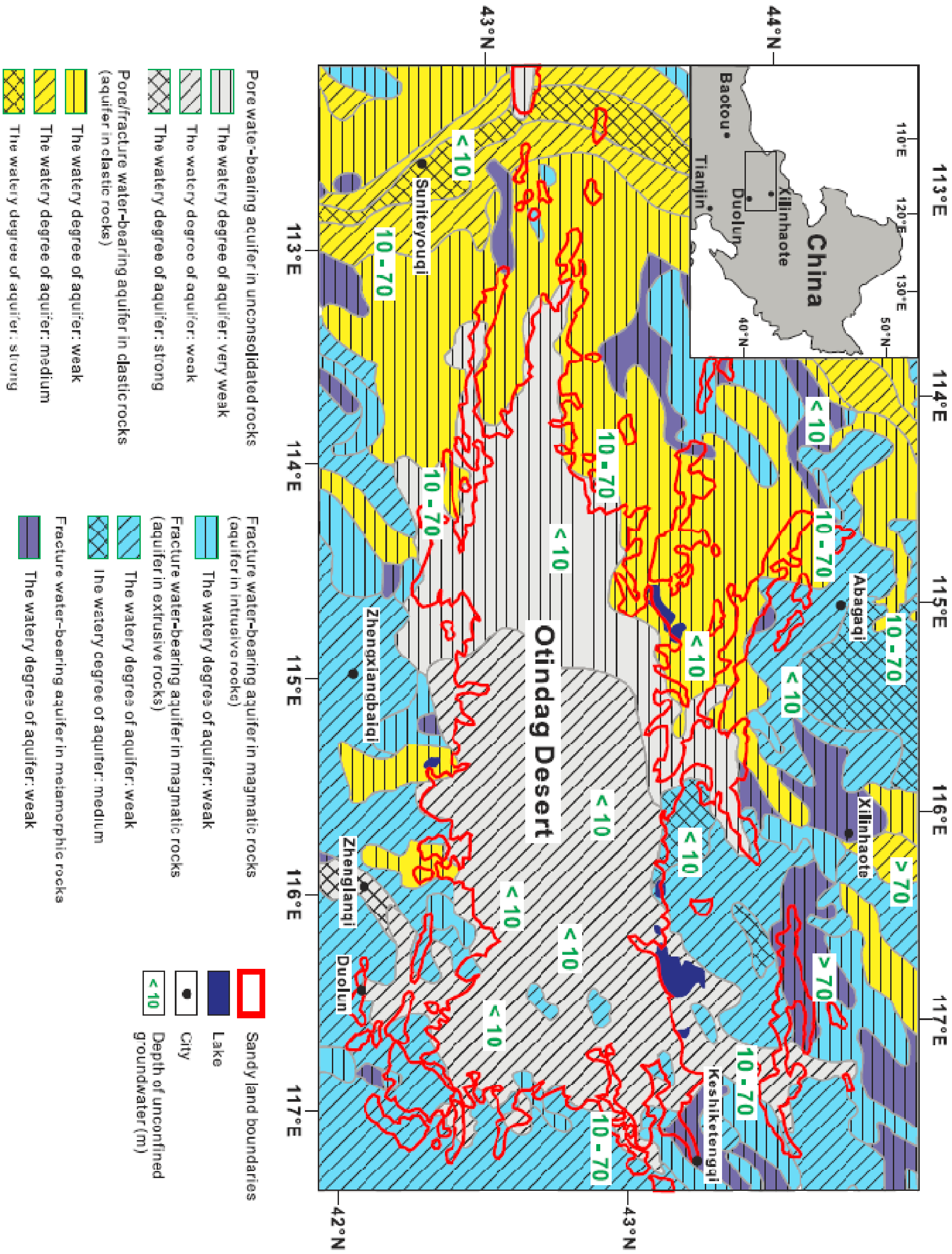

Fig. 4. The locations of the water sampling sites in this study.

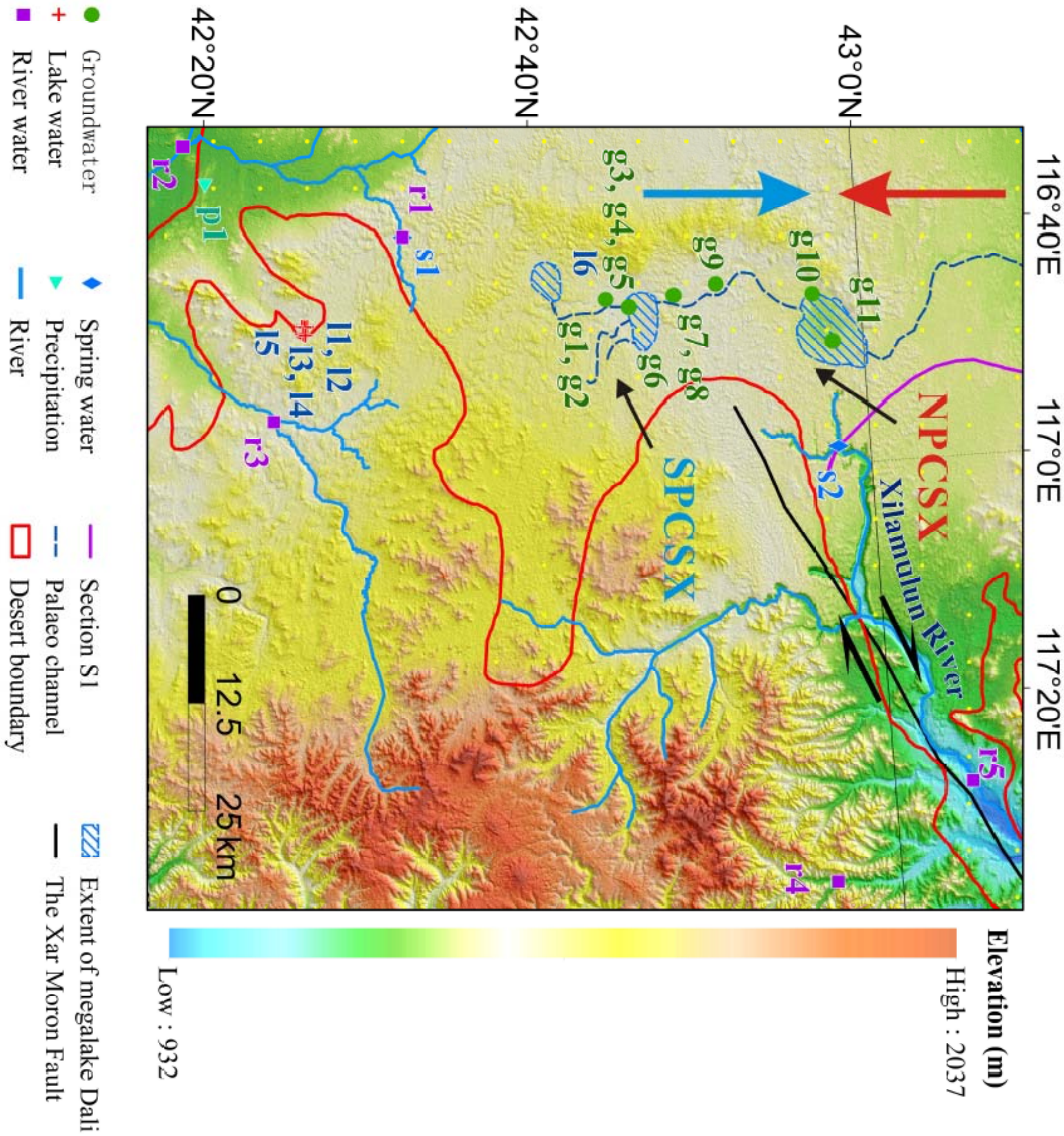

Fig. 5. The fingerprint diagram showing the variations of multiple ions' concentrations in the studied water samples in an equivalent unit. The HCO_3+CO_3 concentration in the sample p1 was not shown, due to its value being lower than the detection limit.

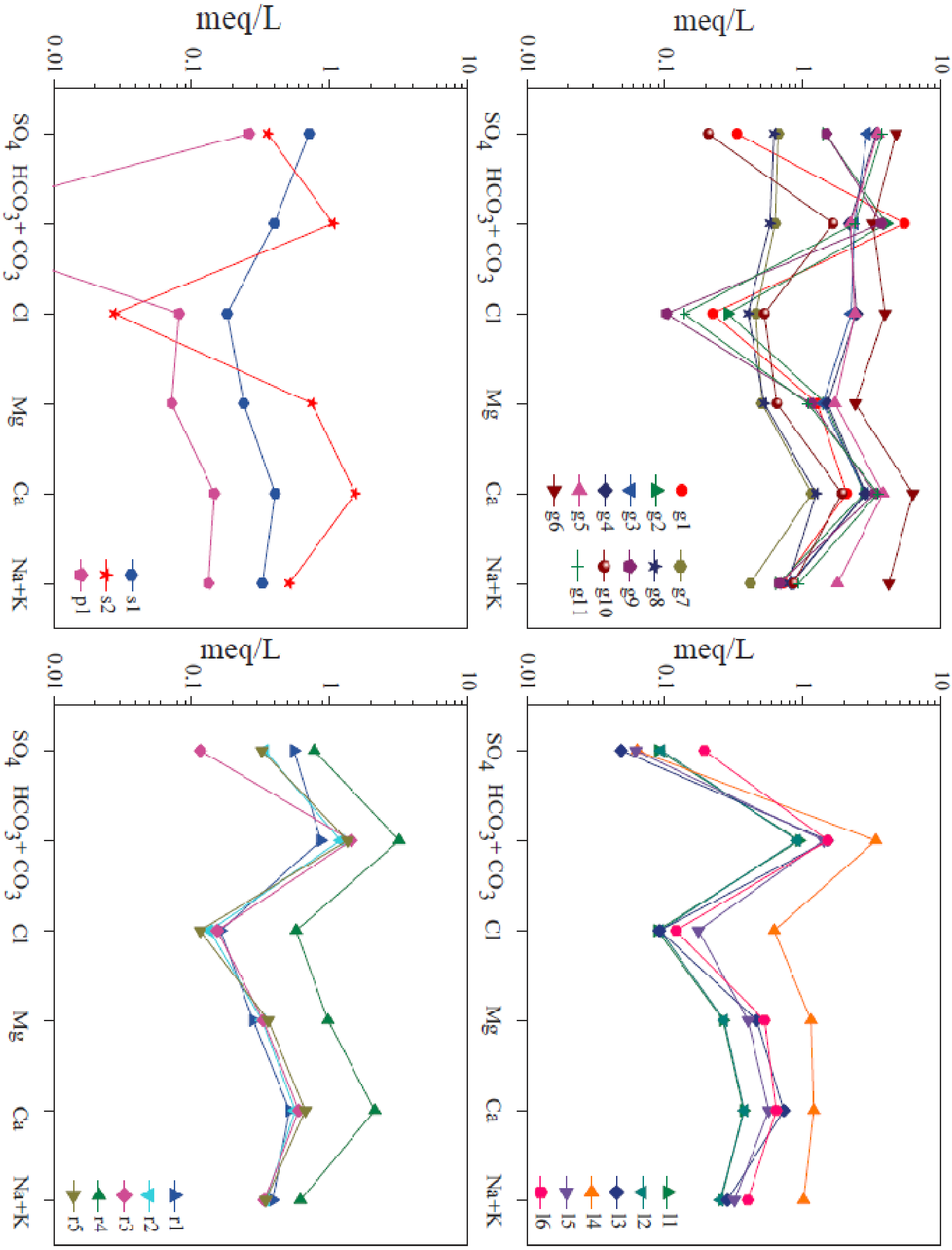

Fig. 6. The Piper diagram showing the relative abundances of major cations and anions in the studied water samples. Major water types are also shown in this diagram.

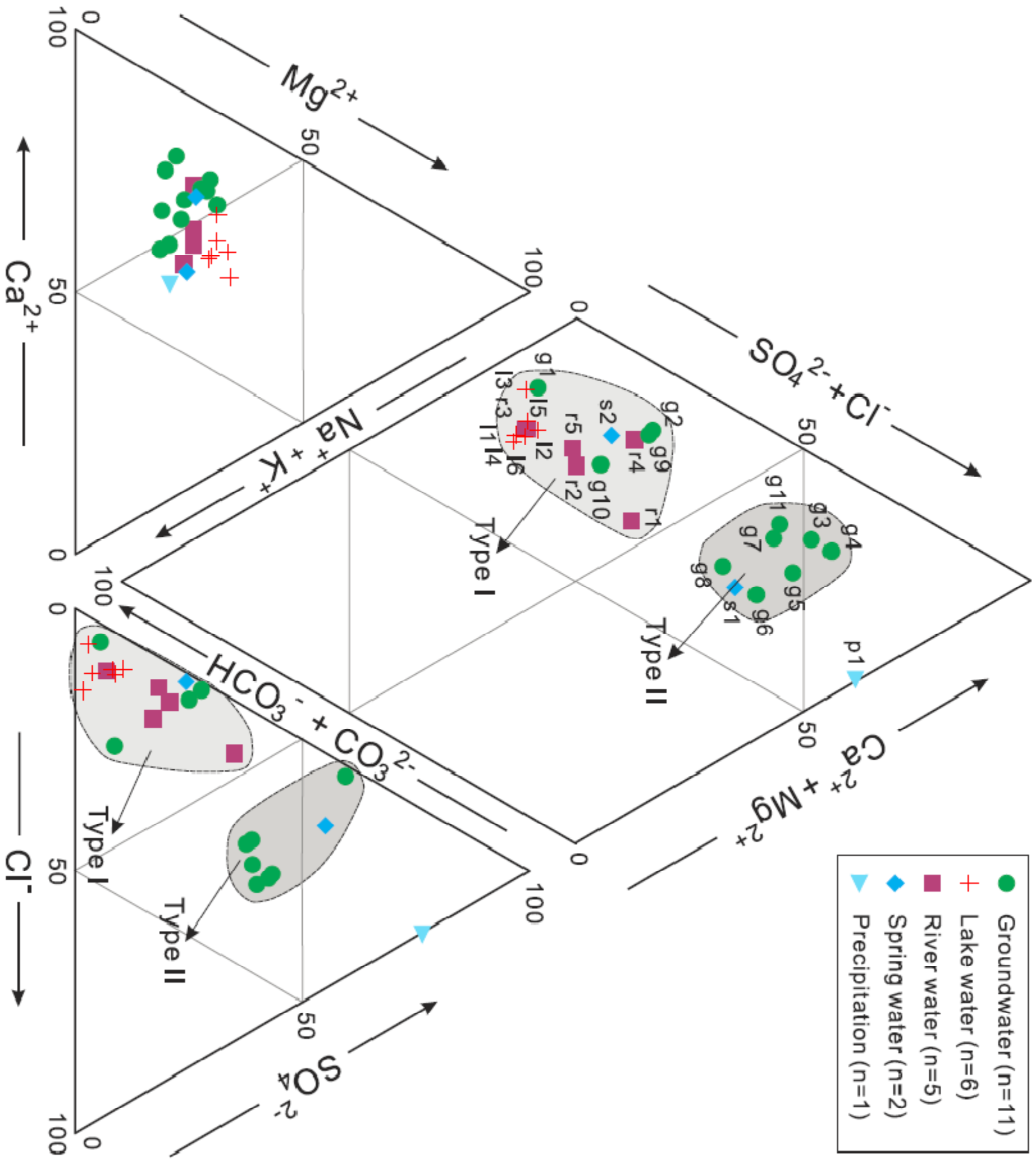

Fig. 7. The bivariate diagram of δD and $\delta^{18}O$, i.e. the Craig diagram, for the natural water samples in this study. Different relationships between the groundwaters, lake waters, river waters, spring waters and the precipitation waters are illustrated. AWMB, the annual weighted mean value at the Baotou station; AWMT, the annual weighted mean value at the Tianjin station; LWMB, thelong-term weighted means at the Baotou station; LWMT, the long-term weighted means at the Tianjin station; GMWL, the Global Meteoric Water Line; LMWL-B, the local meteoric water line calculated based on the data from the Baotou station; LWML-T, the local meteoric water line calculated based on the data from the Tianjin station; EL1, the evaporation line calculated based on the data of water samples collected in this study.

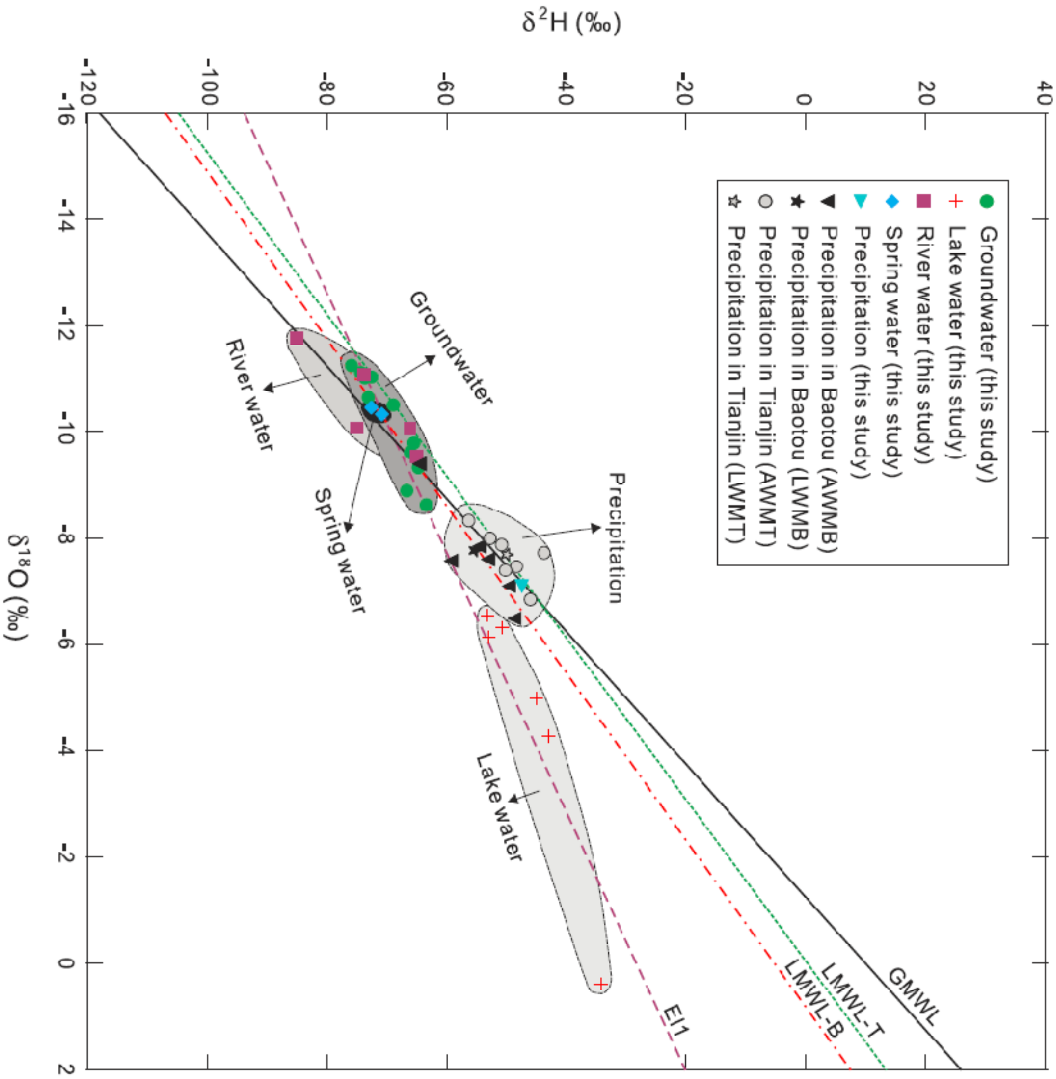

Fig. 8. The seasonal mean distributions of (a) precipitation, (b) surface air temperature and (c) water vapor pressure from the Baotou and Tianjin weather stations (station sites seen in **Fig. 1a**) in the surrounding areas of the Otindag for the period 1981-2010. The seasonal mean distributions of (d) $\delta^{18}O$ and (e) δD values in precipitation from the Baotou and Tianjin weather stations in the surrounding areas of the Otindag for the period 1986-2001.

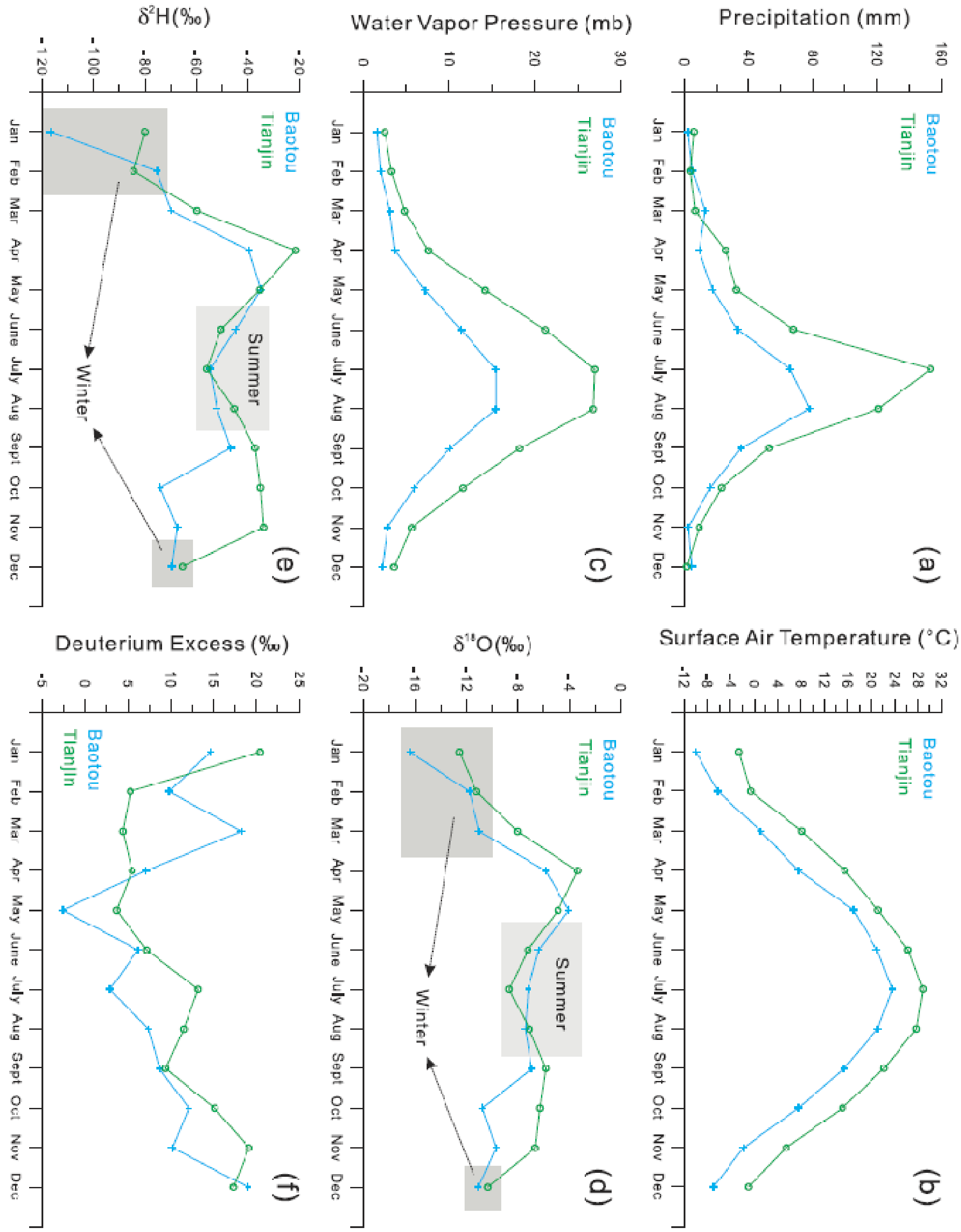

Fig. 9. The bivariate diagram of δD and $\delta^{18}O$, i.e. the Craig diagram, for the natural water samples collected in the Otindag (this study) and the Dali Basin. Different relationships between the groundwaters, lake waters, river waters, spring waters and the precipitation waters are clearly illustrated. AWMB, AWMT, LWMB, LWMT, GMWL, LMWL-B, LWML-T, and EL1 are the same as in Fig. 7. EL2, the evaporation line calculated based on the data from the groundwater, lake water, river water and spring water samples collected from the Otindag and Dali Basin. The data for the Dali were taken from Chen et al. (2008) and Zhen et al. (2014).

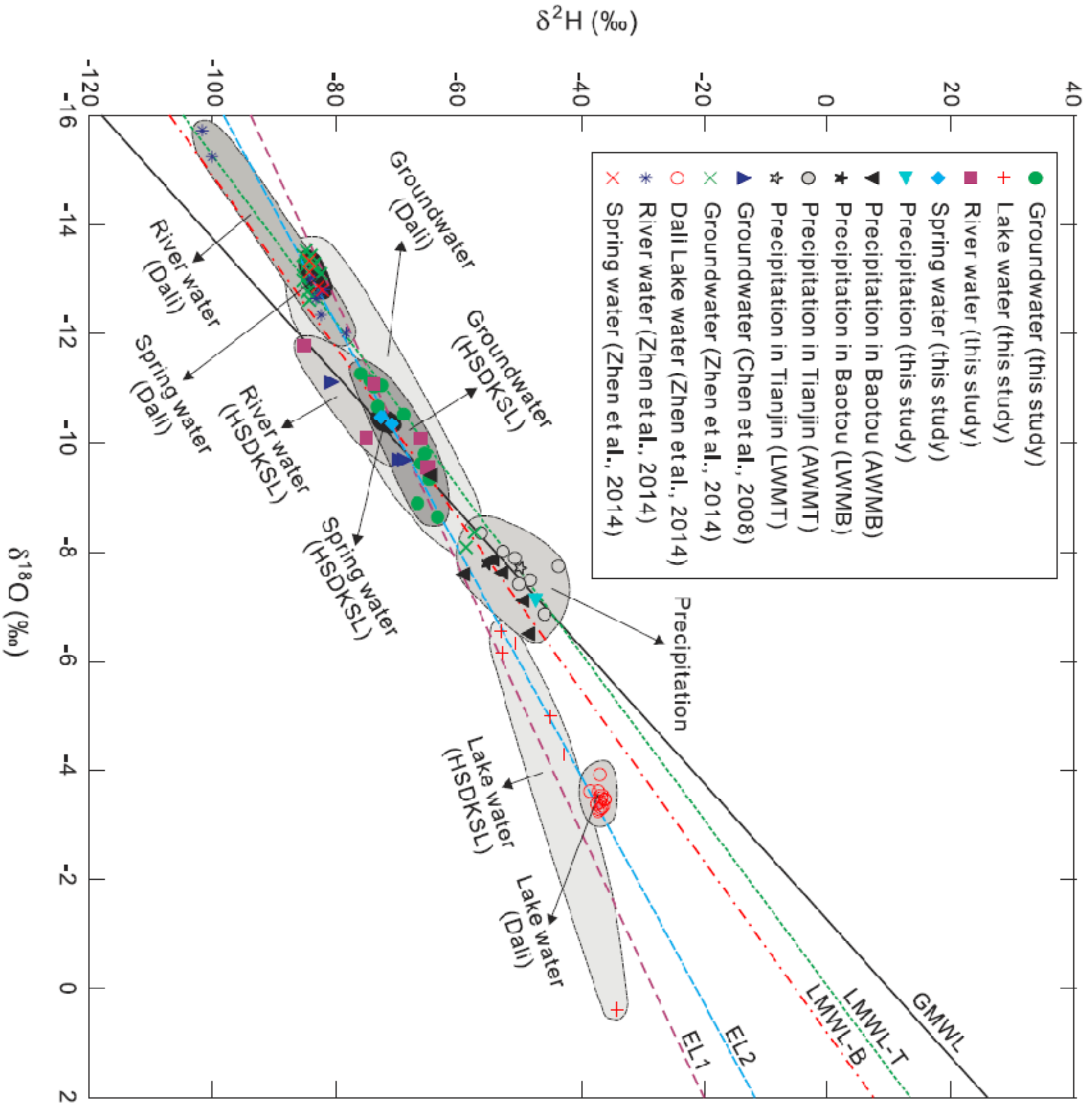

Fig. 10. (a) Sketch map showing the relationship between the groundwaters in the NPCSX and SPCSX areas, based on variations of (a) the chloride concentrations, (b) the TDS concentrations, (c) the $\delta^{18}O$ values and (d) the δD values of these water samples versus their distances away from the water sample g1 along the palaeo river channel (PCSX) from south to north. The dashed line in (c) and (d) represents the corresponding values of the spring water sample s2, and divides samples into the NPCSX and SPCSX parts. (e) Variations of tritium contents vs. deuterium excess for the groundwater samples in the study area. The sample g6 was omitted due to its potential contamination.

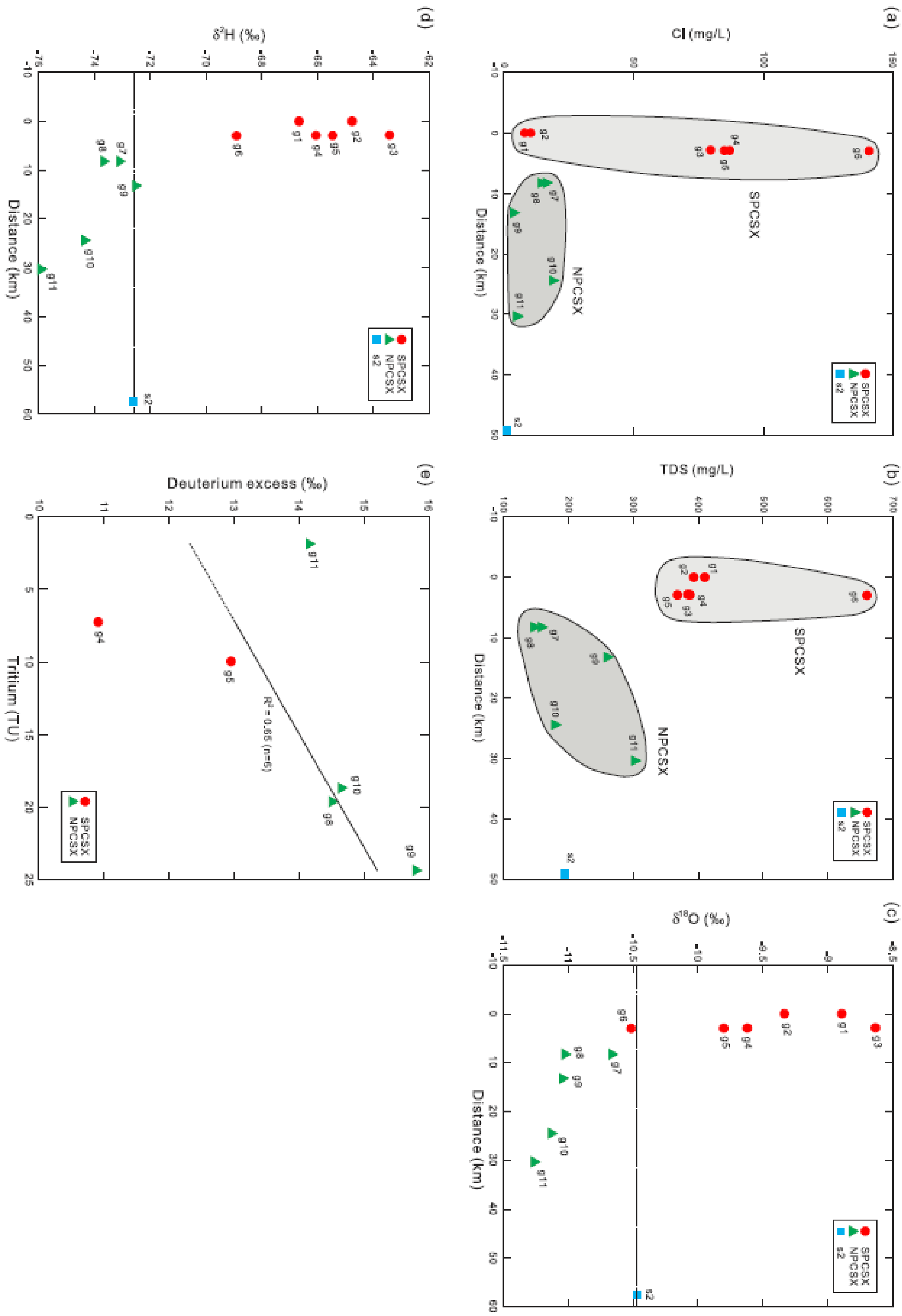

Fig. 11. Variation of the topographical elevation along the section S1 (see Fig. 1b) from the upstream of the Dali Lake to the location site of the spring water sample (s2) in the riverhead of the Xilamulun River. Note that no river water samples are shown in this figure.

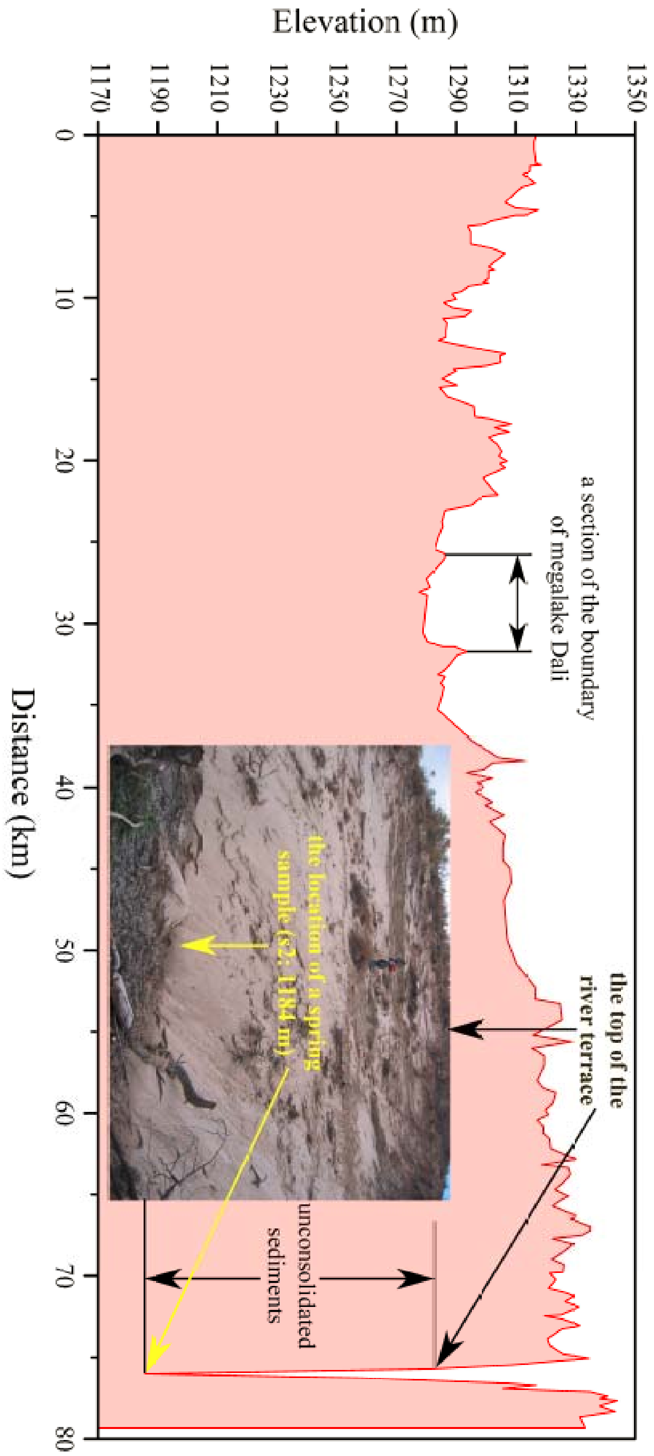

Table Captions:

Table 1. The physical parameters measured for the natural water samples in the study area.

Sample ID	Water type	Latitude (N, degree)	Longitude (E, degree)	Elevation (m a.s.l)	Depth (m)	Temperature (°C)	pH	Eh (mV)	EC (μS/cm)	TDS (mg/L)	Salinity (%)	Alkalinity (meq/L)	Hardness (°dH)
g1	Groundwater	42.736306	116.747333	1396	12	5.8	6.72	3	769	410	0.6	5.47	9.42
g2	Groundwater	42.736306	116.747333	1396	26	6.0	6.91	-10	736	393	0.5	4.07	11.96
g3	Groundwater	42.760194	116.760139	1355	32	7.7	6.88	-6	725	384	0.5	2.39	11.94
g4	Groundwater	42.759694	116.760417	1360	7	10.0	6.74	1	725	387	0.5	2.20	12.28
g5	Groundwater	42.759556	116.760556	1362	27	7.6	6.46	16	691	368	0.5	2.23	15.57
g6	Groundwater	42.760111	116.760250	1365	7	10.3	6.26	22	1240	660	0.8	3.25	24.45
g7	Groundwater	42.806361	116.747806	1352	20	6.8	6.71	2	297	158	0.2	0.63	4.70
g8	Groundwater	42.806361	116.747806	1352	16	6.5	6.92	-8	276	147	0.2	0.58	5.00
g9	Groundwater	42.850333	116.735722	1347	30	7.2	6.74	-1	487	260	0.4	3.73	12.68
g10	Groundwater	42.949861	116.759194	1321	37	9.9	6.75	-2	337	179	0.2	1.66	7.23
g11	Groundwater	42.967111	116.827528	1317	60	8.6	6.99	-14	571	302	0.4	2.40	12.94
l1	Lake water	42.424611	116.769194	1368	/	16.9	9.44	-151	126	67	0.1	0.95	1.79
l2	Lake water	42.424611	116.769194	1368	/	19.6	9.18	-137	132	70	0.1	0.92	1.82
l3	Lake water	42.424611	116.757806	1365	/	20.2	7.38	-36	196	105	0.1	1.53	3.36
l4	Lake water	42.427083	116.757639	1366	/	20.5	7.87	-64	448	238	0.2	3.42	6.61
l5	Lake water	42.421806	116.756917	1360	/	20.1	8.23	-83	173	92	0.1	1.43	2.73
l6	Lake water	42.736389	116.747222	1374	/	10.7	8.35	-89	194	103	0.1	1.53	3.30
r1	River water	42.530917	116.641250	1355	/	20.6	7.31	-33	180	96	0.1	0.88	2.23
r2	River water	42.310883	116.494817	1231	/	14.9	7.67	-52	178	95	0.1	1.21	2.50
r3	River water	42.385778	116.886194	1362	/	9.5	7.62	-48	177	94	0.1	1.45	2.62
r4	River water	42.931417	117.585306	1217	/	10.5	7.97	-69	474	252	0.3	3.22	8.73
r5	River water	43.079083	117.457389	1006	/	12.9	7.87	-62	191	101	0.1	1.37	2.88
s1	Spring water	42.530917	116.641250	1359	/	20.9	6.63	5	165	88	0.1	0.40	1.81
s2	Spring water	42.965417	116.975361	1184	/	19.0	7.47	-46	371	195	0.2	1.07	6.40
p1	Precipitation	42.330750	116.551694	1260	/	20.2	4.61	109	78	42	0.0	/	0.61

Table 2. The concentrations of major cations and anions measured for the water samples in the study area.

Sample	F^- (mg/L)	Cl^- (mg/L)	NO_2^- (mg/L)	NO_3^- (mg/L)	SO_4^{2-} (mg/L)	CO_3^{2-} (mg/L)	HCO_3^- (mg/L)	Li^+ (mg/L)	Na^+ (mg/L)	NH_4^+ (mg/L)	K^+ (mg/L)	Mg^{2+} (mg/L)	Ca^{2+} (mg/L)
g1	0.13	7.90	2.32	0.48	16.10	0.00	334.60	0.02	13.79	10.54	4.59	15.52	41.81
g2	0.21	10.21	0.00	6.15	70.61	0.10	247.70	0.02	13.36	6.56	3.45	17.91	56.04
g3	0.11	79.56	0.00	0.00	140.76	0.00	145.40	0.01	17.92	2.28	1.76	17.06	57.29
g4	0.10	86.90	0.00	5.73	164.80	0.00	133.70	0.02	18.02	0.00	2.02	18.50	57.32
g5	0.07	84.82	0.00	0.76	169.30	0.00	136.20	0.00	39.68	1.02	2.72	20.94	76.86
g6	0.07	140.54	0.00	110.77	228.80	0.00	198.20	0.00	79.80	0.00	29.47	29.25	126.68
g7	0.37	16.31	0.00	306.31	32.01	0.00	38.70	0.06	7.83	0.00	3.09	6.21	23.37
g8	0.29	14.28	0.00	35.49	29.89	0.00	35.50	0.02	16.21	0.11	3.38	6.44	25.14
g9	0.10	3.66	0.15	1.19	71.56	0.00	227.40	0.06	12.92	0.55	4.50	14.06	67.52
g10	0.24	18.80	0.00	49.49	9.97	0.00	101.10	0.00	18.54	0.00	2.09	7.92	38.68
g11	0.28	4.94	0.00	0.00	181.53	0.00	146.20	0.05	20.40	2.59	2.06	13.30	70.59
l1	0.16	3.15	0.00	0.07	4.32	0.00	57.90	0.01	5.42	0.00	0.86	3.24	7.49
l2	0.16	3.30	0.00	1.66	4.57	0.00	55.80	0.00	5.33	0.00	0.84	3.29	7.61
l3	0.11	3.27	0.00	0.61	2.33	0.00	93.30	0.01	5.88	0.00	1.19	5.68	14.66
l4	0.17	22.12	0.00	0.39	3.04	0.10	207.60	0.00	9.21	0.70	24.21	14.02	24.18
l5	0.09	6.24	0.00	0.65	2.97	0.10	86.80	0.01	6.72	0.00	1.16	4.91	11.41
l6	0.18	4.29	0.00	0.80	9.34	0.10	93.00	0.01	8.41	0.00	1.36	6.47	12.95
r1	0.30	5.76	0.00	2.38	26.67	0.30	52.40	0.01	7.15	0.00	2.99	3.41	10.34
r2	0.19	4.82	0.00	0.65	16.40	0.10	73.10	0.01	6.82	0.00	1.92	3.96	11.36
r3	0.64	5.46	0.00	0.43	5.57	0.00	88.10	0.01	7.11	0.00	1.13	4.04	12.06
r4	1.08	20.39	0.00	19.27	37.25	0.50	195.00	0.01	13.02	0.00	1.96	11.90	42.81
r5	0.19	4.10	0.00	1.08	15.57	0.00	82.60	0.01	6.71	0.00	2.08	4.38	13.40
s1	0.16	6.44	0.00	1.95	34.25	0.00	24.30	0.02	6.56	0.00	1.62	2.92	8.10
s2	0.05	0.98	0.00	0.45	17.15	0.00	64.90	0.02	9.87	0.00	3.32	9.10	30.79
p1	0.61	2.90	0.00	9.46	12.65	0.00	0.00	0.00	2.09	2.07	1.64	0.88	2.95

Table 3. The analytical data of stable and radioactive isotopes measured for the water samples in this study.

Sample ID	δD (‰)	σ‰	$\delta^{18}O$ (‰)	σ‰	deuterium excess (d)	Tritium (^3H) (TU)
g1	-66.664	0.199	-8.895	0.026	4.496	/
g2	-64.758	0.291	-9.336	0.039	9.930	/
g3	-63.424	0.269	-8.635	0.008	5.656	/
g4	-66.055	0.149	-9.621	0.062	10.913	7.250
g5	-65.462	0.111	-9.802	0.027	12.954	9.975
g6	-68.913	0.287	-10.514	0.039	15.199	22.908
g7	-73.105	0.298	-10.662	0.041	12.191	/
g8	-73.676	0.220	-11.023	0.037	14.508	19.611
g9	-72.530	0.181	-11.041	0.015	15.798	24.345
g10	-74.362	0.201	-11.127	0.026	14.654	18.681
g11	-75.924	0.340	-11.260	0.015	14.156	1.860
l1	-53.128	0.229	-6.553	0.002	-0.704	/
l2	-50.721	0.304	-6.320	0.026	-0.161	/
l3	-42.877	0.239	-4.292	0.034	-8.545	/
l4	-34.155	0.243	0.381	0.040	-37.203	/
l5	-45.057	0.206	-4.987	0.009	-5.161	/
l6	-52.866	0.187	-6.150	0.049	-3.666	/
r1	-66.157	0.118	-10.069	0.015	14.395	/
r2	-64.996	0.148	-9.549	0.012	11.396	/
r3	-73.790	0.315	-11.083	0.021	14.874	/
r4	-85.155	0.244	-11.781	0.005	9.093	/
r5	-74.978	0.195	-10.084	0.003	5.694	/
s1	-70.832	0.074	-10.340	0.007	11.888	/
s2	-72.601	0.281	-10.468	0.046	11.143	/
p1	-47.435	0.374	-7.141	0.017	9.693	/

Table 4. The statistical frequency of rainfall events being >20 mm per year during the recent 30 years from 1985 to 2014. The data come from the China Meteorological Data

Sharing Service System.

Station	One time/year	Two times/year	Three times/year	Four times/year	Five times/year	Six times/year	Seven times/year	Mean times/year
Duolun	2	8	8	4	4	3	1	3.4
Xilinhaote	8	5	2	6	3	2	0	2.5

Table 5. The measured contents of tritium in the groundwater samples studied and the calculated ages of these samples.

Sample-ID	Tritium content (T.U.)	Possible ages (years)
g1	not measured	not clear
g2	not measured	not clear
g3	not measured	not clear
g4	7.25	20-40
g5	9.97	13-33
g6	22.91	0-20
g7	not measured	not clear
g8	19.61	0-20
g9	24.34	0-17
g10	18.68	0-22
g11	1.86	40-65

Direct or indirect recharge on groundwater in the middle-latitude desert of Otindag, China?

Bing-Qi Zhu[1*], Xiao-Zong Ren[2], Patrick Rioual[3]

[1]KLWCRESP, IGSNRR, CAS, Beijing, China
[2]SGS, TYNU, Jinzhong, China
[3]KLCGE, IGGCAS, Beijing, China

Correspondence to: Bing-Qi Zhu (zhubingqi@sina.com)

Abstract. Although rainfall is scarce in most desert lands of the world, the Otindag Desert inthe middle-latitude desert zone of northern China in Northern Hemisphere (NH)hadis abundant of water resources, mainlygroundwater. To gain an insight into the origin of groundwater originin this desert, stable and radioactive isotopes andmajor ion hydrochemistry of groundwater, as well as other natural waters including river water, spring water,lake water andprecipitation water, were investigated in the eastern part of the Otindag. The results showed that the groundwatersin the Otindagarewerefreshwater (TDS < 700 mg/L) and weredepleted inδ^2H and δ^{18}O,when compared withthe modern precipitation. The major water types arewerethe Ca HCO$_3$ and Ca/Mg SO$_4$typeswaters.No Cl-type and Na-type waters occurredin the study area. The ionic and depleted stable isotopic signals in groundwater, as well as the high values contents in of tritium contents (5-25 TU), indicated that thesegroundwatersstudiedwereareyoung but not of meteoric origin, i.e., out of control by the modern and palaeo-direct recharge. Clear differencesin the isotopic signals werer observed between the groundwaters in the north (NPCSX) and south (SPCSX) parts of the study area, but the signals were silimar inbetweenthe groundwaters betweeninthe NPCSX and itsneighbouring catchment, the Dali Basin.The topographical elevation is decreasesing from the SPCSX (1396 m a.s.l.) to the NPCSX (1317 m a.s.l.) and the Dali (1226 m a.s.l.).Groundwaters in the NPCSX arewere characterized by lower elevations, the lower chloride and TDS concentrations, higher tritium contents, higher deuterium excess, and more depleted values of δ^2H and δ^{18}O than those in the SPCSX. Thespatial distribution pattern of these environmental parametersThisindicatesda discrepancydisunitybewtweenin the one hand,the hydraulic gradient of groundwater andin the other hand,the isotopic and hydrochemicalgradients of groundwater in the deserteastern Otindag. It also, suggestsingthat the groundwaters havedifferent waterrecharge sources between the two areasparts in the study area. However, the groundwaters in the two areas shared a common evaporation line (EL2) in the Craig diagram of δ^2H and δ^{18}O, indicating a genetic relationship in their recharge sources.Combined analysis was further performedusing the isotopic and physio-chemicaldata of natural waters collected fromthe Dali Basin and the surrounding mountains.It indicated that the major rechargesources of the groundwaters in the NPCSX, as well as the river waters and groundwatersinthe Dali Basin,were mainly derived from the Daxin'Anling Mountains, by leaking of the Xilamulan River water through a thick aquifer in the eastern margins of the Otindag. By contrast, While the groundwaters in the

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~~SPCSXweremainly recharged from two sources~~,. ~~One was the flash floodsderived from the Yinshan Mountains and the~~ river waters ~~other was the Xilamulun River waters derived from the Daxin'Anlin Mountains. It indicatesthat the modern indirect recharge mechanism, instead of the direct recharge and the palaeo~~_~~water recharge,is~~the most ~~significant for grou~~n~~dnwaterrecharge in the eastern Otindag. This suggests thatthetecto~~nic ~~settings at a regional scale, but not the climate,~~is at the origin of ~~was responsible forthe groundwater origin in the Otindag. This study provide~~sd ~~a new~~ perspective~~sight into the origin and evolution of groundwater resourcesin the middle-latitude desert zone of NH.~~The Otindag Desert is essential to livestock-economy and ecoenvironment of northern China. Although surface water is the traditional source for China's socio-economy in arid areas, the groundwater resources underlying the desert are increasingly burdened by groundwater pumping, which increases interest in the status of the groundwater resources. Widespread fresh groundwater deep to 60 m was found at the eastern part of the Otindag Desert. The occurrence of this massive fresh groundwater raises doubts on the often-made assumption in the literature that regional atmospheric precipitation or palaeowater, namely the direct recharge, is the source of water in the middle-latitude desert aquifers of northern China and makes further investigation necessary. Knowledge on the origin and recharge of this fresh groundwater is key in assessing the possibility of groundwater exploitation and utilization. In this study we conducted hydrogeochemical and isotopical analyses to assess possible origin and recharge of these groundwaters. It is concluded that the fresh groundwater can neither originate from regional atmospheric precipitation derived from the Asian Summer Monsoon system, nor from palaeowater that formed during the last glacial period. Our results indicate that with groundwater dating it is possible to originate from remote mountain areas via the faults of the Solonker Suture zone, including the Daxing'Anlin and Yinshan Mountains. Furthermore, it is deduced that the hydrological connection between desert aquifers and mountain systems through the suturezone is crucial to the hydrogeological functioning of the Otindag aquifer.Thissuggests that the modern indirect recharge mechanism, instead of the direct recharge and the palaeo-water recharge,is the most significant for groundwaterrecharge in the Otindag Desert. This study provides a new perspective into the origin and evolution of groundwater resourcesin the middle-latitude desert zone of Asian continent.

Keywords: fresh groundwater recharge ~~origin~~; atmospheric precipitation; direct recharge; indirect recharge; palaeowater recharge; fault hydrology; middle-latitude desert; ~~direct and indirect recharge; stable and radioactive isotope; ion hydrochemistry;climate control; tectonic control;~~Otindag Desert.

1. Introduction

~~Water Resources.~~ In a semi-arid to arid region where rainfall is insufficient to supply the needs of a growing population and a higher standard of living, the deficit is normally made up by extracting groundwater. ~~【Alsharhan, 2001, Hydrogeology of an Arid Region The Arabian Gulf and Adjoining Areas】As rainfall events are infrequent in arid and semi-arid regions of the world, surface runoff andrelated water resources are globally scarce and ephemeral.These areas thus rely heavily on groundwater asthe primary water resource to support local ecosystems(Herczeg and Leaney, 2011; Scanlon et al., 2006).It has been widely proved that the origin, quality and quantity of groundwater in~~

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arid lands can be deeply influenced by environmental factors/processes,whichcontrollingthe groundwater recharge and evolution, such as in the arid lands of northwestern China and Central Asia (Zhu et al., 2015, 2016, 2017).For this reasonthese factors/processes become an essential component in the understanding of regional hydrological systems and the management of water resources (Dogramaci et al., 2012). For example, groundwater recharged by modern precipitation can refill quickly but is vulnerable to contamination by the surface wastes, inversely, groundwater containing mostly ancient water may not recharge to a useful extent over human timescalesand cannot be affected by surface waters(Bethke and Johnson, 2008). Therefore, different strategies on groundwater resourcesmanagement should be adopted when the different recharge mechanisms of groundwater occurring.

In general, groundwater recharge can be broadly classified into two ways,the direct recharge,namelydiffuse recharge by native water resources, and the indirect recharge,namely focus recharge by external water resources. The direct recharge is replenished by precipitation infiltration through the unsaturated zone and the indirect recharge is defined as recharge from mappable features such as rivers, canals, and lakes originated from remote areas(Healy, 2010). It is well known that groundwater recharge can be influenced by environmental factors, including climate change, underlying soil and geology, land cover and population growth,over withdrawal and economic development (Zhu et al., 2015, 2017), thus the amount of groundwater in arid and semi-arid regions decrease rapidly while human demands on the limited water resources increase rather than decrease (Ma et al., 2013). Between environment and groundwater recharge, climate and land cover largely determine precipitation and evapotranspiration, whereas the underlying soil and geology dictate whether a water surplus (precipitation minus evapotranspiration) can be transmitted and stored in the subsurface (Giordano, 2009; Doll, 2009). Modelled estimates of diffuse recharge globally (Doll and Fiedler, 2008; Wada et al., 2010) range from 13,000 to 15,000 km^3/yr, equivalent to ~30% of the world's renewable freshwater resources (Doll, 2009) or a mean per capita groundwater recharge of 2100 to 2500 m^3/yr. These estimates represent potential recharge fluxes as they are based on a water surplus rather than measured contributions to aquifers. Furthermore, these modelled global recharge fluxes do not include focused recharge, which, in semi-arid and arid environments, can be substantial (Scanlon et al., 2006; Favreau et al., 2009). For keeping sustainable management of water resources, it requires urgently tounderstand both diffuse and focused recharge and meet both human and ecosystem needs in arid areas of the world, particularly in Central Asia and Northern China.

Many areas iIn the middle-latitude desert zone of northern China such as, many areas of these lands the Badanjilin Desert, the Mu US sandy Land and the Hobq Desert (Chen et al., 2012a; Chen et al., 2012b), are unexpectedly rich in incommensuratewith large groundwater resources , such as the Badanjilin Desert, the Mu Us Sandy Land and the Hobq Desert (Chen et al., 2012a; Chen et al., 2012b), although they have been under arid or hyper-arid climate for a long time (Sun et al., 2010). How these groudndwaters are originated and how they are recharged in these deserts are thus fundamental scientific becaming a keyquestions. Until now, however, no consensus has been achieved ithas long been alteracated in the acadeamic circles.

For some of the earth scientists, the direct recharge is thought to be very important for

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groundwaters in the wide desertlands of northwestern China due to lack of surface runoffs(Yang et al., 2010; Yang and Williams, 2003; Zhao et al., 2017). They argued that although the amount of atmospheric precipitation is small, the vast catchment area in the desert region couldconcentrate the rainfall into large inland basins, creating an aquifer with large storage capacity and great thickness.However, some of hydrologists suggested that the estimate of direct recharge usedby the chloride mass balancemethodwas 1.4 mm/year, approximately only 1.7% of the mean annual precipitation in a cold large desert (Badanjilin) in northern China (Gates et al., 2008). A similar estimation wasonly 1 mm/year for Gobi deserts from the Hexi Corridor to the Inner Mongolia Plateau in northwestern China(Ma et al., 2008). Consequently, they thought that heavy potentialevaporation and little precipitation make it difficult for direct recharge to meet the supply of groundwater in these desert areas.Thus, the indirect recharge isconsidered to be an important mechanism for groundwater recharge in these desert areas. For example, based on isotopic compositions of natural waters,Zhao et al. (2012)suggested that little precipitation had rechargedinto groundwaters in the Badain Jaran Desert.Chen et al. (2004)argued that the groundwatersin the Badanjilin Desert were recharged by palaeo-glacial melt water through faults and deep carbonate layers far away from the local desert.Many studies also suggested that palaeowaters stored in aquifer during wetter climate periods could recharge to groundwater under certain conditions in arid lands (Edmunds et al., 2006; Ma and Edmunds, 2006).Other kinds of indirect recharge, such as mountain front recharge from adjacent mountain blocks,are also proposed to offer an important inflow to aquifers within arid to semiarid catchments(Blasch and Bryson, 2007).

The Otindag Desert is one of the largest sandydesert lands located at inthe monsoon margin of northern China and is the geographical centre of the northeastern Asian Continent (Fig. 1), which can be regarded as a significant repository of information relating to the groundwater recharge in the arid Inner Asia. At present, the eastern Otindag is also a typical case for its unexpected incommensurate groundwater resources, because t-There is abundant of groundwater in this desert land and even rivers originate there due to the spillover of spring water, such as the tributaries of Xilamulun River in its north and the Shandian River in its south (Fig. 1). Climatically, the monsoon margin of northern China refers to a strip along the present East Asian Summer Monsoon (EASM) limits and is considered to be sensitive to climate change (Wang and Feng, 2013). Geologically, the Otindag Desert lies in a tectonic depression of the central Solonker suture zone with a few faults stretching east and west (Fig. 2), with its northern margin along a fault marked by a series of lake basins. Thus, the large-scale hydrogeological conditions of the Otindag Desert belong to a fault zone under the influence of the EASM climate.

Until now, hHowever, whether the climate or other factorsthe tectonic faults affected the origin of groundwater recharge andthefluid flow patterns in groundwateraquifersin the Otindag are still not known. -Because at present Until now, however, lLittle data and documents about the groundwater and its origin is available -in the literature inOtindag, and knowledge and reliable data on various hydrogeological characteristics of the desert such as the catchment extent, input/output, the hysteretic hydraulic functions, the transient hydraulic conditions, in-homogeneities, and on transfer functions to

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overcome scale problems are also missing. Under such conditions, conventional methods such as water balance and hydraulic methods sometimes fail in determining groundwater recharge, particularly in extreme environments (arid, semi-arid, or cold) (Drever, 1997). BBeacuseecause pristine aquatic conditions may significantly differ from managed conditions in arid environment, and thus groundwater recharge is not a fixed number, but may vary with the boundary conditions of the recharge system (Seiler and Gat, 2007).

can be obtained in literature.Whether the direct or indirect recharge is the major mechanism for groundwater recharge in OtindagIn general, gGroundwater recharge can be broadly classified into two categories: the direct recharge by native water resources and the indirect recharge by external water resources (Herczeg and Leaney, 2011). Water infiltration of atmospheric precipitation through the unsaturated zone to the groundwater is hydrologically defined as the direct recharge, and t.The indirect recharge is defined as recharge from mappable features such as rivers, canals, lakes and originates from remote areas (Scanlon et al., 2006; Healy, 2010)(Healy, 2010). It is well known that groundwater recharge can be influenced by environmental factors, including climate change, underlying soil and geology, land cover and the growth in human population that affects withdrawal and economic development (Zhu et al., 2015, 2017). Among these environmental factors, climate and land cover largely determine precipitation and evapotranspiration, whereas the underlying soil and geology dictate whether a water surplus (precipitation minus evapotranspiration) can be transmitted and stored in the subsurface (Giordano, 2009; Doll, 2008, 2009; Giordano, 2009).

For some earth scientists, the direct recharge is thought to be very important for groundwaters in the wide desert lands of north China due to the lack of surface runoffs (Yang et al., 2010; Yang and Williams, 2003; Zhao et al., 2017)(Yang et al., 2010; Yang and Williams, 2003; Zhao et al., 2017). They argued that although the amount of atmospheric precipitation is small, the vast catchment area in the desert region could concentrate the rainfall into large inland basins, creating an aquifer with large storage capacity and great thickness. However, some hydrologists estimated by the chloride mass balance method that the direct recharge was 1.4 mm/year, which represents approximately only 1.7% of the mean annual precipitation in a cold large desert (Badanjilin) in northern China (Gates et al., 2008)(Gates et al., 2008). A similar estimation of 1 mm/year was given for Gobi deserts from the Hexi Corridor to the Inner Mongolia Plateau in northwestern China (Ma et al., 2008)(Ma et al., 2008). Consequently, they thought that heavy potential evaporation and little precipitation make it difficult for direct recharge to meet the supply of groundwater in these desert areas. Thus, the indirect recharge is considered to be an important mechanism for groundwater recharge in these desert areas. For example, based on isotopic compositions of natural waters,Zhao et al. (2012) suggested that little precipitation had recharged into groundwaters in the Badain Jaran Desert. Chen et al. (2004) argued that the groundwaters in the Badanjilin Desert were recharged by palaeo-glacial melt water through faults and deep carbonate layers far away from the local desert. Many studies also suggested that palaeowaters stored in an aquifer during wetter climate periods could recharge to groundwater under certain conditions in arid lands (Edmunds et al., 2006; Ma and Edmunds, 2006). Other kinds of indirect recharge, such as mountain front recharge from adjacent mountain blocks, are also proposed to offer an important inflow to aquifers within arid to semiarid catchments (Blasch and Bryson, 2007).(Blasch and

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Bryson, 2007).

In this paper, we focus to answer the a question that whether groundwater recharge in Otindag is mainly direct or indirect, using hydrochemical and isotopic indicators as tracers to offer a valuable support for identifying the contributions of preicipitation recharge on groundwater, since these indicators reflect the composition of water molecules and are sensitive to physical processes such as mixing and evaporation (Lawrence et al., 1976;Coplen, 1993; Sultan et al., 2000; Guendouz et al., 2003; Petrides et al., 2006; Scanlon et al., 2006; Zhu et al., 2007, 2008; Jobbágy et al., 2011; Zhai et al., 2013; Eissa et al., 2014). T, as the abovementioned hot question for other deserts in China,is alsounknown.

It should be kept in mind that virgin aquatic conditions may significantly differ from managed conditions in arid environment, because groundwater recharge is not a fixed number, but may vary with the boundary conditions of the recharge system (Seiler and Gat, 2007). Conventional methods such as water balance and hydraulic methods sometimes fail in determining groundwater recharge in extreme environments (arid, semi-arid, or cold) (Drever, 1997), because of missing knowledge and the lack of reliable data on various characteristics such as the catchment extent, input/output, the hysteretic hydraulic functions, the transient hydraulic conditions, in homogeneities, and on transfer functions to overcome scale problems (Seiler and Gat, 2007). Under such conditions, tracer methods offer a valuable support for natural water studies.

Geochemical elements and environmental isotopes have been widely used as effective tracers to determine the sources of groundwater recharge, which could be attributed to infiltration by rainfall, surface waters or both of them(Zhu et al., 2007, 2008; Zhu et al., 2017). For example, by comparing the composition ofstable isotopies of hydrogen and oxygen in local meteoric waterswith these in groundwaters, many studies successfully applied in identifyingwhether the rainfall play a vital role in recharging groundwater or not(Zhu et al., 2007; Petrides et al., 2006; Jobbágy et al., 2011; Zhai et al., 2013). Also, investigating the spatial distribution of groundwater age represented by the concentration of tritium or radioactive carbon (^{14}C) can provide a way to understand the recharge relationship between the modern rainfall and the groundwater(Sultan et al., 2000; Zhu et al., 2008). For the indirect recharge, the groundwater flow regimes or its movement pathway deduced from hydrochemical and isotopical tracers can indicate its origin and recharge processes. For example, the groundwater mineralisation will increaseas a result of dissolution of evaporite minerals along flow lines that begin with the recharge area (Guendouz et al., 2003). While, the geochemical and isotopic composition of groundwaterswill be much complexat interface zones between groundwaters with different hydrochemistry or ages, they will show distinct physiochemical characteristics indicating how they mixed(Lawrence et al., 1976; Eissa et al., 2014).

he detailed The objectives of this study are: (1) to examine the distribution patterns of environmental signals in the stable and radioactive isotopes and the major ionic hydrochemistry of groundwater in the eastern Otindag drainage system, and (2) to recognize the major sources of groundwater in the area, and (32) to identify the key mechanism of groundwater recharge in the desert. land, particularly to discriminate whether the direct recharge or the indirect recharge being the major control on groundwater rechage in the desert land.

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2.Regional settings

Geographic setting. The Otindag Desert lies between latitudes 42° and 44°N and longitudes 112° and 118° E (Fig. 1). It forms a part of the great middle-latitude desert belt in northern China which stretches from the Taklamakan Desert of northwestern China to the Kelqin Desert of northeastern China, near the west coast of the Pacific Ocean. The desert has an area of approximately ~~The Otindag Desert (~~~21,400 square kilometers ~~km^2)is~~ , ~~a middle-latitude sandy land desert~~ located in ~~in~~the eastern ~~of the~~ Inner Mongolia ~~-Plateauand~~and at ~~situated at~~ the monsoon margin of northern China~~as the geographical centre of the northeastern Asian Continent~~ (Fig. 1). It ~~,~~is the fourth largest sandy land~~s~~ in China (Yang et al., 2012) ~~(Yang et al., 2012),~~and is bordered by a flat steppe terrain of Dali Basin to the north, the Yinshan Mountains ~~Range~~ and mountainous loess landscape to the south, and the the Greater Khingan (Daxing'Anling) Mountains ~~Range~~ to the east (Fig. 1). The Otindag Desert is essential to livestock-economy and ecoenvironment of northern China. Settlements in this desert are restricted to areas to permanent springs, shallow groundwater and oases to areas where irrigation is possible. Some nomads continue to eke out a precarious existence grazing livestock in the desert.

Topography and geomorphology. The Otindag Desert has a varied relief, combining extensive dune fields with rugged mountains along the eastern, southern and southeastern rims. In the east, the Daxing'Anling Mountains stretch from the Heilong River Valley into the upper reach valleys of the Xilumulun River from northeast to southwest, gradually increasing in height northwards from about 180 m near Huma to Huanggangliang, where the highest peaks reach 2,029 m with an average elevation range from 1,100 to 1,400 m. In the south and southeast, the Yinshan Mountains decline gradually near Duolun and Zhenglanqi, and in some areas leave wide alluvial plains. The terrain of the Otindag Desert is less rough and elevations decrease from ca. 1300 m in the southeast to ca. 1000 m in the northwest. Over the greater part of this desert the ground cover consists of fixed and semi-fixed sandy dunes, with a few mobile dunes in area of little vegetation. The dominated dune types are represented from parabolic to barchans, linear and grid-formed types, ranging from a few meters to over 40 m in height (Zhu et al., 1980; Yang et al., 2008).

Climate, vegetation and soil.

The climate of the Otindag Desert was not uniform in geological period, with much sand movement, occasional rainy years, and several wetter intervals during the Holocene (Yang et al., 2015; Tian et al., 2017). At present t~~The Sandy Land is in a tectonic depression with a few faults stretching east and west, with its northern margin along a fault marked by a series of lake basins. Tertiary and Quaternary sandstones and mudstones are the common basement rocks under the dunes, and extensive volcanic basalts forming flat terrains are to the north (Zhu et al., 1980;Li et al., 1995).【Yang et al., 2007, Catena】~~

~~The Otindag's elevation is variable, ranging from ca. 1300 m in the southeast to ca. 1000 m in the northwest.~~The whole desert belongs to the ~~a~~temperate arid and semi-arid temperate zone ~~of northern China~~, with a meanannual temperature of 2 °C in the north and 4°Cin the south (Liu and Yang, 2013)~~(Liu and Yang, 2013)~~. At t~~T~~he regional scale, the climate of the desert ~~climate~~is typically controlled by the East -Asian M~~m~~onsoon system, characterized by a warm summer, with precipitation transported by the EASM, and by a cold and dry winter under the influence of the East Asian Winter

Monsoon (EAWM). The rainfall in the desert exhibits a wide variation in space and time. I~~whose~~ ~~i~~nfluence of the EASM ~~is~~ changes~~ing~~ from southeast to northwest in the desert, and varies with latitude and distance from the Pacific Ocean, leading to the mean annual rainfall decreasing from ~450 mm in the southeast to ~150 mm in the northwest (Yang et al., 2013)~~(Yang et al., 2013)~~. This uneven distribution of precipitation has a major influence on the availability of near-surface moisture, consequently on the distribution of vegetation, soil and the animal husbandry potential of local communities. The basic soil cover consists of grey desert soil in the west and changes to sierozems and chernozem or chestnut soil in the east. Through the desert, vegetation is sparse in the west and relatively abundant in the east. The natural vegetation is characteristic of desert or semi-deserts, with scrub woodland in the east and steppe in the west. Due to the scarcity of surface water, the growing season is affected by temperature, rainfall and elevation, and hence cultivation is restricted mainly to flood plains.~~Fixed and semi-fixed sandy dunes are dominate~~ the landscape~~d~~ ~~in the desert land, with a few mobile dunes in area of little vegetation.~~ Several ~~d~~Dune types ~~are~~ represented ~~various from parabolic to barchans, linear and grid-formed types, ranging from a few meters to over 40 m in height (Yang et al., 2008; Zhu et al., 1980).~~

Geology. The O~~n~~tindag Desert is located in a tectonic depression of the Solonker Suture Zone (Jian et al., 2010) bounded by the Northern Early to Mid-Paleozoic Orogen Zone and the Hatug Uul Block to the north, the Southern Early to Mid-Paleozoic Orogen Zone and the North China Craton system to the south (Fig. 2). A few faults such as the Xar Moron Fault and Chifeng-Bayan Obo Fault stretch east and west, with its northern margin along the Solonker Suture Zone marked by a series of lake basins (Figs. 1 and 2). The tectonostratigraphic units and overall structural trends are mainly oriented NE–SW (Fig. 2), which may be interpreted as resulting from overall compressive stresses oriented principally in the NW–SE quadrants during orogenesis (Jian et al., 2010; Zhang et al., 2015). Diverse rock types from unlithified and lithified clastic sediments through to carbonate, crystalline, and volcanic rocks are distributed in and around the Otindag Desert (Zhang et al., 2015) (Figs. 2 and 3~~XX~~). ~~【Bense et al., 2013, ESR】~~

Tertiary and Quaternary sandstones and mudstones are the common basement rocks under the dunes of the Otindag, and extensive volcanic basalts forming flat terrains are to the north (Zhu et al., 1980; Li et al., 1995).

Hydrology and hydrogeology.

The Otindag Desert originated during the Late Quaternary (Yang et al., 2015) and various alluvial fans formed at the margins of this desert during the early to middle Holocene. These are composed of conglomerate and sand deposits, where major periodic steams or wadis debouched into the Otindag. At present two rivers run through the eastern margin of the Otindag Desert, i.e. the Xilamulun River in the north and the Shandian River and its two tributaries, the Shepi River and Tuligen River in the south. Both stem from the eastern and southeastern parts of the Otindag (Fig. 1). The Xilamulun River, 380 km in length and 32.54×10^3 km^2 in area, is a neighboring river both to the northeastern Otindag and the southeastern Dali Basin, the northern catchment of the Otindag Desert. The Xilamulun River flows to the east and finally goes into the Xiliao River, with an annual mean runoff of 6.58×10^8 m^3 (Wu et al., 2014). The Shandian River is the upper reach of the Luan River.

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with a length of 254 km and a catchment area of 4.11×10^3 km^2 (Yao et al., 2013). Along the low, flat and sandy shorelines of some lakes in the Otindag, salt flats or sabkhas have formed in shallow depressions. Due to the high rate of evaporation, salt crusts develop which have been locally exploited where the salt is relatively free from sand. During rainy season, some rain and floodwaters (generally coming from the Yinshan piedmonts) are retained in low-lying areas, which may temporarily recharge shallow aquifers. Under storm conditions, occasional heavy, short rainstorms cause floods in soil-rich wadi channels. Under other conditions, sand dunes and sand sheets bury the ground and sabkhas.

The Otindag Desert can depend on several water-bearing formations and units (aquifers) for their groundwater resources (Fig. 3). Coarse- to f~~Fault zone hydrogeology【Bense et al., 2013, ESR】~~

~~Outcrop observations indicate that fault zones commonly have a permeability structure suggesting they should act as complex conduit-barrier systems in which along-fault flow is encouraged and across-fault flow is impeded.【Bense et al., 2013, ESR】~~

~~Hydrogeological observations of fault zones reported in the literature show a broad qualitative agreement with outcrop-based conceptual models of fault zone hydrogeology.【Bense et al., 2013, ESR】~~

~~Nevertheless, the specific impact of a particular fault permeability structure on fault zone hydrogeology can only be assessed when the hydrogeological context of the fault zone is considered and not from outcrop observations alone.【Bense et al., 2013, ESR】~~

~~Diverse rock types from unlithified and lithified clastic sediments through to carbonate, crystalline, and volcanic rocks are distributed in and around the Otindag Desert (Fig. XX)【Bense et al., 2013, ESR】~~

Fine-grained sedimentary rocks, magmatic rocks and ~~aeolian sediments~~metamorphic rocks of the Inner Mongolia-Daxing'Anling Orogenic Belt (Zhang et al., 2015) ~~XXXX geological province~~ form the major regional aquifer unit (Fig. 3). They are composed mainly of alluvial sediments (mid-Permian Zhesi Formation), melange (Solonker suture zone), A-type granite (early Permian), bimodal volcanic rocks with sedimentary intercalations (early Permian Dashizhai Formation), diorite-quartz diorite-granodiorite rocks (Carboniferous-Permian) and metamorphic complex (predominantly gneiss, early Paleozoic) (Fig. 2). The aquifer is generally unconfined in dune fields of the Otindag Desert, unconfined to semi-confined in the Yinshan~~XXX~~ Mountains' piedmont, and semi-confined to confined in the Daxing'Anling~~XXX~~ uplands (Fig. 3). Water-level measurement in June 2010 indicated that the general depth of unconfined groundwater level ranges between 10 to 70 m in the Otindag Desert (Fig. 3)~~-~~. Local granular aquifers in the central desert are composed of coarse~~coarse~~ fluvial, lacustrine and aeolian sediments, but their extent and thickness vary throughout the watershed (Zhu et al., 1980; Li et al., 1995). ~~【Benoit et al., 2014, CWRJ】~~The generally coarse-grained texture of the unconsolidated rock formations provides primary porosity in terms of groundwater flow in the desert.

~~Most of the tectonic fabric of the Appalachians was generated by compression or low-angle thrusting; in those areas where major faults are strike-slip in nature, deformation is largely limited to rocks adjacent to the faults. The tectonostratigraphic units and overall structural trends are mainly oriented NE-SW, which may be interpreted as resulting from overall compressive stresses oriented principally in the NW-SE quadrants during orogenesis (Faure et al. 2004, 2006). The generally fine-grained texture of the rock formations provides negligible primary porosity in terms of~~

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groundwater flow (Benoît et al. 2008). 【Benoit et al., 2014, CWRJ】

Deformation along faults in the shallow crust (<1 km) introduces permeability heterogeneity anisotropy, which has an important impact on processes such as regional groundwater flow. Fault zones have the capacity to be hydraulic conduits connecting shallowand deep geological environments, but simultaneously the fault cores of many faults often form effective barriers to flow.The direct evaluation of the impact of faults to fluid flow patterns remains a challenge and requires a multidisciplinaryresearch effort of structural geologists and hydrogeologists.【Bense et al., 2013, ESR】

The Otindag Desert depend on several water bearing formations and units (aquifers) for their groundwater resources. Theyare composed mainly of sandstone and limestone. 【Alsharhan, 2001, Hydrogeology of an Arid Region The Arabian Gulf and Adjoining Areas】

During rainy season, some rain and flood waters are retained behind dune dams and recharge shallow aquifers.

Two rivers inrun through the Otindag, i.e. the Xilamulun River in the north and the ShandianRiverand its withtwo tributaries,of theShepi River and the Tuligen River in the south. B,bothstem from the eastern and southeastern parts of the Otindag(Fig. 1). The Xilamulun River flows to the east and finally goes into the Xiliao River, with a catchment area of 32.54×10^3 km^2 and an annual mean runoff of 6.58×10^8 m^3 (Wu et al., 2014).The Shandian River is the upper reach of the Luan River, with a length of 254 km and a catchment area of 4.11×10^3 km^2 (Yao et al., 2013).

3.Methods

The hydrochemistry of natural water in the Otindag Desert, as related to the prevailing EASM climate, as well as, the dominant topographical, geological (tectonic) and hydrogeological conditions, are discussed here and interpreted, using chemical and isotope analyses of water samples from rain, springs, shallow aquifers and deep aquifers, rivers and lakes, and are represented on relevant graphs and diagrams. Fieldworks took place during the summer season of 2011 and the spring season of 2012. The water samples selected in this study were all collected from natural water, including the groundwater, river water, lake water, spring water and precipitation water in types. A tTotal of twenty-fivewater samples were analyzed collected for ion chemical,stable and radioactive isotopic analyseisforin this study.Water Groundwatersamples is the major type among these waters, whichwere mainly retrieved taken from shallow and deep wells widelylocated over a wide area in dune fields of the study regionsarea. The detailed locations of the sampling sites are shown in Fig. 43.

Two groups of parameters are measured to characterize the chemistry of any water analysis: field-measured parameters and lab-measured parameters. The filed-measured parameters include temperature (°C), hydrogen-ion concentration (pH), electrical conductivity (EC in micro-Siemens per centimeter or μS/cm) and total dissolved solid (TDS, mg/L). The values of these parameters change when they are not directly measured in the field. The number lab-measured parameters depend on the purpose of study. However, the measurement of major cations (F^-, Cl^-, NO_2^-, NO_3^-, SO_4^{2-} HCO_3^-, CO_3^{2-} and $H_2PO_4^-$) and anions (Li^+, Na^+, NH_4^+, K^+, Mg^{2+} and Ca^{2+}) are determined in most chemical analyses. Analysis for stable (^2H and ^{18}O) and radioactive isotopes (^3H) in rain and groundwater are

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also included. The analytical data of the physiochemical parameters and the stable and radioactive isotopes of the water samples collected in this study are listed in Tables 1, 2 and 3, respectively.

Thesurface waters were mainly sampledfrom rivers and lakes in the Otindag, and the spring waters were collected from the riverhead of the Xilamulun River,the Shepi River and the Tuligen River. One rainfallsample of the local atmospheric precipitation (p1)was also collected at the southeastern margin of the Otindag in the 2011 summer season.Water samples were filtered using 0.45μm membrane filters for cation and anion analysis, and were acidified with 1% HNO_3 for cation analysis.Water samples for stable and radioactive isotope analysis were collected in the field with a polyethylene bottles of 0.5L in volume, respectively. Variables Some kinds of analysis were measured on site with a portable instrument (Eijkelkamp). These determinations included temperature, pH, oxidation-reduction potential (Eh), electrical conductivity (EC), and total dissolved solid (TDS).The measurement errors barswere<±0.1 °C for temperature, <±1% for pH, <±5% for Eh, <±5% for EC, and <±0.5% for TDS, respectively.

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The concentrations of major anions (F^-, Cl^-, NO_2^-, NO_3^-, SO_4^{2-} and $H_2PO_4^-$) and cations(Li^+, Na^+, NH_4^+, K^+, $Mg^{2+}$and Ca^{2+}) were determined by electrochemical detectors of an ion chromatography (Dionex 600) in the Institute of Geology and Geophysics, Chinese Academy of Sciences, with measurement errorsbars<±3% for anions and <±2% for cations. The concentrations of carbonate (alkaline) ions of HCO_3^- and CO_3^{2-}were measured by titration with HCl (0.1 M)following theaGran Method (Gran, 1952), with an error bar<±5%. The hardness (HD, German standards) of these water samples wascalculated based on the equation HD = ([Mg^{2+}]×100/24.305+[Ca^{2+}]×100/40.08)/17.847, [Mg^{2+}] and [Ca^{2+}] referring to the concentration of Mg^{2+} and Ca^{2+} with unit of mg/L.

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Two stable isotopes of ^2H and ^{18}O,as being expressed in δ notation ($\delta^2H={}^2H/{}^1H$, $\delta^{18}O={}^{18}O/{}^{16}O$) relative to the Vienna standard mean water (VSMOW), were measured for all of the water samples collected in this study,usingby MAT-252 in the Laboratory for Stable Isotope Geochemistry, Institute of Geology and Geophysics, Chinese Academy of Sciences, with σ< ±0.374‰ for δ^2H and <±0.062‰ for δ^2H and $\delta^{18}O$, respectively.

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Several groundwater samples (500 ml each), collected from wells (6-60 m deep) in the study area, were prepared for the analysis of radioactive isotope (tritium) analysis. 300 ml of water sample, added with addition of 1 g $KMnO_4$, were distilled to remove any impurities. In order to increase the tritium concentration to an easily measurable level, electrolytic enrichment was applied (Kaufman, 1954; Baeza et al., 1999). A volume of 250 ml of previously distilled sample with 2.5 g NaOH was then put to the electrolysis apparatus containing electrolytic cells with co-axial stainless steel electrodes. Electrolysis was carried out until the volume of electrolyte was reduced to 8 ml and all runs were performed at a temperature of 2–5 °C to prevent the loss of tritiated water molecules by evaporation. After electrolysis CO_2 was bubbled through the cell to neutralize the water because the medium in which the electrolysis took place earlier is alkaline. The water sample was separated from the electrolyte by distilling. The pretreated samples were measured by a low level background liquid scintillation counter (Quantulus 1220-003) according to the manufacturer's guidelines. The error bar of the measurement errors are should be< ±3%. The tritium data of several groundwater samples collected in this study had been partially mentioned by Yang et al. (2015) as one of the supplementary maeterials.

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It was systematically discussed in this study.

4.Results and Discussions

The analytical data of the physiochemical parameters and the stable and radioactive isotopes of the water samples collected in this study werelisted in Tables 1, 2 and 3, respectively.The study area and the sampling siteslocation for each sample analyzed wereshowed in Figs.1 and 2, respectively.

4.1.Hydrochemical characteristicsstry of natural the ground and surface waters in the Otindag

The pH values of the water samples studied varied from 6.26 to 9.44 (except sample p1, precipitation, 4.61)(Table 1) ,with a median value of 7.27, indicating that the waters are generally neutral to slightly alkaline. The TDS ranged between 67mg/L and 660 mg/L (average 211 mg/L) (Table 1), all belonging to fresh water (TDS < 1000 mg/L) in the salination classification of natural water (Meybeck, 2004).The natural water samples collected in this study are generally neutral to slightly alkaline, with the pH values varying between 6.26 and 9.44 (except the precipitation sample p1, 4.61) (Table 1) and a median value of 7.27. The TDS values range between 67 and 660 mg/L (average 211 mg/L) (Table 1), all belonging to fresh water(TDS < 1000 mg/L) in the salination classification of natural water (Meybeck, 2004).

The variations in ion concentrations of the major cations and anions in the studied water samples were displayed in a Schoeller diagram (Schoeller, 1955), a fingerprint diagram with a semi-logarithm ofy-axis (Fig. 35). The rain water sample is the most depleted in ions among these samples. TIn general, tThethe groundwater samples have hadthe highest concentrations of cations and anions while the precipitation sample (p1) had the lowest concentrations,and the lake, river and spring waters had intermediate the medium values. The calcium concentration iswas the highest among incations in almost all of the water samples, and the HCO_3+CO_3 concentration (bicarbonate + carbonate alkalinity) is wasthe highest among inanions in most of the water samples. For ,except for several groundwater samples (g3, g4, g5, g6 and g11), andone of thespring sample (s1) and the precipitation sample (p1), they have which had the higher SO_4 concentrations than the alkalinity (Fig. 53).

Two chemically distinct water types are recognized for the studied waters invia a Piper diagram (Fig. 6)(Piper, 1944), calcium bicarbonate and calcium sulphate (Fig. 4). The relative differences in abundance of ion concentrations between different waterscan be detectablerevealed in a Piper diagram(Piper, 1944).The water samples studied can be classified into two water types in the Piper diagram (Fig. 4). T, type I, the Ca-HCO_3 water, which generally represents the typical bicarbonate water experiencedaffected bynear surface mineral weathering,and type II, the Ca/Mg-SO_4water, which indicates saline waterdominated by alkaline earth metals (Zhu et al., 2011, 2012; Clark, 2015). For water type I,the weak acids exceededthe strong acids;the carbonate hardness (secondary alkalinity) exceeded 50% and was dominated by the alkaline earths.While for water Type II,the strong acids exceededthe weak acids andno carbonate hardness exceeded 50%. The alkaline earths (Ca+Mg) exceeded the alkalis (Na+K) in all the water samples studied.There were nNo any Chloridel-type and sodiumNa-type waters occurring in the study area (Fig. 64). Based on more than 10,000 chemical

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analyses of groundwater samples from the world, Chebotarev (1955) observed that the global groundwater tends to evolve chemically towards the composition of seawater. He also observed that this evolution is associated with regional changes in dominant anions but not cations, as the concentration of cations may exhibit a wide range of fluctuations in groundwater and is not as steady as the changes in anion dominance. Freeze and Cherry (1979) illustrated the Chebotarev's (1955) general evolution of groundwater as a anion evolution line: HCO_3^- → $HCO_3^- + SO_4^{2-}$ → $SO_4^{2-} + HCO_3^-$ → $SO_4^{2-} + Cl^-$ → $Cl^- + SO_4^{2-}$ → Cl^-, which travels along the flow paths and increasing ages. On this evolution line, bicarbonate water is generally characteristic of low salinity, renewable water resources and low residence time, while sulphate waters predominate in groundwater passing through gypsum and anhydrite aquifers, and is usually associated with intermediate salinity in unconfined aquifers (Clark, 2015). The distribution pattern of water chemical types occurred in the studied area , indicatesing a primary stage of groundwaterwater evolution for natural watersin the Otindag Desert., in terms of the hydrogeochemical perspective.

The hydrochemical facies of the studied water samplescan be further illustrated by anDurov diagram (Durov, 1948) and its expanded models (Lloyd and Heathcote, 1985; Al-Bassam et al., 1997; Chadha, 1999; Al-Bassam and Khalil, 2012). All the groundwater and spring water samplesin this study fell into the Durov fields 1, 4 and 5 of the expanded Durov diagram (Fig. 5).The water samples in the Durov field 1were actually thesame than to those classified into the Piper water type I (Fig. 4),while samples in the Durov fields 4 and 5 were the same thantothose of the Piper water type II (Fig. 4). Based on the graphic decipherment of Lloyd and Heathcote (1985), water samples in field 1 represent the presence of HCO_3^- and Ca^{2+} dominant water type, while samples in field 4 indicate the SO_4^{2-} dominant (or anions indiscriminate) and Ca^{2+} dominant water type, and samples in field 5 represent the water type without any dominant anion or cation. All the groundwater and spring water samples in this study were distributed close to the line of simple dissolution or mixing process. However, almost all the river and lake water samples were located in the Durov field 2 and were close to the line of ion exchange process (Fig. 5). These distribution patternsindicated that the ground waters and the surface waters had experienced different geochemical processes in the formation and evolution of natural waters in the Otindag.

4.2.The sStable and radioactive isotopic compositions esof natural waters in the Otindag

If we plot the relationships between oxygen and hydrogen isotopes of groundwater, springer, river water and lake water, we find that they are distributed between two straight lines with a gradient of 4.4, but with different y-intercepts (Fig. XX), as shown in the following equations:

$\delta D = 4.38\delta^{18}O - 24.97$ (R^2=0.87, n=11) for groundwater samples.

$\delta D = 4.44\delta^{18}O - 24.56$ (R^2=0.86, n=13) for groundwater and spring water samples.

$\delta D = 4.09\delta^{18}O - 28.31$ (R^2=0.93, n=24) for groundwater, springer water, river water and lake water samples.

$\delta D = 7.95\delta^{18}O + 10.52$ (R^2=0.77, n=5) for river water samples.

$\delta D = 2.69\delta^{18}O - 33.94$ (R^2=0.92, n=6) for lake water samples.

$\delta D = 6.57\delta^{18}O + 0.31$ (R^2=0.88, n=XX) for precipitation water in the Tianjin Station.

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$\delta D = 6.36\,\delta^{18}O - 5.21$ (R^2=0.93, n=XX) for precipitation water in the Baotou Station.

$\delta D = 6.86\delta^{18}O - 2.23$ (R^2=0.91, n=XX) for precipitation water in springin the Tianjin Station.

$\delta D = 6.68\delta^{18}O - 0.98$ (R^2=0.93, n=XX) for precipitation water in summer in the Tianjin Station.

$\delta D = 5.51\delta^{18}O - 4.13$ (R^2=0.55, n=XX) for precipitation water in autumn in the Tianjin Station.

$\delta D = 7.44\delta^{18}O + 13.57$ (R^2=0.94, n=XX) for precipitation water in winter the Tianjin Station.

$\delta D = 6.66\,\delta^{18}O + 0.30$ (R^2=0.93, n=XX) for precipitation water in spring in the Baotou Station.

$\delta D = 5.07\delta^{18}O - 15.1$ (R^2=0.80, n=XX) for precipitation water in summer in the Baotou Station.

$\delta D = 6.98\delta^{18}O + 0.85$ (R^2=0.95, n=XX) for precipitation water in autumn in the Baotou Station.

$\delta D = 6.86\delta^{18}O - 0.72$ (R^2=0.98, n=XX) for precipitation water in winter in the Baotou Station.

The stable isotopes of δ^2H and $\delta^{18}O$ were analyzed for all the water samples collected in this study, as shown in Table 3 and Fig. 6.The radioactive isotope of tritium (^3H) was analyzed for a part of the groundwater samples.

The δD^2H values of the groundwater samples collected in this study varied from -63.42‰ to -75.92‰ (Table 3), with an average -69.53‰. The $\delta^{18}O$ values ranged between -8.64‰ and -11.26‰ (Table 3), with an average -10.17‰.

The spring water samples ,whichdirectly drain into rivers,were relatively concentrated in values ofδ^2HD and $\delta^{18}O$ and were greatly similar to those of the groundwater samples (Fig. 76). The δ^2H and $\delta^{18}O$ values in the spring samplesvaried from -70.83‰ to -72.60‰ (mean value -71.72‰)and from -10.34‰ to -10.47‰(mean value -10.40‰), respectively(Table 3).

The δD^2H and $\delta^{18}O$ values in the river water samples were slightly more variable edand were also similar to those of the groundwater (Fig. 76), with a range of between -65.00‰ and -85.16‰(mean value -73.02‰) inδD^2Hvalues and a range of between -9.55‰ and -11.78‰(mean value -10.51‰)in$\delta^{18}O$(Table 3).

The lake water samples in this studywere enriched in δ^2HD and $\delta^{18}O$ by comparison ng to the groundwater samples (Fig. 6), with avariable range of between -34.16‰and -53.13‰(mean value -46.47‰)inδ^2H values and a range of between 0.38‰and -6.55‰(mean value -4.65‰)in$\delta^{18}O$(Table 3).

The precipitation sample p1 was also enriched in δD and $\delta^{18}O$ by comparison to the groundwater samples (Fig. 76), showed theaδ^2H value of -47.4‰ and athe$\delta^{18}O$ value of -7.14‰, respectively(Table 3).The content of radioactive isotope of tritium (^3H) measured in seven well groundwater samples with 6-60 m depth ranged from 1.86 to 24.35 TU (Table 3), with an average 14.95 TU, higher than the mean tritium concentration (9.8 TU) of groundwater in the Vienna Basin, Austria (Stolp et al., 2010), the seat of the International Atomic Energy Agency (IAEA).

If we plot the relationships between oxygen and hydrogen isotopes of groundwater, springer, river water and lake water samples, we observed find that the regression line that fits all data points can be

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described by the equation: they are distributed $\delta D = 4.09\delta^{18}O - 28.31$ (R^2=0.93, n=24) between two straight lineswith a gradient of 4.4, but with different y-intercepts(EL1 in Fig. 76XX)), as shown in. This local groundwater line (LGWL) is different from the Global Meteoric Water Line (GMWL, $\delta D = 8\delta^{18}O + 10$) and the Mediterranean Meteoric Water Line (MMWL, $\delta D = 8\delta^{18}O + 20$) estimated by Craig (1961), but it is similar to the local groundwater lines established for other deserts in northern China and central Asia with a same slope but different Y-intercepts, such as $\delta D = 4.17\delta^{18}O - 31.3$ for the Badanjilin Desert (Jin et al., 2018), $\delta D = 4.8\delta^{18}O - 15.2$ for the Ejina Desert in China (Wang et al., 2013), and $\delta D = 4.26\delta^{18}O + 9.23$ for the Rub Al Khal Desert in the United Arab Emirates (Rizk and El-Etr, 1997). The scatter of stable isotope data points for the lake water samples (Fig. 76) in the Otindag suggests that the lake waters are affected by evaporation, but the other waters in the desert are not so. the following equations:

$\delta D = 4.38\delta^{18}O - 24.97$ (R^2=0.87, n=11) for groundwater samples,

$\delta D = 4.44\delta^{18}O - 24.56$ (R^2=0.86, n=13) for groundwater and spring water samples,

$\delta D = 4.09\delta^{18}O - 28.31$ (R^2=0.93, n=24) for groundwater, springer water, river water and lake water samples.

$\delta D = 7.95\delta^{18}O + 10.52$ (R^2=0.77, n=5) for river water samples,

$\delta D = 2.69\delta^{18}O - 33.94$ (R^2=0.92, n=6) for lake water samples,

$\delta D = 6.57\delta^{18}O + 0.31$ (R^2=0.88, n=XX) for precipitation water in the Tianjin Station,

$\delta D = 6.36\delta^{18}O - 5.21$ (R^2=0.93, n=XX) for precipitation water in the Baotou Station,

$\delta D = 6.86\delta^{18}O - 2.23$ (R^2=0.91, n=XX) for precipitation water in springin the Tianjin Station,

$\delta D = 6.68\delta^{18}O - 0.98$ (R^2=0.93, n=XX) for precipitation water in summer in the Tianjin Station,

$\delta D = 5.51\delta^{18}O - 4.13$ (R^2=0.55, n=XX) for precipitation water in autumn in the Tianjin Station,

$\delta D = 7.44\delta^{18}O + 13.57$ (R^2=0.94, n=XX) for precipitation water in winter the Tianjin Station,

$\delta D = 6.66\delta^{18}O + 0.30$ (R^2=0.93, n=XX) for precipitation water in spring in the Baotou Station,

$\delta D = 5.07\delta^{18}O - 15.1$ (R^2=0.80, n=XX) for precipitation water in summer in the Baotou Station,

$\delta D = 6.98\delta^{18}O + 0.85$ (R^2=0.95, n=XX) for precipitation water in autumn in the Baotou Station,

$\delta D = 6.86\delta^{18}O - 0.72$ (R^2=0.98, n=XX) for precipitation water in winter in the Baotou Station,

The isotopic regression equation of the Otindag evaporation line (EL1) (Fig. 6), which was calculated based on the δ^2H and $\delta^{18}O$ data of the groundwater, lake, river and spring water samples in this study, was $\delta^2H = 4.09\delta^{18}O - 28.31$ (R^2=0.93, n=24).

The content of radioactive isotope of tritium (^3H)was measured in seven well groundwater samples with 6-60 m deepthin this study.The tritium concentrations ranged from 1.86 to 24.35 TU (Table 3), with an average 14.95 TU, higher than the mean tritium concentration (9.8 TU) of groundwater in the Vienna Basin, Austria (Stolp et al., 2010), the seat of the International Atomic Energy Agency (IAEA).

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5.Discussion

45.21. Evaluation of LlLocal precipitation recharge on as a recharge source ofgroundwater in the Otindag

Comparison of the isotopic signalsbetween the modern regional precipitation and natural waters in the Otindag

To incorporate the isotopic analysis of precipitation with similar areas in the studied area, local data (p1) was plotted with those of Baotou (Fig. 76). The isotopic composition of rainfall in Baotou, the nearest long-term station to the Otindag Desert, was monitored for the period 1986-2001 within the scope of the International Atomic Energy Agency/World Meteorological Organization (IAEA/WMO) global survey. The stable isotope data available from this station was used to provide basic characteristics of the stable isotopic composition of the present-day meteoric water, especially in the westward inland areas of the Otindag Desert (Fig. 1). Stable isotope data of the Tianjin station was also used to characterize precipitation of the eastern coastal areas of the Otindag Desert (Fig. 1).

At present, the extensive record of stable isotope measurements fromin atmospheric precipitation areis still lacking from absent in the Otindag. T, thus in this study, we usedthe decadal isotope data of atmospheric precipitation around the Otindag were collected in this study to determine the isotopic relationship between the local groundwater and the regional precipitation that are available from. A global database, the IAEA Global Network of Isotopes in Precipitation (GNIP) database, is available to use in this study. Taking into account the boundary between the northern hemispheric westerly and the Asian summer monsoon (Chen et al., 2010), which are the two major climate systems controlling the Otindag(Yang et al., 2013), we chose two GNIP meteorological stations,as the representations of the atmospheric precipitation derived from the northern hemispheric westerly and the Asian summer monsoon, respectively. One is the Baotou station, located to the southwest of the Otindag as representative of (the westerly system), and another is the Tianjin station, located to the southeast of the Otindag, as representativeof (the Asian summer monsoon system) (Fig. 1a). The historical isotopic data (^{3}H, δ^2H and δ^{18}O, ‰VSMOW) over the last four decades from the two stations, as well as other data including the daily precipitation amount (mm) and air temperature (°C) in the same period, were taken as the references of the stable isotopic signals in precipitation in the Otindag.

The annual weighted mean values of δ^2H and δ^{18}O at the Baotou station varied were variable from -64.32‰ to -48.44‰ and from -9.40‰ to -6.50‰ during the period of 1986 to 1992, respectively. The annual weighted mean values of δ^2H and δ^{18}O at the Tianjin station varied from -56.30‰ to -43.72‰ and from -8.35‰ to -6.86‰ during the periodsof 1988 to 1992 and of 2000 to 2001, respectively. The long-term weighted mean values of δ^2H and δ^{18}O at the Baotou station (LWMB) were 55.27‰ and -7.78‰, respectively, and were -49.97‰ and -7.70‰ at the Tianjin station (LWMT), respectively. The radioactive isotope of ^{3}H (TU) in precipitation was not stable at the GNIP Baotou station. The annual weighted mean values were higher than 30 TU in this station and tended to be decreased from 1986 to 1991 (72.06, 57.81, 59.97, 52.79, 55.89, 34.35 TU, respectively). The annual weighted mean values of ^{3}H at the GNIP Tianjin station were lower than those of the Baotou station. The mean values were 21.99, 21.65, 18.55, 25.72, 18.80 TU from 1988 to 1992, and 7.01 and 15.48 TU from 2000 to 2001.

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As theThe sample p1,the only one precipitation sample collected in this study (during the 2011 summer rainfall event) of the Otindag, the sample p1 fell onto the Global Meteoric Water Line (GMWL: $\delta^2H = 8\delta^{18}O + 10$) estimated by Craig (1961). It showed similar δ^2H and $\delta^{18}O$ values to those of the precipitation collected in the GNIP stations of Baotou and Tianjin (Fig. 6).

Compared to the precipitation data from the GNIP Baotou and Tianjin stations and from the local precipitation (p1) in the Otindag, the groundwater samples were evidently depleted in heavy stable isotopes in the OtindagHSKDSL(Fig. 6).

In contrast to the precipitation data, the water samples from springs and rivers in the study area also showed a depletion characteristics in the stable isotopes of δ^2H and $\delta^{18}O$(Fig. 6).

Based on the isotopic data from the Baotou station, tThe local regional meteoric water lines , i.e. the regional Craig lines, can be statistically describedexpressed as the isotopic regression equation of $\delta D^2H = 6.36\delta^{18}O - 5.21$ (line LMWL-B). It can also , based on the isotopic data fromat the Baotou station,and can be destribedexpressed as $\delta D^2H = 6.57\delta^{18}O + 0.31$ (line LWML-T), based on the data fromat the Tianjin station (Fig. 76). The precipitation sample p1 collected in this study fell onto the GMWL (Fig. 7). It also showed similar δD and $\delta^{18}O$ values to those of the precipitation collected in the GNIP stations of Baotou and Tianjin (Fig. 76).

Compared to the precipitation data from the GNIP stations and from the local precipitation (p1), the groundwater, spring, and river water samples were evidently depleted in heavy stable isotopes in the Otindag (Fig. 76). Exceapt for the lake water samples, most of the groundwater, river water and spring water samples in the Otindag fallfell on or lay between the LMWL-B and the LMWL-T lines, and are werelocated at the lower left area of the precipitation points (Fig. 76).This indicates indicated that no strongdeep evaporation process was experienced by these ground and surface waters (except for lake waters) compared with than the precipitation.

For the Otindag evaporation line (EL1), its equation slope and intercept were significantly lower than that of the GMWL, LMWL-B and LMWL-T (Fig. 6). The points of intersection between the EL1 and LMWL-B were atwas -69.93‰ for δ^2H and -10.18‰for $\delta^2H$and for$\delta^{18}O$, respectively, while the intersection points between the EL1 and LMWL-T werewas -75.51‰ for δ^2H and -11.54‰ forδ^2H and$\delta^{18}O$, respectively.

5.2.The direct recharge of groundwater in the eastern Otindag

Water infiltration of atmospheric precipitation through the unsaturated zone to groundwater is hydrologically definied as the direct recahrge. The deuterium and oxygen isotopesare the composition of water molecules and are sensitive to physical processes such as mixing and evaporation, hence they are ideal tracers of the origin of groundwater(Coplen, 1993; Scanlon et al., 2006). Weusedthem to identify the contribution of preicipitation recharge on groundwater in this study.

Because the annual mean precipitation amount in the semi-arid regions of northern China is between 200–400 mm, it seems that the direct recharge on groundwater cannot be neglected in the eastern Otindag under a semi-arid climate. However, when we checked the stable isotopic data fromthe GNIP stations both at the Baotou and Tianjin, we observed that almostall the annualweighted mean values of the stable isotope contentsinprecipitationwere enriched in$\delta^2H$and $\delta^{18}O$ compared with than

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~~those values measured for the groundwater, spring water and river watersamples in this study (Fig. 6).~~Because the isotopic evolution of δD^{2}~~H~~ and δ^{18}O in water illustrated in the Craig line represents a one-way and irreversible process, ~~thus~~ the water bodies distributed at the upper right area of the Craig line can not be recharge sources for the water bodies distributed at the lower left area of the line. Such results indicate~~d~~ that the groundwater, river water and spring water in the Otindag are~~were~~ not recharged by the regional precipitation, namely no significant modern direct recharge has taken place for groundwater in the Otindag.

Dogramaci et al. (2012) documented that only ~~the~~intense and remarkable rainfall events ~~of~~ >20 mm could ~~remarkably~~ recharge groundwater in the semi-arid Hamersley Basin of northwest Australia, while the rainfall events <20 mm had limited influences on groundwater recharge. Chen et al. (2014) described that rainfall events ≤5 mm in the arid and semi-arid region of northern China would be evaporated into the atmosphere rapidly before it is infiltrated into the groundwater system. Based on the analysis on the data records from two meteorological stations around the Otindag, i.e.~~,~~the Duolun ~~station~~and ~~the~~ Xilinhaote stations (see Fig. 1a), we observed that ~~the average times of~~ rainfall events ~~being~~ >20 mm on average~~in amount were~~ only occur 2.5-3.4 times per year (Table 4). In some years (e.g. from 2005 to 2007 at the Xilinhaote Station), no ~~Even none of the~~ rainfall events ~~of~~ >20 mm even occurred~~during the year from2005 to 2007 at the XilinhaoteStation~~. It further indicated ~~confirmed that~~ the ~~small amounts of intensive rainfall eventshad~~limited ~~the~~ contribution of regional precipitation on groundwater recharge in the Otindag.

In addition to groundwater, the river ~~water~~ and spring water samples from~~in the~~ the Otindag ~~hadthesimilar isotopic signals with those of groudndwaters, and were~~ also deviated from the local ~~modern regional~~ precipitation in the Craig diagram (Fig. 7~~6~~).These water samples came from the Xilamulun, Shepi and Tuligen rivers. They shared the same evaporation line (EL1) with the groundwater and lake water samples (Fig. 7~~6~~). Generally speaking, natural waters that have a same recharge source are ~~can be~~distributed on a same line of evaporation in the δ^{2} and δ^{18}O diagram (Chen et al., 2012b)~~(Chen et al., 2012b)~~. This indicates ~~d~~that the recharge sources of groundwater, river water, spring water and lake water in the Otindag are ~~were~~genetically associated each other and ~~were~~differ from ~~ential to~~ the local~~regional~~ precipitation. ~~During the fieldinvestigation, we observed that the elevation of spring outflow waslower thanthat of the groundwater table in some areas. Thisimplies yed that the spring water can be originateds fromthe local phreatic water (groundwater). The same isotopic signals between the two kinds of water confirmed their close relationship in origin.~~

~~4~~5.~~3~~3. Winter precipitation and palaeowater recharge on groundwater in the Otindag

~~**Potential sources of groundwater other than summer precipitation in the Otindag: three hypotheses**~~

Since the groundwater samples in the Otindag are~~were~~ depleted in their δD ^{2}~~H~~and δ^{18}O values even more than those of the ~~modern~~local rainfall (Fig. 7~~6~~), they must be sourced from other waters characterized by similar ~~with same~~ or more depleted signals in their stable isotopes compositions. Due to the temperature effect (such as evaporation) on isotopic fractionation, only the waters issued from colder environments can be more depleted in their δD and δ^{18}O values even more than those of the

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local rainfall.

Because the Otindag Desert is under the control of the EASM climate (Fig. 1), the local rainfall~~y~~ in the desert is maily sourced from summer precipitation. This can also be illustrated by the seasonal distributions in annual mean precipitation (Fig.8~~7~~a), in annual mean air temperature (Fig. 8~~7~~b) and in annual mean water vapor pressure (Fig. 8~~7~~c) over the last forty years at the two surrounding GNIP weather stations in Baotou and Tianjin.

~~Climatically tBecause the Otindag Desert is under the control of the East Asian Summer Monsoon climate (Yang et al., 2013),thus the local modern rainfall in the desert is mainly sourced from the summer season'sprecipitation, with rain and heat over the same period.Theseclimatic characteristics wereillustrated by the seasonal distributionsof the annual mean precipitationamount(Fig.7a), theannual mean air temperature (Fig. 7b) and theannual mean water vapor pressure (Fig. 7c) over the last forty years at the two surrounding GNIP weather stations in the Baotou and Tianjin.~~The seanonal distributions of stable isotopes in the two stations (Fig. 8d-e) show that the ~~se records indicates that the~~ summer rainfall is ~~warmer and~~ evidently ~~relatively~~ positive in its~~the~~ signals of δD~~^{2}H~~ and δ^{18}O by comparison with~~than~~ those of the winter rainfall, further suggesting that the waters issued from cold environments can be more depleted in their δD and δ^{18}O values than those of the summer rainfall. ~~the waters originated in a colder environment, due to the evaporation effect on isotopic fractionation. It t~~Thus we ~~can be~~ speculate~~d~~ that ~~the potential water sources of~~ groundwater in the Otindag can be potentially ~~must be~~derived from ~~waters originated in a colder environment, sucha as~~ (1) ~~the~~ modern precipitation in winter, (2) ~~the~~ palaeowater formed in the past glacial period, or (3) remote/~~the~~ mountains waters that emanate in ~~with~~ colder and wetter conditions.

~~Given the hypothesis (1) "themodern winter precipitation", we can get cluesfrom the isotopic recordsof winter precipitationin the Baotou and Tianjing stations.It is shown that t~~The annual mean values of δD~~^{2}H~~ and δ^{18}O over the last forty years are~~were~~ more depleted in ~~the~~ winter p~~e~~recipitation than in ~~the~~ summer precipitation at the Baotou and Tianjin stations (Fig. 8d-~~ea-b~~). This isotopic signal qualifies the ~~suggestedthat the~~ regional winter precipitation to be ~~wasqualifiedto be~~ a potential souce of groundwaters in the Otindag. However, ~~the limited water amount of the winter precipitation in these regions seemed to be a question towards its importance as an efficient source of groundwater,because~~the precipitation amounts and the water vapor pressures (effective moisture) in ~~the~~ winter months are~~were~~ much lower than those in the summer months at both the Baotou and Tianjin stations (Fig. 8~~7~~a and 8~~7~~c~~d~~). It indicates~~d~~ that the winter seasons in these regions are~~were~~ relatively colder and drier but not colder and wetter. A colder-wetter ~~pattern of~~ winter season~~precipitation~~ is a necessary condition for winter precipitation to be ~~as~~ a water source for the formation of groundwater under a summer monsoon climate. This is~~,~~ because the bigger amounts of summer precipitation will easily remove or weaken the depleted isotopic signals of winter prepicitation in groundwater. In this regard, ~~view of this consideration, the~~ modern winter precipitation is unlikely to ~~might not~~ be an important source of groundwater in the Otindag~~. The hypothesis (1) can be neglected~~.

As to the ~~hypothesis (2) "the~~ palaeowaters" formed in colder and wetter periods such as the last glacial", it has been proposed to be a potential water source for groundwaters in the wide arid lands of the world. ~~In fact, T~~The depleted signals of stable isotopes (δD ~~^{2}H~~and δ^{18}O) in groundwater have been

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recognized in global arid and semi-arid regions, such as the Sinai Desert in Egypt (Gat and Issar, 1974) (Gat and Issar, 1974), Israel (Gat, 1983) (Gat, 1983), South Australia (Love et al., 1994, 2000) (Love et al., 1994, 2000),, northern China (Ma et al., 2010) (Ma et al., 2010), , Saudi Arabia (Bazuhair and Wood, 1996) and North Africa (Moser et al., 1983; Guendouz et al., 2003). These signals are very often explained as palaeo-groundwater that recharged by precipitation during past wetter and colder periods (Love et al., 1994, 2000; Herczeg and Leaney, 2011)(Love et al., 1994, 2000; Herczeg and Leaney, 2011).Gat and Issar (1974)reported that palaeowaters played a central role in the deep aquifers of the Sinai Desert, with the evidentsthat groundwater stable isotope compositions ($\delta^{18}O$ and δD^2H) were more negative than those of weighted mean contemporary rainfall.Ma et al. (2010)presented data from groundwater in the aquifer of Jinchang city and the adjacent Gobi desert areas in northern China, which showed that palaeowaters were depleted in ^{18}O and ^{2}H relative to modern precipitation in the same region.

In order to identify the role of palaeowater recharge on groundwater in the Otindag, Here we use dthe tritium data as a environmental tracer to estimate the groundwater age in the Otindag. The half life of tritium is 12.43yr. Based on this decay time and the tritium concentrations ingroundwater, the exponential decay equation can be used to provide a qualitative age indication to interpretate the regional groundwater flow system (Ma et al., 2010). Due to the lack of tritium data of local precipitation in the Otindag, we still usedTthe tritium data at the GNIP stations of the Baotou and Tianjin are also referenced as the background values in precipitation of recent years.

A "piston model (flow)" was used to evaluate Tthe residence time of groundwater in aquifer and the residual tritium of a water body can be calculated by $N = N_0e^{-\lambda t}$ (Yang and Williams, 2003). Where N = content of residual tritium in water sample, λ = 0.0565, the radioactive decay constant, N_0 = content of tritium at the time of rainfall and t = years after precipitation. Based on this equation, the residual tritium was theoretically calculated and the standard for tritium dating was established for .In this study, the content of tritium was measured forseven groundwater samples in the Otindag Desert (Table 3). As a result, , all of which were taken from the wells in the Otindag dune field. To the extent that the input function and piston model are reasonable approximations, ages of 0-60 years were obtained for these groundwater samples (Table 5). ,This which indicatesd that recent recharge took place several decades after the peak in global nuclear tests had been several decade years undereway. Based on the relatively high tritium contents and the calculated datings of the groundwater samples in this study (Table 5), Wwe thus concludeded that groundwater is generally not older than 70 years in the study area. It means The hypothesis (2) that the groundwater in the Otindag are not werepalaeowater recharged during glacial periodin the Otindagis not valid.

Both the modern summer and winter precipitation recharge and the palaeowater recharge can be the hypotheses (1) and (2) refuted, were proved to be valid, indicating ing that the direct recharge is not a major mechanism controlling the groundwater recharge in the Otindag.

45. 44. Remote waters recharge on groundwater in the Otindag: Dali Basin

The indirect recharge of groundwater in the eastern Otindag?

Through the above analysis, it seemed that the modern winter meteoric water was not a

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~~volumetrically important source of groundwater in the Otindag, and the groundwater was not recharged by palaeowaters.Thus,~~ ~~T~~the third hypothesis that ~~,~~"remote/~~the~~ mountains waters emanate under ~~with~~ colder and wetter conditions" is further ~~,should be~~ considered here ~~as a key souce of groundwaterin the Otindag~~. In essence, it is an indirect recharge m~~e~~achanism~~, as the indirect recharge is defined~~ as as water originates~~d~~ from remote areas (Healy, 2010; Herczeg and Leaney, 2011)~~.(Healy, 2010)and it generally occurs through rivers, canals, lakes and flash floodings(Herczeg and Leaney, 2011).~~

It is~~was~~ worth noting that the values of deuterium and oxygen-18 ~~in the groundwater samples of the eastern Otindagare were variable. These values~~for groundwater in the north part of the study area are~~were~~ more depleted in δD~~²H~~ and δ^{18}O than those in the south part (Table 3). It suggests that the Otindag groundwater ~~in the study area~~ might be potentially recharged by water resouces coming from the northern neighboring catchment ~~of the eastern Otindag~~, such as the Dali Basin.

~~In order to estimate the potential linkage between the eastern Otindag and the Dali Basin, R~~Recently published data of δD and δ^{18}O ~~deuterium and oxygen-18~~ in groundwater~~s~~, lake water~~s~~, river water~~s~~ and spring water ~~s~~sampled from the Dali Basin (e.g., Chen et al., 2008; Zhen et al., 2014) were compiled ~~collected~~in this study and were co-analyzed with the data from the Otindag.

~~In total, There were totally a~~About 70 natural water samples from the Dali and Otindag with δD~~²H~~ and δ^{18}O values are~~being~~ shown in a Craig diagram (Fig. 9). ~~As a result, A~~all of these samples fell on or lied near the evaporation line EL2 in the Craig diragram (Fig. 9), with a regression equation of δD~~²H~~= 4.81δ^{18}O - 21.55 and a high ~~er~~correlation coefficient (R^2=0.98, n=70)~~ than that of EL1 (R^2=0.93, n=24) for the Otindag samples~~.

Compared to the groundwater samples in the Otindag, water samples from the groundwaters, rivers and springs from~~in~~ the Dali Basin are~~were~~ more depleted in δ^{18}O and δD~~²H~~ (Fig. 9). Such results further indicate ~~d~~that, in terms of its~~the~~isotopic signature~~perspective~~, the groundwater in the ~~eastern~~ Otindag has a close relationship with the natural waters in the Dali Basin~~, except for the lake water in Dali~~. ~~It seems that the Dali wateris a potential source for groundwater in the Otindag, or both of them are recharged by a common souce derived from surrounding mountains.~~

~~**5. 4. 1. Linkage of the river water in the Dali and the groundwater in the Otindag**~~

The similar signals of δD and δ^{18}O ~~deuterium and oxygen-18~~ between the groundwater in the Otindag and the river water in the Dali (Fig. 9) point towards the~~gave us a possible~~ idea that the groundwater in the Otindag might be sourced from the river water in the Dali Basin, since the Dali has more depleted isotopic signals in water than the Otindag (Fig. 9).

Considering ~~Regarding to~~ the topographical gradient of ~~the~~ elevations between the two regions, however, river water in the Dali Basin cannot~~'t~~ flow into the eastern Otindag, because the terrain elevation of the Dali Basin is lower than that of the Otindag (Fig. 1). This is also the reason why the huge Dali Lake ~~is formed~~that lies in the Dali Basin has no equivalent ~~but not~~ in the Otindag (Fig. 1). If there is a hydraulic linkage between the two regions, water should flow from the Otindag into the the Dali, but not conversely.

~~A hypothesis that water flows from the Otindag into the Dali Lake has also been proposed by Yang et al. (2015). They argued that a mega palaeolake in Dali, who was almost twice the size of the~~

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~~present Dali Lake in area, was recharged by river systems to its south in the Otindag ca. 4,200 years ago. After that, due to the catastrophic decrease in precipitation that occurred inmonsoonal regions being experienced catastrophic precipitation decreasing and the groundwater in Otindag being sappinged and captured of the Otindag groundwater by the Xilamulun River flowing eastward, the Otindag's water was no longer recharging the megalake Dali and left a palaeo-channel between the two regions(Fig. 2). Since then the connection between surface waters in the two regions has been halted.was broken.~~

In view of the hydraulic gradient, river water in the Dali Basin could not be a recharge source for groundwater in the Otindag. However, in view of the isotopic gradients, groundwater in the Otindag could not conversely be the source of river water in the Dali ~~, at present, due to the more depleted values of deuterium and oxygen-18 in Dali than in Otindag~~(Fig. 9). Thus, the similar isotopic signals between the river water in Dali and the groundwater in Otindag indicate~~d~~ that these waters might be recharged from a common source.

~~5. 4. 2. Linkage ofgroundwaters between the Otindag and the Dali~~

Similar isotopic signals also occurred in the groundwaters between the Otindag and the Dali Basin (Fig. 9). ~~The linkage of groundwatersbetween the two regions is still unknown at present.~~In order to understand the linkage of groundwaters between the two regions, ~~answer this question, we need to know~~the potential movement of groundwater in the transition zone of the two regions need to be known.

~~Due to the inherent difficulties to directly observe groundwater movement along its hydraulic gradient under ground, inert isotopic and hydrochemical tracers are often used to identify groundwater movement (Nakaya et al., 2007), such as chloride, TDS and H-O isotopes, which arewere used as environmental fingerprints to indicate groundwater movement in arid lands (Yang and Williams, 2003). In a theoretical line of groundwater evolution, the chloride in water is readily removed from matrix materials rather than being precipitated due to its high solubility, thus chloride concentrations tend to be increased with the increasing of the flow path's length and residence time of groundwater (Lioyd and Heathcote, 1985). The TDS has a similar trend with chloride in groundwater evolution, but its tendency might be disturbed due to potential precipitation of certain ions when reaching their saturation conditions. According to the salination classification of water, all the groundwater samples collected in this study arewere fresh water in type (TDS < 1000 mg/L). Thus evident precipitation of major ions can be considered as could be weak in theOtindag groundwaters.~~

In this study, a groundwater-sampling project was designed in the field along a ~~n~~N-S section of a palaeo-channel located at the transition zone between the Dali and Otindag (Figs. 1, 2). The channel ~~is located nearthesouth distal reach of the Xilamulun Riverand~~was named "PCSX" in this study, with its ~~. The~~ north part ~~of the channel,~~named "~~as~~ NPCSX" and ~~, is located atthe riverhead of the Xilamulun River and~~ the south part named "~~as (~~SPCSX"~~.) is close to the eastern margin of the Yinshan Mountains (Figs. 1, 2).~~

T~~Regarding to the topographical gradient in the Otindag, t~~he GPS elevation of the northernmost sampling site in the NPCSX (g11, about 1317 m a.s.l.) was much lower than that of the southernmost site in the SPCSX (g1, 1396 ma.s.l.) (Fig. 2 and Table 1). Regarding to the topographical gradient in the channel, tThere is a drop of It is about an 80 m meter drop between the NPCSX and the SPCSX. Under such slope, the underground hydraulic gradient for groundwater flow can be roughly parallel with that of the surface water flow, namely that the groundwaterflow should move downwards from the SPCSX area into the NPCSX area. Thus we can speculate that groundwater in the NPCSX would have higher salinity concentration values of chloride and TDSin concentration than those in the SPCSX under such flowing direction, if the groundwater was flowing from the SPCSX to the NPCSX.

In order to verify check up this speculation, the actual variations of water thesalinity environmental tracers(chloride and TDS) were detected along the PCSX section. The sampling site g1 was defined as the initial point and the distances between g1 and other sampling sites along the PCSX section were calculated, based on their GPS geographical coordinates records measured in the field. The results arewere shown in Fig. 10a-b. It is was veryclear that the variations of chloride and TDS concentrations in groundwater dodid not increase along the palaeo-channel from south to north (Fig. 10a-b). On the contrary, both the values of chloride and TDS arewere lower in the NPCSX area than those in the SPCSX area. Such kind of spatial variations in the chloride and TDS values was contradict edto the speculated patterns abovementioned, suggesting that the hydraulic gradient of groundwater flowing path in this region is not controlled by the topographical gradient between the NPCSX and SPCSX areas.

a complicated movement of groundwater in the study area. It also indicatesd that the hydraulic linkage wasweak in the groundwaters between the NPCSX and SPCSX areas.

SThe stable and radioactive isotopic data were also used here as tracers to differentiate the groundwaters between the two regions.Before we use the stable isotopic signals, however,it is necessary to think about the effect of evaporation process on the fractionation of stable isotopes. During the evaporation process, dissolved chloride, the conservative ion, will be enriched along with the heavy isotopes, which is manifested as a correlation between the chloride concentration and the deuterium content in groundwater (Sklash and Mwangi, 1991; Taylor and Howard, 1996).Based on this consideration, a bivariate diagram can be was built using the chloride and deuterium data of the groundwater samples in this study, as shown in Fig. 11. The gGroundwater samples from the PCSX section showed a very weak correlation between the chloride and deuterium (Fig. 11).This indicateds that the groundwaters studied are werenot strongly affected by evapotation process in a deep degree.

Compared between the NPCSX and SPCSX regions, the stable isotopic values (δ^{18}O and δD^{2}H) of groundwaters in the SPCSX region varyied greatly with a large amplitude, while those in the NPCSX arewere relatively constant (Fig. 10c-d12). This indicatesd that the recharge sources of groundwater in the SPCSX are more diverse were diversity than those in the NPCSX.The constant variations indicated that the recharge source of groundwater in the NPCSX is relatively unitary. The isotopic values in the SPCSX arewere much lighter than those in the NPCSX along the distance section from south to north (Fig. 10c-d12). The heaviest valuses occurred in the sample g11 collected from the NPCSX (Fig. 10c-d12), indicating a water being earlier firsthand recharged. The spring water sample s2, a representation of discharge water, iswas characterized by medium values of δD^{2}H and δ^{18}O. Similarly, the deuterium excess values of these groundwaters also showed such spatial patterns in the two regions

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(Fig. 10e f13), These results indicated that the groundwaters in the SPCSX area, with relatively enriched isotopic signals in δ^{2}HD and δ^{18}O by comparison with than those in the NPCSX area, arewere composed of an mixture of the groundwaters in the NPCSX withand other waters. In consequence, thus resulting in the spring water sample s2in the discharge zoneisbeingcharacterized by an intermediate isotopic signal (Figs. 12, 13). A similar case was also observed by Abdalla (2009), who reported a thatprogressive decrease of the isotopic compositions had decreased progressively along a regional-scale flow path of groundwater in the semi-arid central Sudan, because of the mixture of groundwaterswithbetween the heavier/lighter isotope rechargesd and the lighter isotope recharged.

In addition to stable isotopes, tThe tritium contents were broadly and positively related to the values of deuterium excess in the groundwater samples in the PCSX section (Fig. 10eg14a). The deuterium excess or d-excess, computed from the equation d = δ^{2}H — 8δ^{18}O (Dansgaard, 1964),is controlled primarily by themean relative humidity of the air masses formed above the water surface (Merlivat and Jouzel, 1979) and generally reflects the rate of evaporation process experienced during the flowing paths(Dansgaard, 1964).For a water that experiences dan evaporation process, the d-excess value will increase in the evaporated water vapor, but will decrease in the residual water body (Dansgaard, 1964; Merlivat and Jouzel, 1979). In this study, except for sample g11 (a sample very close to the riverhead area), the positive relationship between the tritium and the deuterium excess generally shows edthat the d-excess values arewere higher in the groundwaters collected from the NPCSX, but are werelower in those from the SPCSX (Fig. 10eg14a). This edistribution pattern indicatesd that the groundwaters in the NPCSX arewere relatively younger and had experienced a lower lessdegree of evaporation than those in the SPCSX. The d-excess gradient, increasing from the south to north in the PCSX, further suggestsconfirmsed that groundwater does did not flow from the SPCSX area to the NPCSX area, namely out of the topographical control.

In Fig. 14b, the tritium contents of groundwater increased while the TDS decreasesdfrom the south to north in the PCSX (Fig.14b). This distribution pattern of the two environmental tracers further proved that the groundwaters in the NPCSXarewere younger and fresher than those in the SPCSX. The reason why the older grourndwater hasa higher TDS value can be attributed to the fact that most minerals dissolve slowly in an aquifer and the older groundwater stay have morein contacting with the surrounding rocks for a longer time allowing more time to act between water solution and soluble minerals to pass in solution into the water, leading to a higher TDS (Fitts, 2002). Many studies (e.g., Boronina et al., 2005; Kazemi et al., 2006) have demonstrated that groundwater will flows in the direction in which it gets older. In view of this point, groundwaters in the PCSX region should theritically flow from the NPCSX area to the SPCSX area, in opposition to evidently being paradoxical with the S-N topographical gradient between the Otindag and Daliin the PCSX regions. Thus groundwater in the Dali are not the source of groundwater in the Otindag. The similar isotopic signals between groundwaters in the two regions indicate that these waters might be recharged from a common source in other place.

Overall, it impliesdthat the hydraulic gradient of groundwater derived from thein topography is not consistent with the isotopic and hydrogeochemical gradients of groundwaterthat is observed in the

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eastern Otindag. This further indicates that the origin of groundwater in the Otindag Desert is not geomorphologically or topographically controlled.

45. 55. Remote water recharge on groundwater in the Otindag: mountains waters

Potential sourcesof groundwater from recharge in the Otindag: the Daxinganling and Yinshan Mountains: tectonic control:

The discussions above revealed indicated that groundwater in the eastern Otindag has a close relationship with river water in the Dali Basin in terms of their isotopic signatureperspective, and that both the river water and groundwaters in the Otindag and Dalitwo regionsBasin might be recharged from a common source derived from another place. Considering the third hypothesis abovementioned that "remote/mountains waters emanate under colder and wetter conditions", we propose that this "common source" of the two regions are from mountians areas surrounding the Otindag and Dali Basin.Meanwhile, the isotopic and hydrochemical characteristics of groundwaters both in the NPCSX and SPCSX areas indicated that the groundwaters between the Dali (togethern with the northeast Otindag) and the southeastOtindag were different and the groundwater systems in the two regions were not integrated.

For the Dali catchment, the Dali Lake and its surrounding rivers are the most important water bodies in the Dali Basin. There are two large permanent rivers and lots of small intermittent streams entering the Dali Basin Lake(Xiao et al., 2008), including the Xilamulun River to the south and the Gongger River to the north, both of which are stemming from the Greater Khingan Mountains (Daxing'Aanling Mountains in Chinese pinyinterm, 1,100-1,400 m above seal level) (Fig. 1). The Xilamulun River, 380 km in length and 32.54×10^3 km^2 in area, is a neighboring river both to the southeastern Dali and to the northeastern Otindag (Figs. 1 and 2). The Xilamulun RiverIt carries a large amount of water (about 6.58×10^8 m^3/y) from the Daxing'Aanling Mountains flowing through the east margins of the Dali and Otindag (Wu et al., 2014). This is an important clue linking natural waters between groundwaters in the northeastern Otindag and the river waters and groundwaters iand n the Dali Basin.

Variation in ofthe elevation from the Dali Lake to the riverhead of the Xilamulun River can be clearly found along a land surface topographical section (Fig. 115). The channel of the Xilamulun River is located in a fault called the XilamulunRiver Fault or the Xar Moron River Fault (Fig. 1), which is a part of the Solonker Suture Zone (Eizenhöfer et al., 2014) or the Xilamulun-Changchun-Yanji plate suture zone (Sun et al., 2004) orthe Solonker Suture Zone(Eizenhöfer et al., 2014)in the regional tectonical settings (Figs. -and 2-31 and 2). Outcrop observations indicate that fault zones commonly have a permeability structure suggesting they should act as complex conduit–barrier systems in which along-fault flow is encouraged and across-fault flow is impeded (Bense et al., 2013). Thus the hydraulic grediant of groundwater flow in the Eastern margins of the Otindag and Dali Basin must be controlled by the fault zone hydrogeology. This may be the reason why the hydraulic gradient of groundwater represented by the isotopic and hydrogeochemical gradients of groundwater samples in this study is not consistent with the local topographical gradient in the Otindag Desert. On the other hand, the regional aquifer is generally unconfined in dune fields of the Otindag Desert but

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semi-confined to confined in the Daxing’Anling uplands (Fig. 3), thus the thick unconsolidated aquifers in the study area (Figs. 32 and 115) will be favourable conditions for groundwater storage and transportation along the Solonker Suture Zone. When rivers stem from the Daxing’Aanling Mountainsand flow downward to the marginal areas of the Dali and Otindag, leakage water from these rivers can recharge the desert land through thick unconsolidated aquifers (Fig. 15). A strong isotopic evidence is that the lake and river waters in the Dali Basin share the same evaporation line (EL2) with the groundwaters in the PCSX area.

Although groundwaters in the SPCSX area are weredifferent from those in the NPCSX area, their isotopic data points still fell onto the EL2 (Fig. 9XX), which further indicatesd that the groundwaters in the SPCSX arewere a mixture of waters from the Daxing’Aanling Mountain and other sources. Another

Another source for groundwater recharge in the SPCSX could can be speculatedrepresented by toremote water such as flash floods derived coming from the north Yinshan Mountains (Fig. 1), because it can be clearly observed from digitial maps that many transient rivers or streams originated from the Yinshan Mountrains flow into the south and southeastern Otindag (Fig. 1). Supportive evidence for this idea can be derived A keycluefor this view can also be obtained from the isotopic signals of local precipitation and groundwater samples collectedfromthe areas near to the Yinshan Mountains in this study. Supportive evidence for this idea can also be observed in the summer rainy season. During rainy days or under storm conditions, occasional heavy, short rainstorms cause floods in soil-rich wadi channels and low-lying depressions in the unconfined to semi-confined areas of the Yinshan Mountains’ piedmont. These waters may temporarily recharge shallow aquifers in the SPCSX area.

It has been reported that temperature and altitude can deeply affect theδD and δ^{18}Ocompositions of precipitationthe isotope-depleted signals ofδ^{2}H and δ^{18}O in watersfrom mountain areasto can be passed into the groundwater in aplain areas (Harrington et al., 2002; Vanderzalm et al., 2011; Liu and Yamanaka, 2012; Rattray, 2015; Khalid and Hamid, 2017). Rattray (2015)attributed this isotopic signature to the altitude effect on precipitation, because temperature and altitude can deeply affect the deuterium and oxygen-18 compositions in precipitation. The values of δ^{2}H and δ^{18}O in precipitation from the mountain areaswill be depleted when compared with those in precipitation from the piedmont areas (Rattray, 2015). Rattray (2015)attributed this isotopic signature to the altitude effect on precipitation. For the Yinshan Mountain Range, there is lack of the data ofstable isotopes datain precipitation are lackingfrom the mountains in this study. However, based on the altitude effect of temperature on isotopic signals,wecan theoreticallyestimate the values usingthe precipitation sample (p1), which wascollected fromthe piedmont area of the Yinshan Mountains in this study. For example, tThe GPS elevation of the sample location of p1 is about 1260 m a.s.l. and that of the top of the Yinshan mountain range is around 1700-1800 m a.s.l., thus the elevation drop is approximately 500 m between the two sites. Based on this difference in elevation dropand thea potentialeffect of elevation change on temperature (that elevation arises will lead to a decrease of temperature by0.65°C per 100 m), thetemperature difference between the two sites is about 3.25 °C. According to an empirical estimation for precipitation in NW China that the δ^{18}O temperature gradient is 0.37 ‰/°Candthe

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$\delta^{18}O$ elevation gradient is -0.13‰/100 m (Liu et al., 2014), the $\delta^{18}O$ value in precipitation at the Yinshan Mountains shall be 1.85 ‰ lower than that in the sample p1, namely -8.99‰ in$\delta^{18}O$ for the Yinshanmountain precipitation. This value is very similar to that of the groundwater (-9‰) in the SPCSX area. It indicates that the Yinshan Mountains area is area potential source area for the groundwater recharge inthe SPCSX area.

In general, the above analyses revealed that the highland water resources from the Daxing'Anling and Yinshan Mountains were isotopically and geochemically traced to be a major source for the groundwater in the Otindag. It suggests means that the modern indirect recharge mechanism, instead of the direct recharge and the palaeowater recharge, isresponsible for groudnwater recharge in thisthe desert land in northern China. It also This implies that the tectonic settings (such as the Solonker suture zone), but not the climatic and topographical e control, iswassignificant for the groundwater origin in the Otindag.

56.Conclusions

Water resources in arid lands of the world are generally scarce and highly uncertain. In the middle-latitude desert zone of northern China, however, many deserts such as the Otindag and Badanjilin Deserts, are unexpectedly rich in incommensurate groundwater resources, such as the Otindag and the Badanjilin Deserts, although they have no surface runoff and have been under an arid or hyper-arid climate for a long geological period of time. How the groundwaters are originated and recharged in thesea deserts environment are thus becaming a key questions that are longtime ago, but it is still under an endless debate at present in the acadamic circle. For some of the earth scientists, the direct recharge is thought to be very important for groundwaters in the wide desert lands of northern China, due to the lack of surface runoffs. However, the groundwater availability is very much as function of the local- and regional-scale geological and climatic settingscomponents. To achieve an iIntegrated understanding of the groundwater recharge and its their controlling mechanisms is of great significance. In this study, an effort to explore the groundwater recharge was explored carried out using multiple environmental tracers in the eastern Otindag Desert of northern China, a region that where is under the influence control of the East Asian Summer Monsoon (EASM) climate. The results showed that (1), the natural waters in the study area arewere fresh water (TDS $<$ 1000 mg/L) with and awere neutral to slightly alkalinepH. The major water types arewere the Ca-HCO_3 and Ca/Mg-SO_4 types. There arewere no Cl type and Na type waters occurring in the study area, indicating a primary stage of water evolution in terms of the hydrogeochemicalperspectiveterms. (2) Compared to the modern summer precipitation, the groundwaters, river waters and spring waters are weredepleted in δD^2H and $\delta^{18}O$, while the lake waters arewere enriched in δ^2H and $\delta^{18}O$. All these waters, however, shared a same line of evaporation in the Craig linediagram, indicating a genetic relationship on their recharge sources. The more depleted stable isotopic signals ofin the groundwaters is more depleted than those ofin the modern summer precipitation and this suggestsed that the groundwaters studied here could only be sourced from a colder water different from other than the EASM precipitation. In general, the analyses revealed that the highland remote water resources from the Daxing'Anling and Yinshan Mountains were isotopically and geochemically traced to be a major source for the groundwater in the Otindag.

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The contribution from local winter precipitation iswas very small due to its weak rainfall effect. The high contents (5-25 TU) of tritium in these groundwaters indicated that they arewere young and are could not be recharged by palaeowaters formed during the past glacial periods. (3) There are cClear difference in the isotopic signals occurred between the groundwaters in the north (NPCSX) and south (SPCSX) parts of the study area, but the signals of were silimar between the groundwaters in the NPCSX are similar to that of and its neighbouring catchment, the Dali Basin. (4) Combined analysis was further performed using the isotopic and physiochemical data of natural waters collected from the Dali Basin and the surrounding mountains. The resulsts indicated that the major sources of the groundwaters in the NPCSX, as well as the river waters and groundwaters in the Dali Basin, arewere mainly derived from the Daxin'Anling Mountains, by leaking the Xilamulan River water through a thick aquifer in the eastern margins of the Otindag. By contrast, While the groundwaters in the SPCSX arewere mainly recharged from two sources, the flash floods from the Yinshan Mountains and the river waters from the Daxin'Anling Mountains. (5)It suggests that tThe modern indirect recharge mechanism, instead of the direct recharge and the palaeo-water recharge, iswas the most significant for groudndwater recharge in the eastern Otindag, It indicates that the tectonic settings at a regional scale, but not the climate and topography, iswasat the origin of responsible for the groundwater origin in the Otindag. This study providesd a new perspective sight into the origin and evolution of groundwater resources in the middle-latitude desert zone of northern China.

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Fig. 1. The Geographical location of the Otindag Desert in northern China. (a) The study area shown at a large scale~~in a bigger scale~~, and (b) the study area shown at~~in~~ a smaller scale, with detailed information about the boundary and tectonic settings of the desert land. 1, the palaeo lake area of the megalake Dali; 2, the boundary of the Otindag; 3, the modern lake area; 4, the boundary of Fig. 2; 5, the boundary between the westerlies and the East Asian Summer Monsoon (EASM) climate systems. ①, the Xilamulun River. ②, the Gonggeer River. ③, the Shepi River. ④, the Tuligen River. The boundary between the westerlies and the EASMin (a) and (b)is modified from Chen et al. (2010). The palaeo lake area of the megalake Dali and the palaeo channel in (b) is modified from Yang et al. (2015). The location of the Xar Moron Fault is referenced from Eizenhöfer et al. (2014). Section S1 is an elevation section starting from the upstream of the Dali Lake and ending with~~at~~ a spring sample (s2) in the riverhead of Xilamulun River.

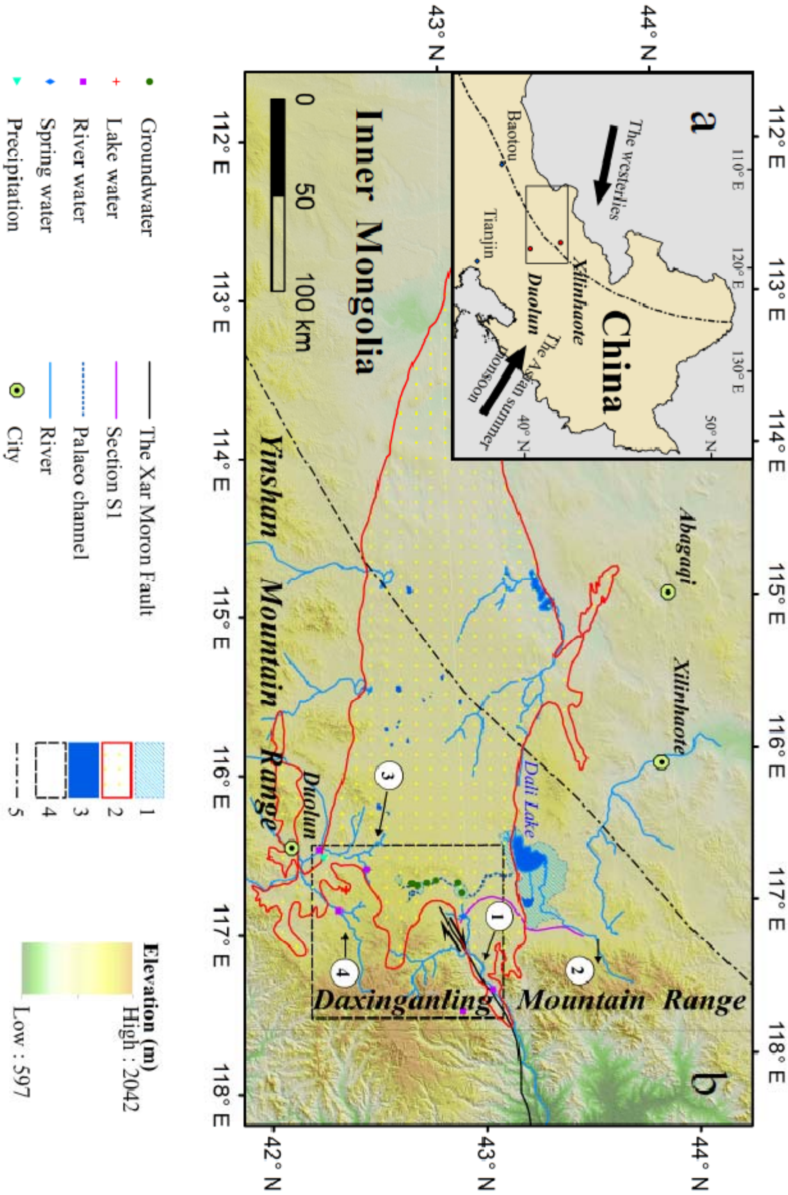

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Fig. 2. (a) Tectonic framework of the north China-Mongolian segment of the Central Asian Orogenic Belt (modified after Jahn, 2004). (b) Geological sketch map of the northern China-Mongolia tract (modified after Jian et al., 2010). The Solonker suture zone represents the tectonic boundary between the northern (Hutag Uul Block-Northern orogen) and the southern (southern orogen-Northern margin of North China craton) continental blocks. Note that the red line marks the early Permian paleobiogeographical boundary (Wang and Liu, 1986; Li, 2006), which coincides with the northern boundary of the suture zone.

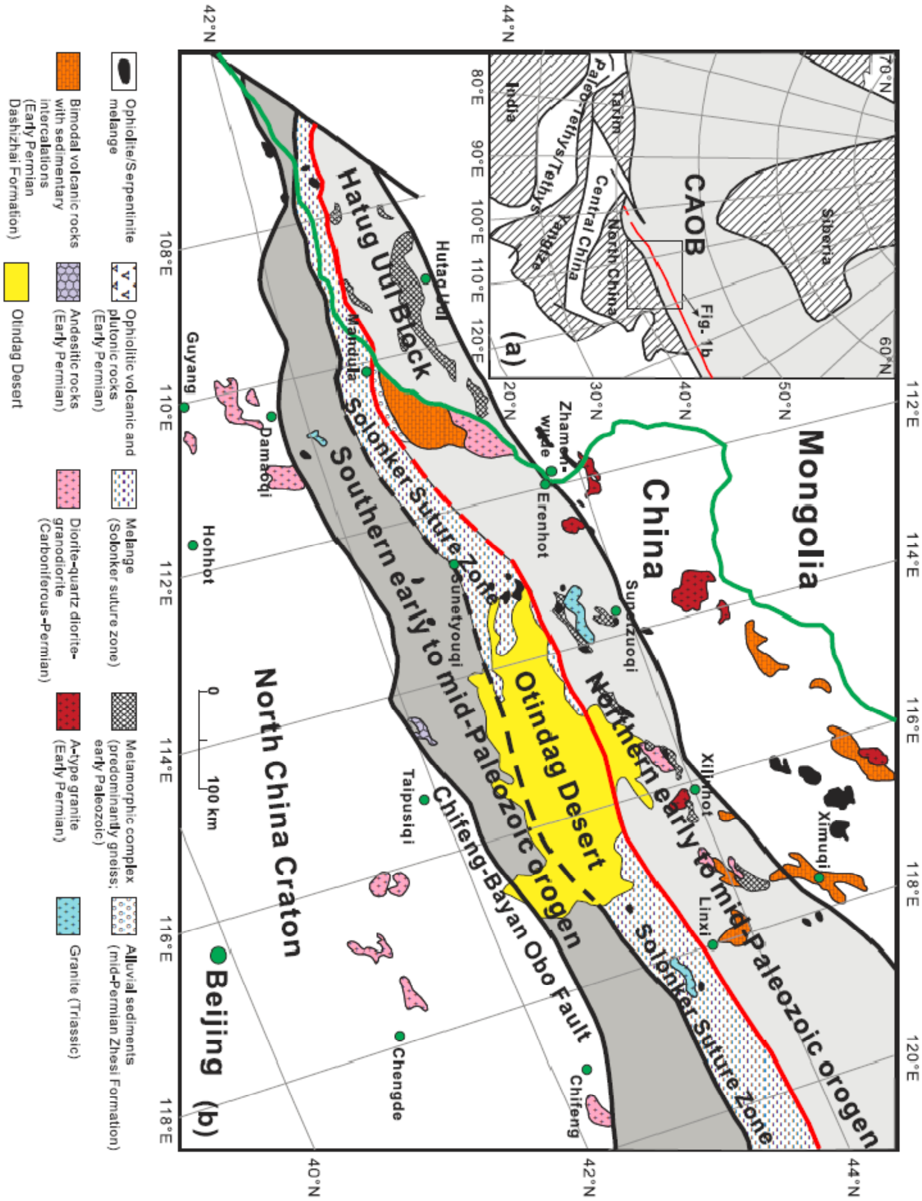

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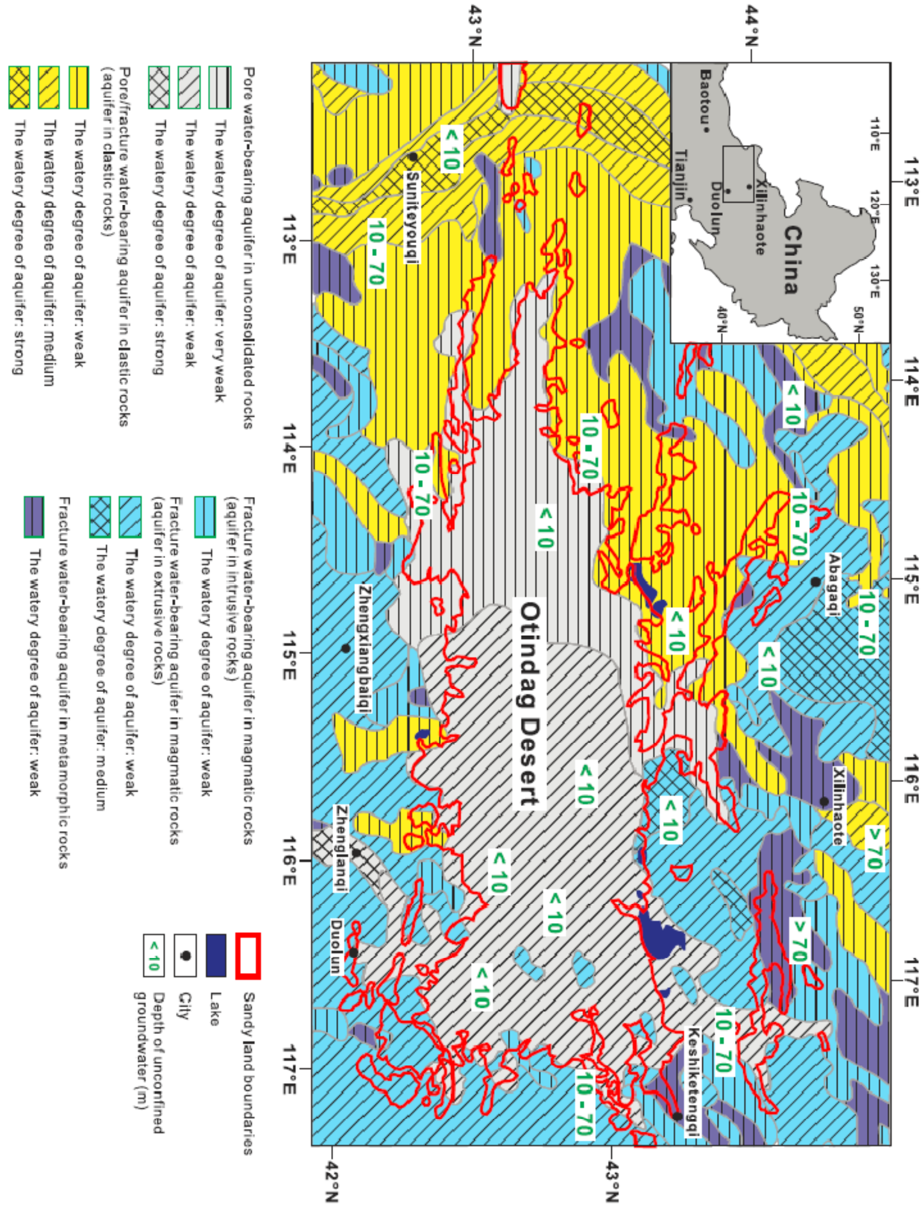
Fig. 3. The hydrogeological division map of the Otindag Desert.



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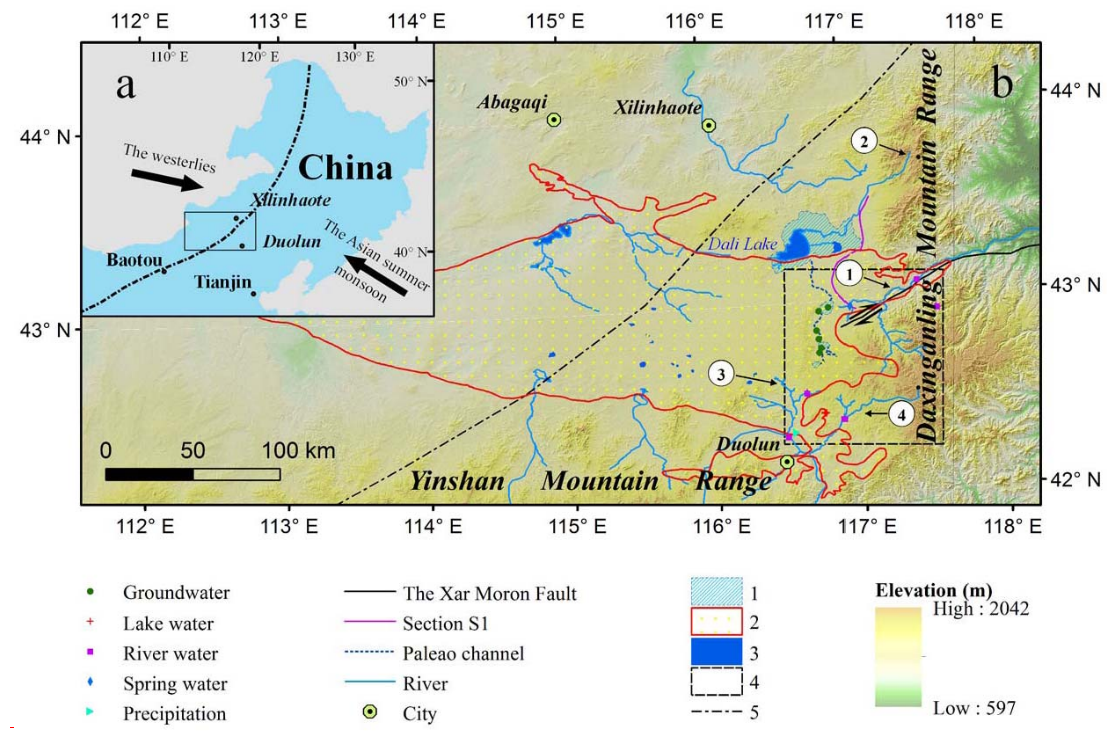

Fig. 42. The locations of the water sampling sites in this study.

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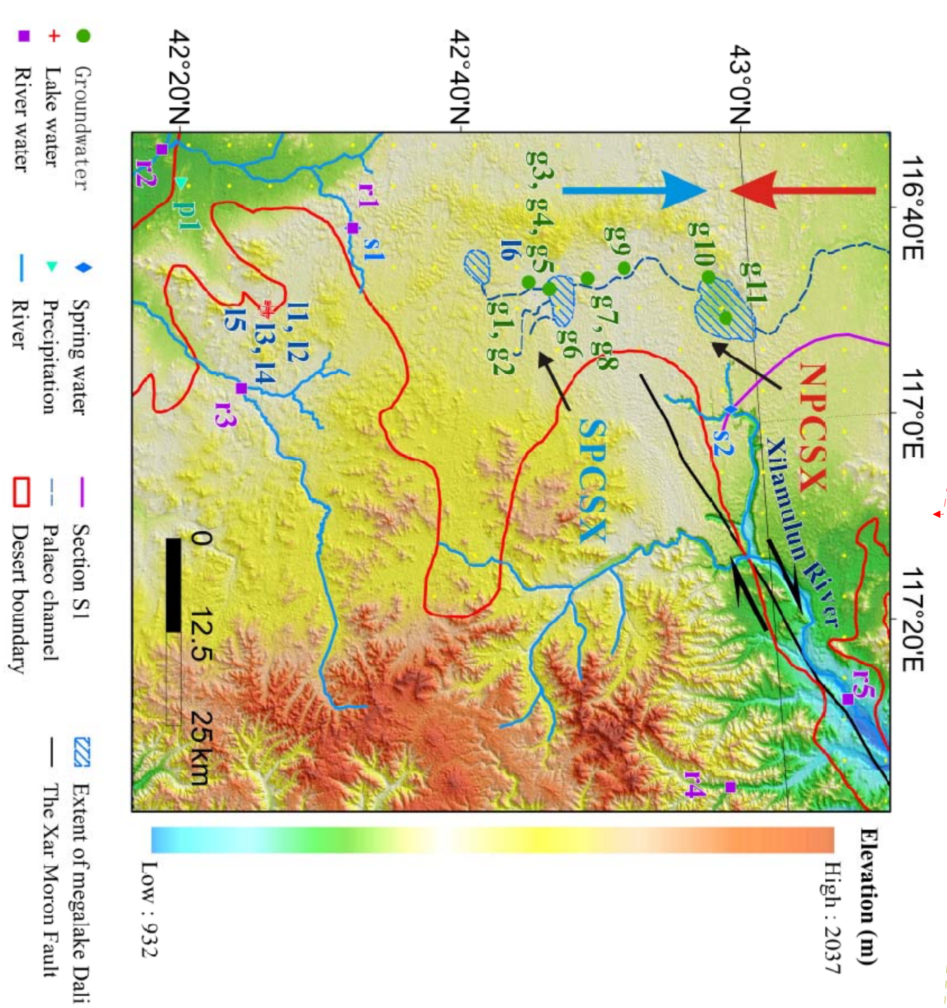

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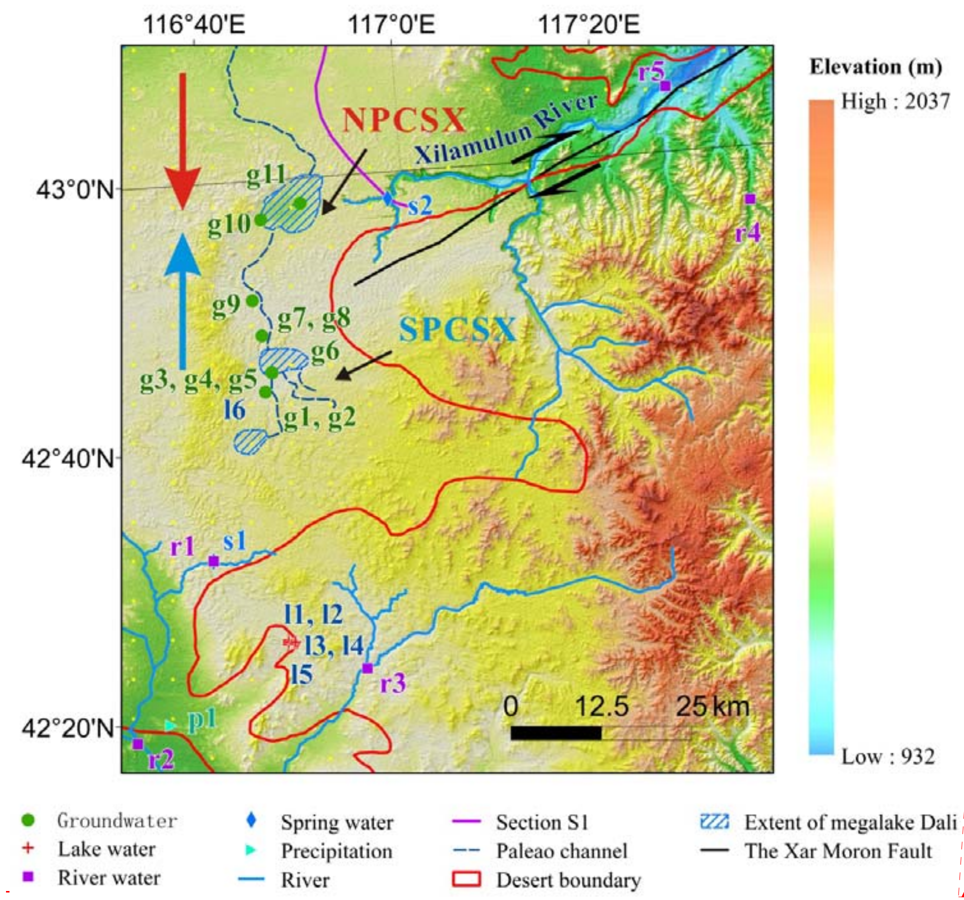

Fig. ~~5~~**3.** The ~~Schoeller diagram(Schoeller, 1955), a~~ fingerprint diagram showing the variations of multiple ions' concentrations in the studied water samples in an equivalent unit. The HCO_3+CO_3 concentration in the sample p1 was not shown, due to its value being lower than the detection limit.

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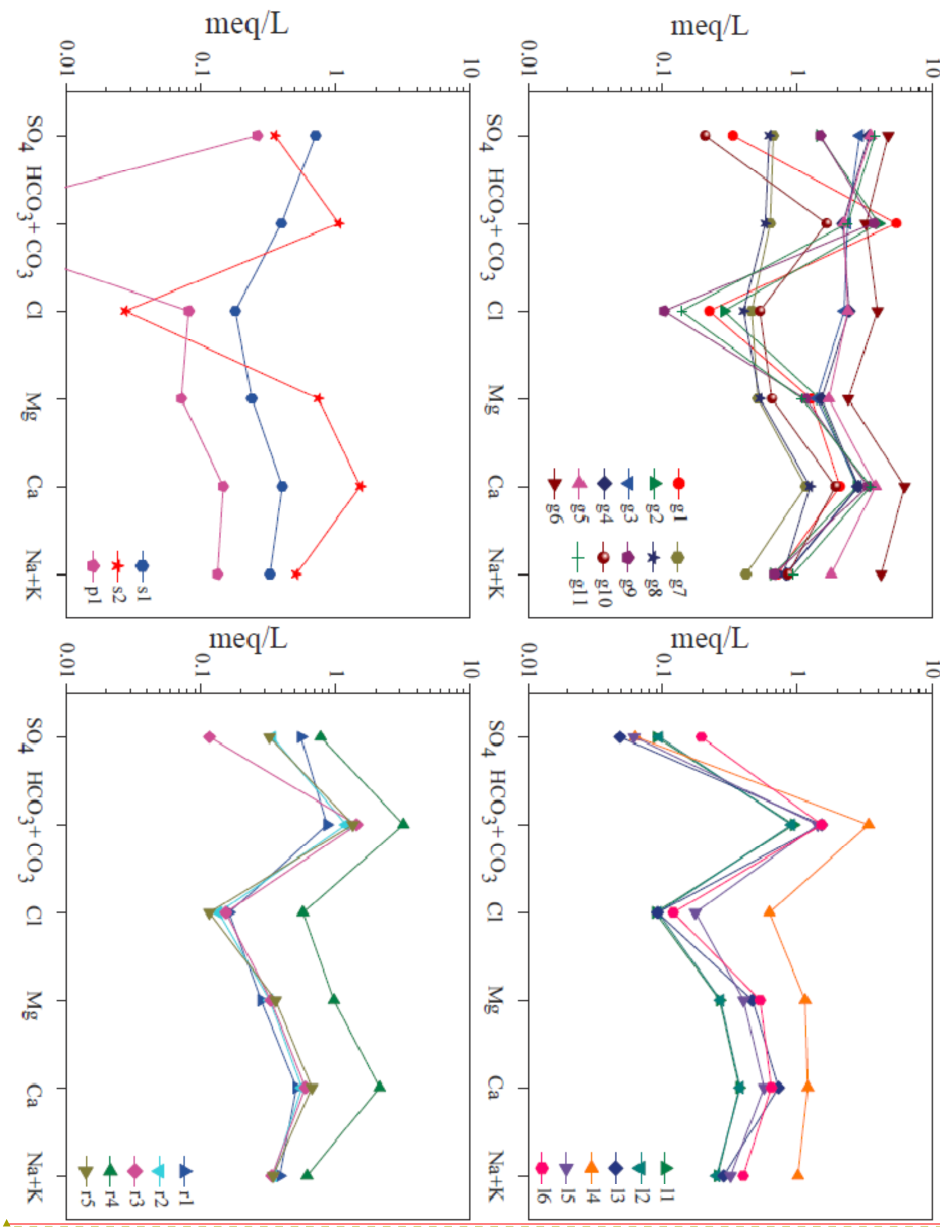

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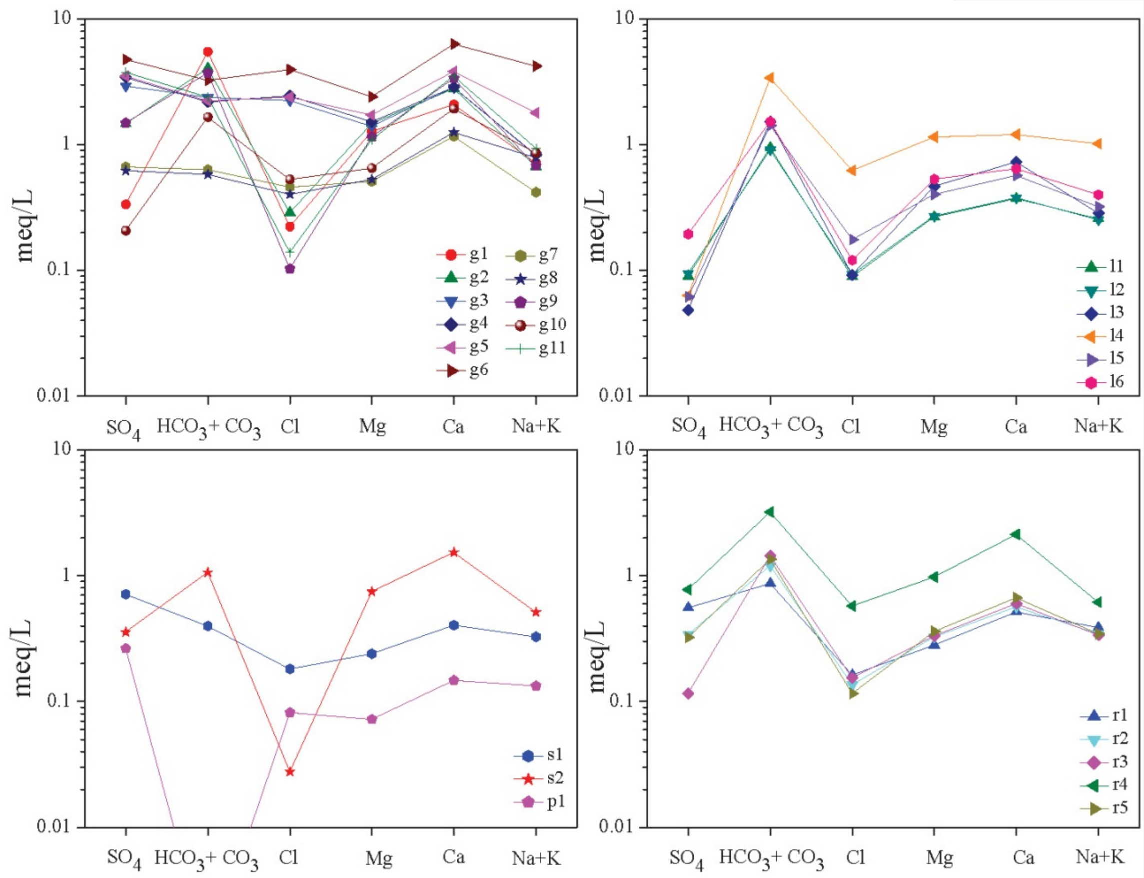

Fig. 6 4. The Piper diagram (Piper, 1944) showing the relative abundances of major cations and anions in the studied water samples. Major water types are also shown in this diagram.

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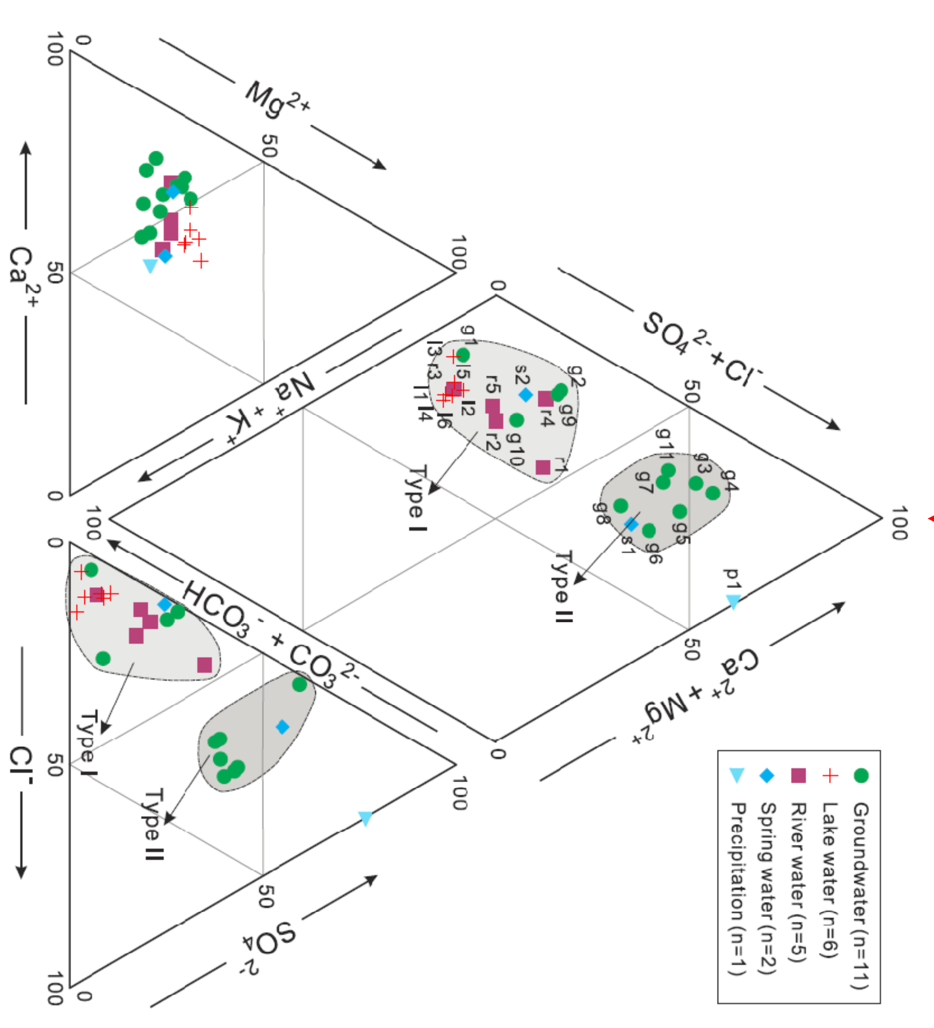

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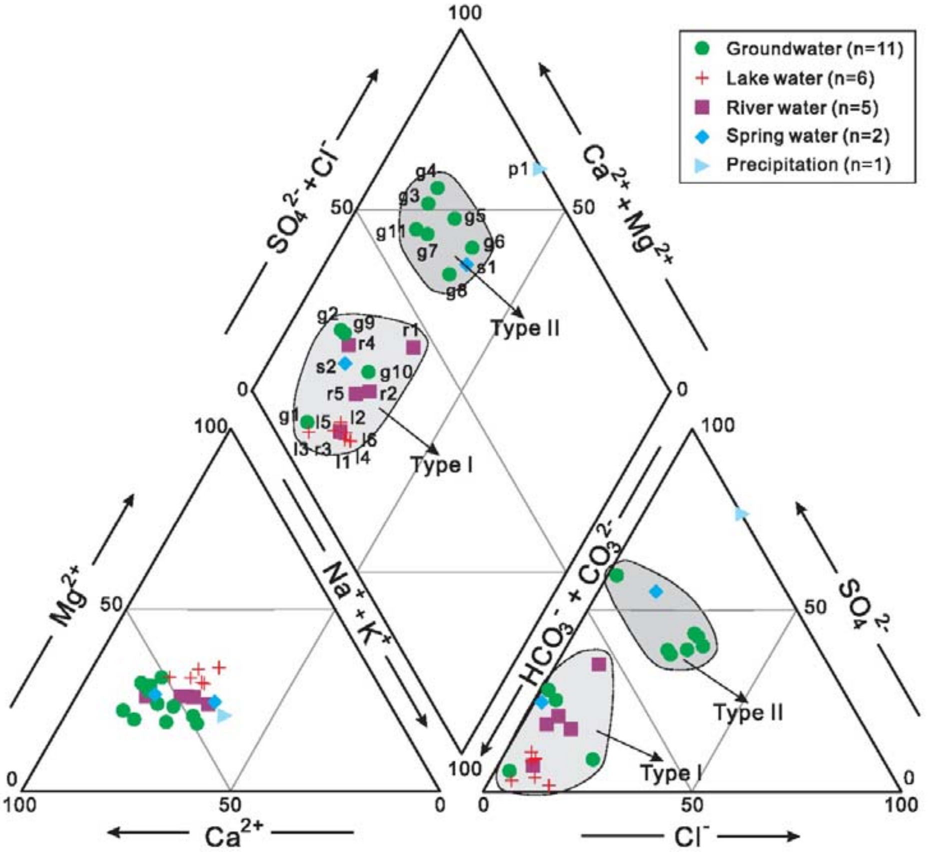

~~**Fig. 5. An Expanded Durov diagram (Durov, 1948; Lioyd and Heathcote, 1985; Al-Bassam et al., 1997; Chadha, 1999; Al-Bassam and Khalil, 2012) showing the linear dissolution or mixing process for groundwater and the ion exchange process occurred in the groundwater and other waters in the study area.**~~

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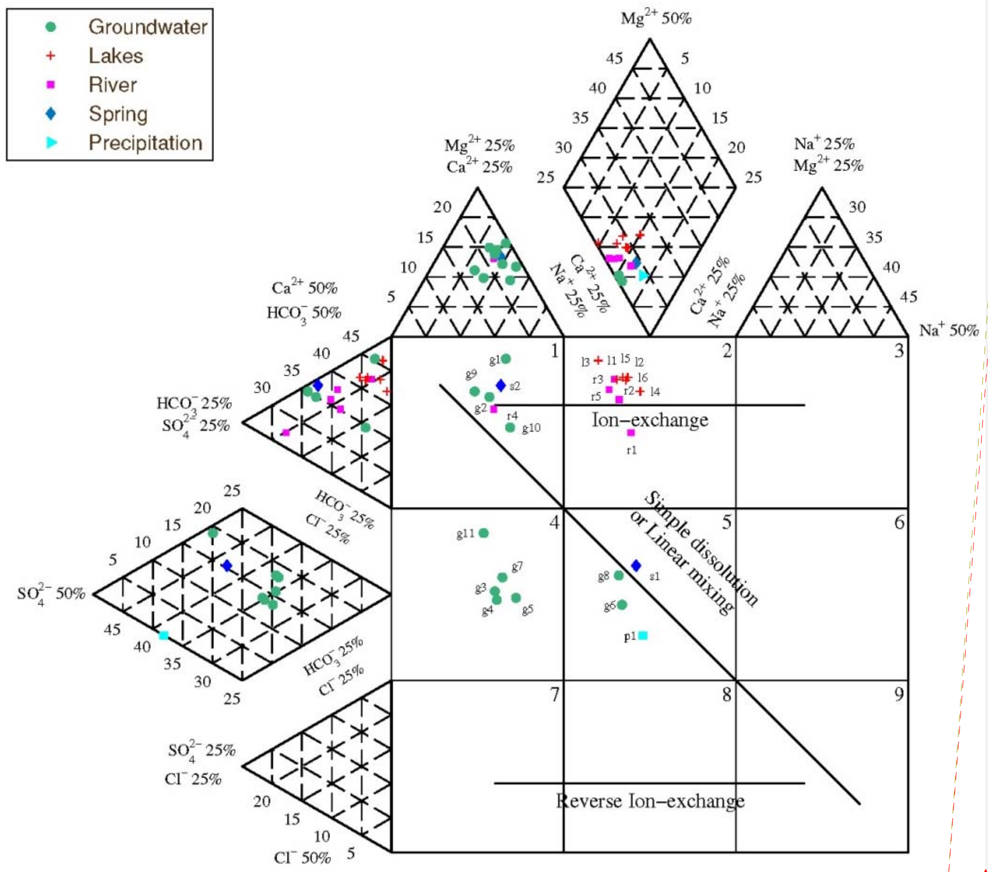

Fig. 76. The bivariate diagram of of δD^{2}H and δ^{18}O, i.e. the Craig diagram, for the natural water samples in this study. Different relationships between the groundwaters, lake waters, river waters, spring waters and the precipitation waters are emphasizedly illustrated. AWMB, the annual weighted mean value at the Baotou station; AWMT, the annual weighted mean value at the Tianjin station; LWMB, thelong-term weighted means at the Baotou station; LWMT, the long-term weighted means at the Tianjin station; GMWL, the Global Meteoric Water Line; LMWL-B, the local meteoric water line calculated based on the data from the Baotou station; LWML-T, the local meteoric water line calculated based on the data from the Tianjin station; EL1, the evaporation line calculated based on the data of water samples collected in this studye eastern Otindag.

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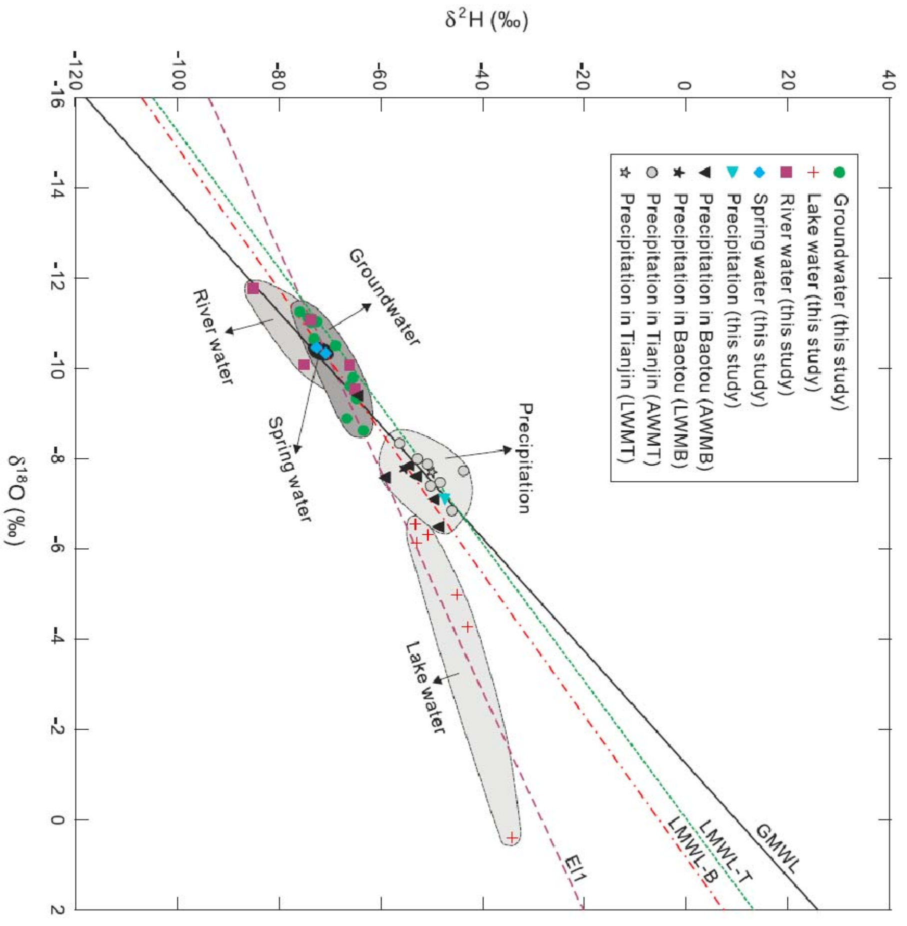

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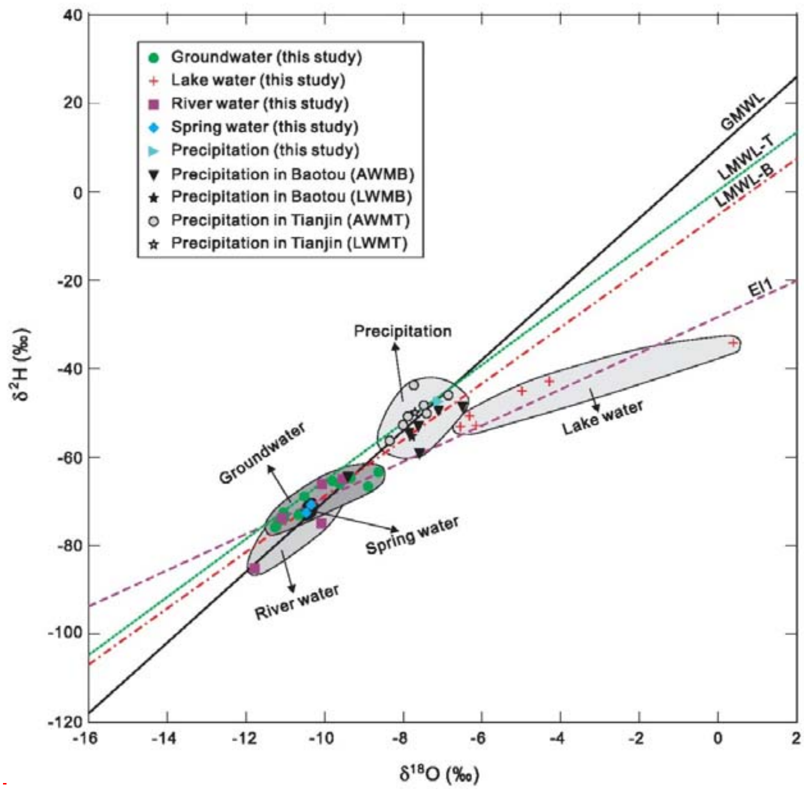

Fig. 87. The seasonal mean distributions of (a) precipitation (a), (b) surface air temperature (b) and (c) water vapor pressure (c) from the Baotou and Tianjin weather stations (station sites seen in **Fig. 1a**) in the surrounding areas of the Otindag for the period in recent thirtyyears (1981-2010).

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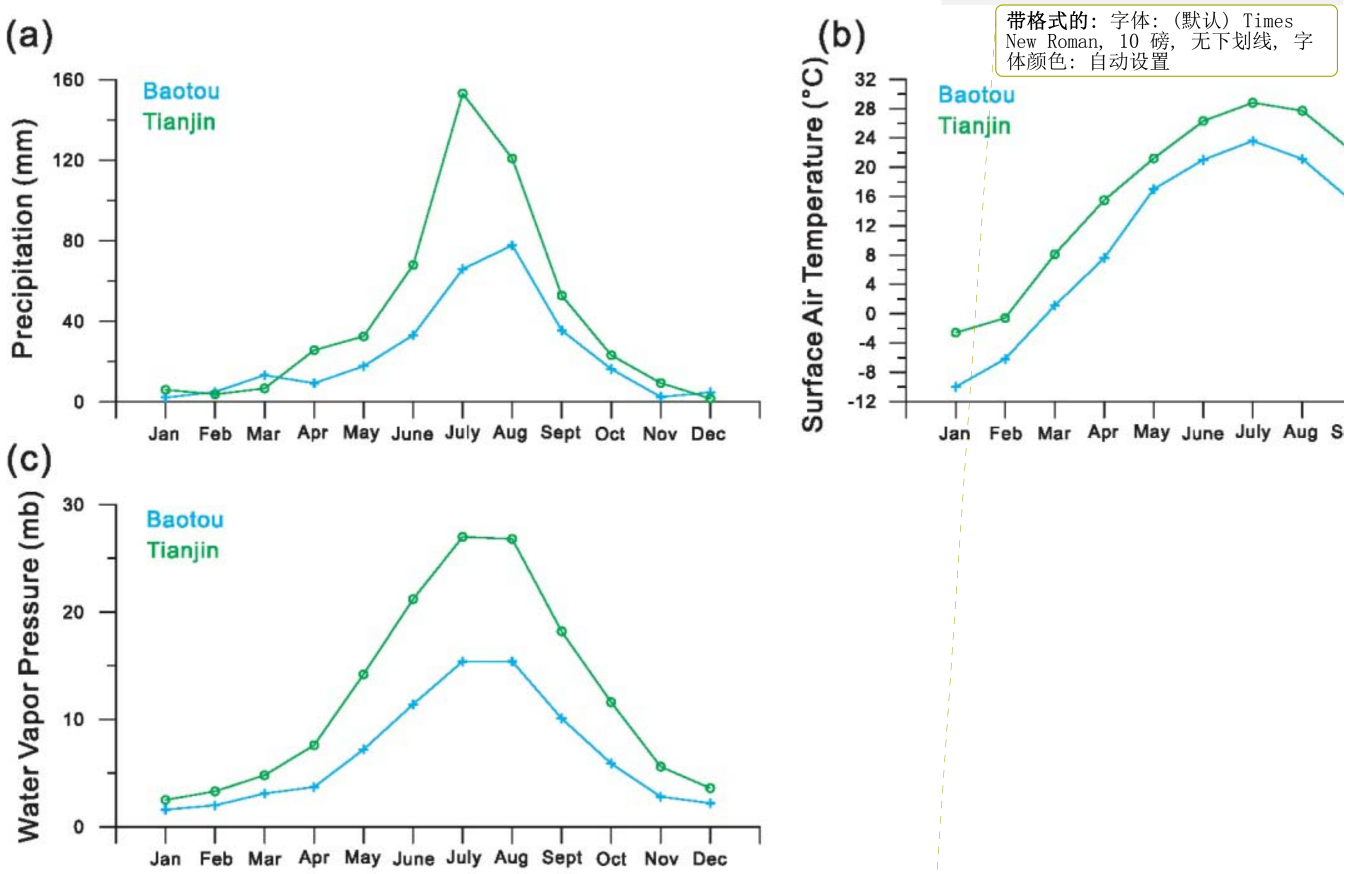

Fig. 8. The seasonal mean distributions of (d) δ^{18}O (a) and (e) δD^{2}H (b) values in precipitation from the Baotou and Tianjin weather stations in the surrounding areas of the Otindag for the period in recent sixteen years (1986-2001).

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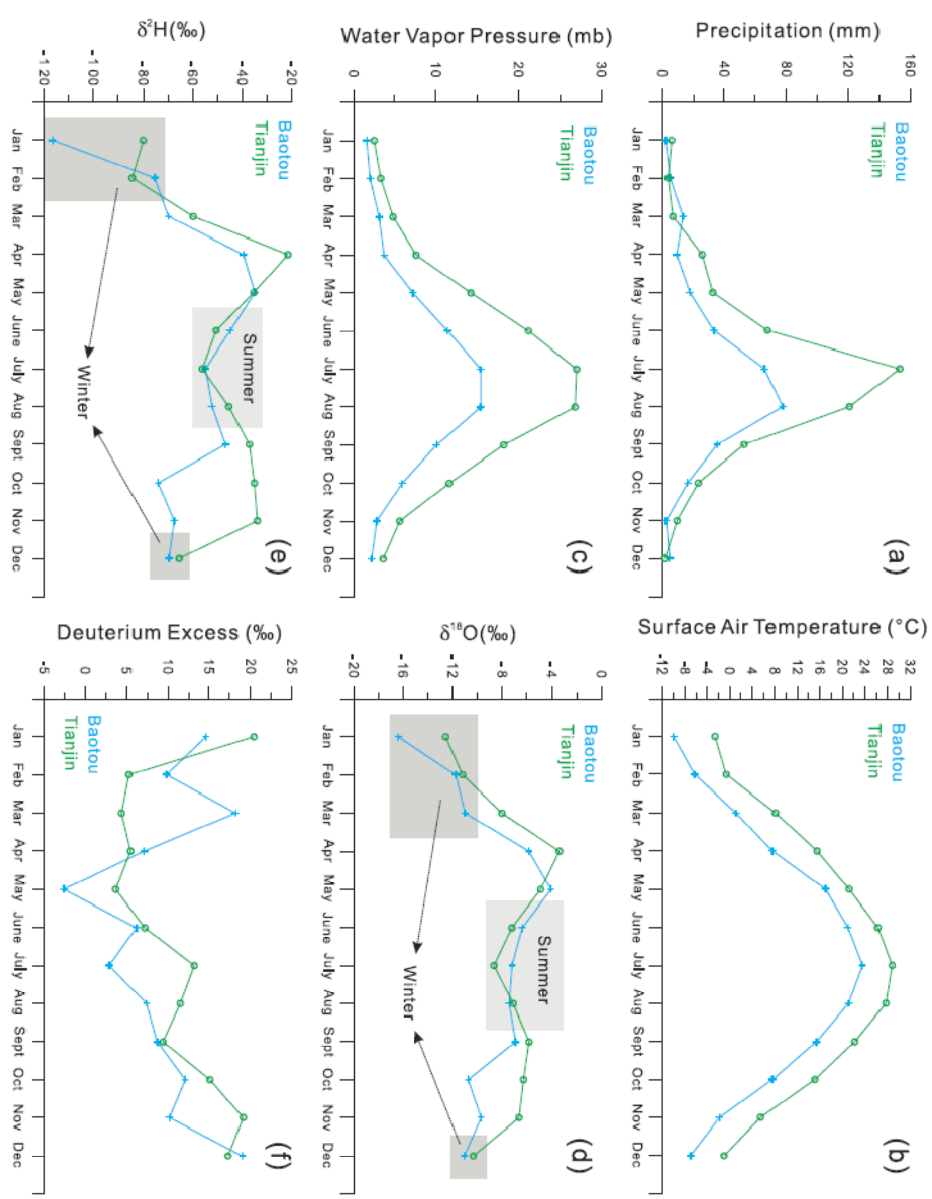

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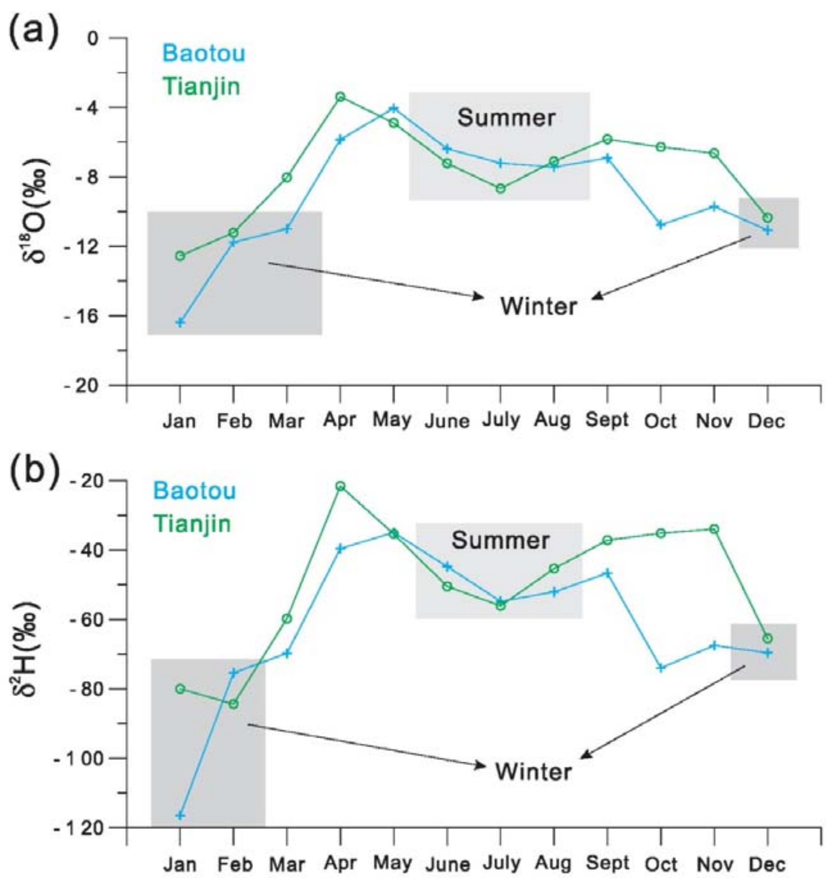

Fig. 9. The bivariate diagram of ~~of~~δD^{2}~~H~~ and δ^{18}O, i.e. the Craig diagram, for the natural water samples collected in the Otindag (this study) and the Dali Basin~~is study~~. Different relationships between the groundwaters, lake waters, river waters, spring waters and the precipitation waters are ~~emphasizedly~~clearly illustrated. AWMB, AWMT, LWMB, LWMT, GMWL, LMWL-B, LWML-T, and EL1 are the same as in ~~to~~ Fig. 7~~6~~. EL2, the evaporation line calculated based on the data from the groundwater, lake water, river water and spring water samples collected from ~~in~~ the Otindag and ~~in the~~ Dali Basin. The data for ~~of~~ the Dali were taken from ~~are cited from previousstudies(~~Chen et al. (~~,~~2008) and ~~;~~Zhen et al. (~~,~~2014)~~)~~.

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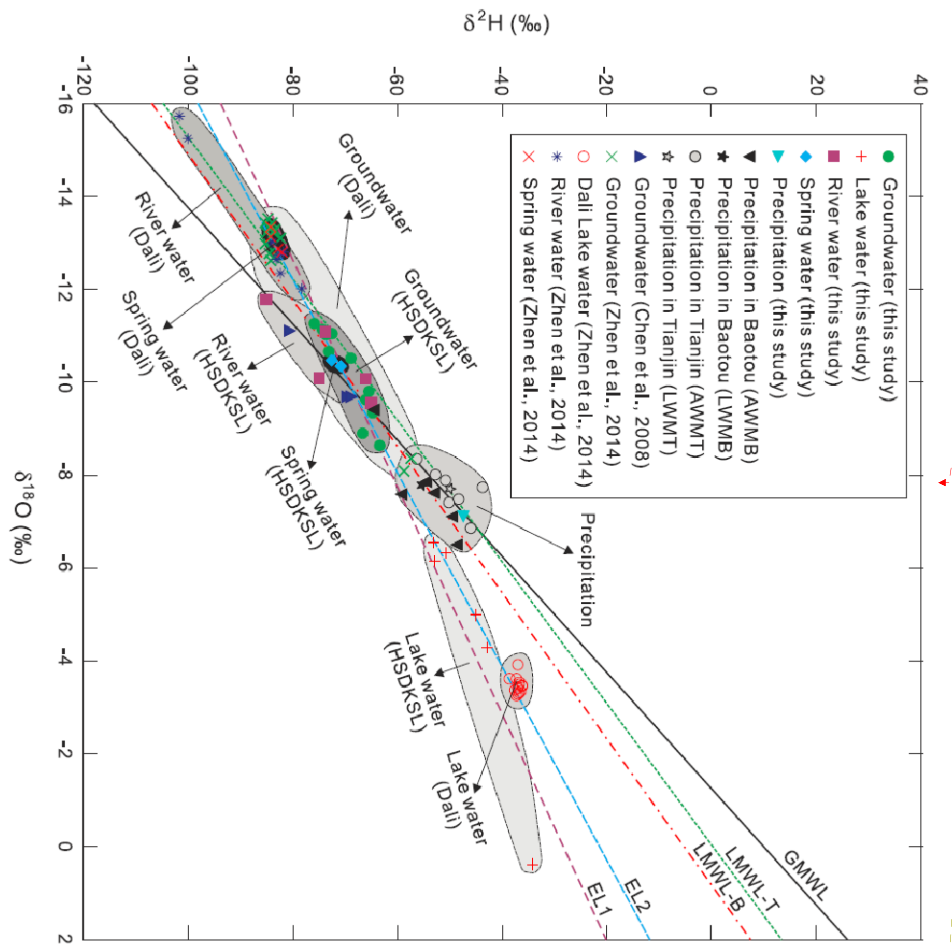

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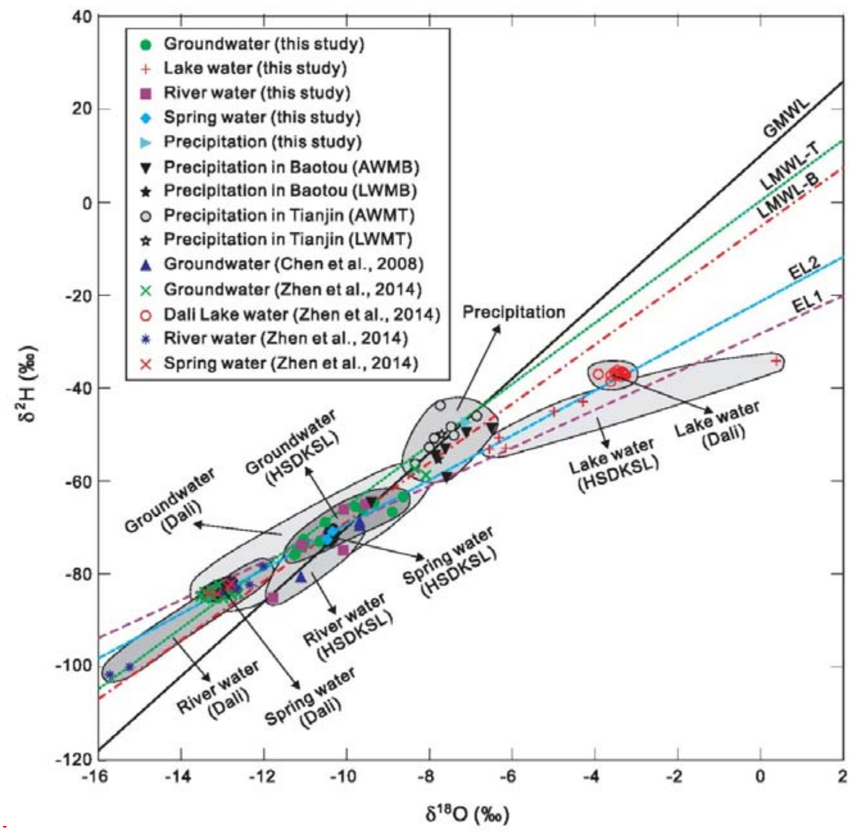

Fig. 10. (a) ~~The s~~Sketch map showing the relationship between the groundwaters in the NPCSX and SPCSX areas, based on variations of (a) the chloride concentrations, ~~(a)and~~ (b) the TDS ~~(b)~~ concentrations, (c) the $\delta^{18}O$ values and (d) the δD values of these water samples versus their distances away from the water sample g1 along the palaeo river channel (PCSX) from south to north.

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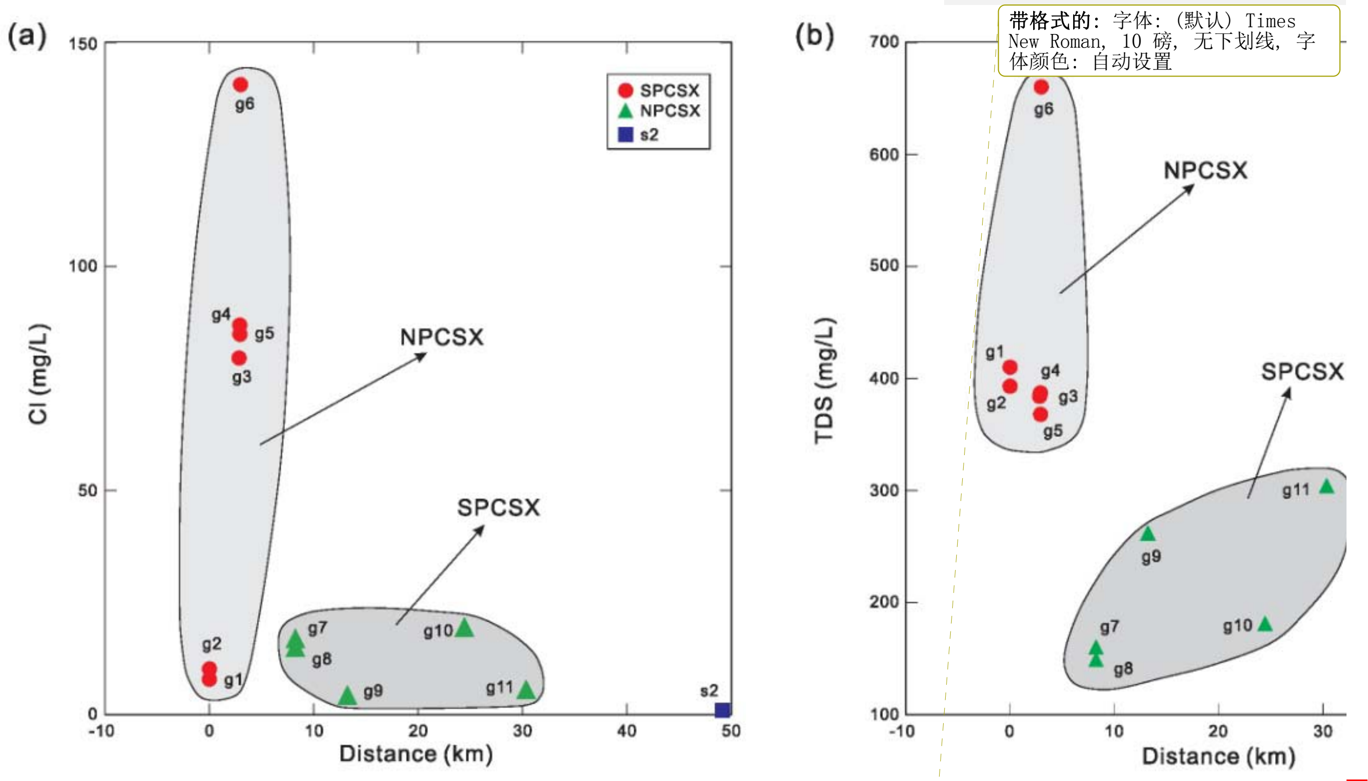

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~~**Fig. 11.** The bivariate plot of Cl vs. δ^2Hin the groundwaters from the PCSX region, which showing that no significant evaporation process has been experienced by these groundwaters.~~

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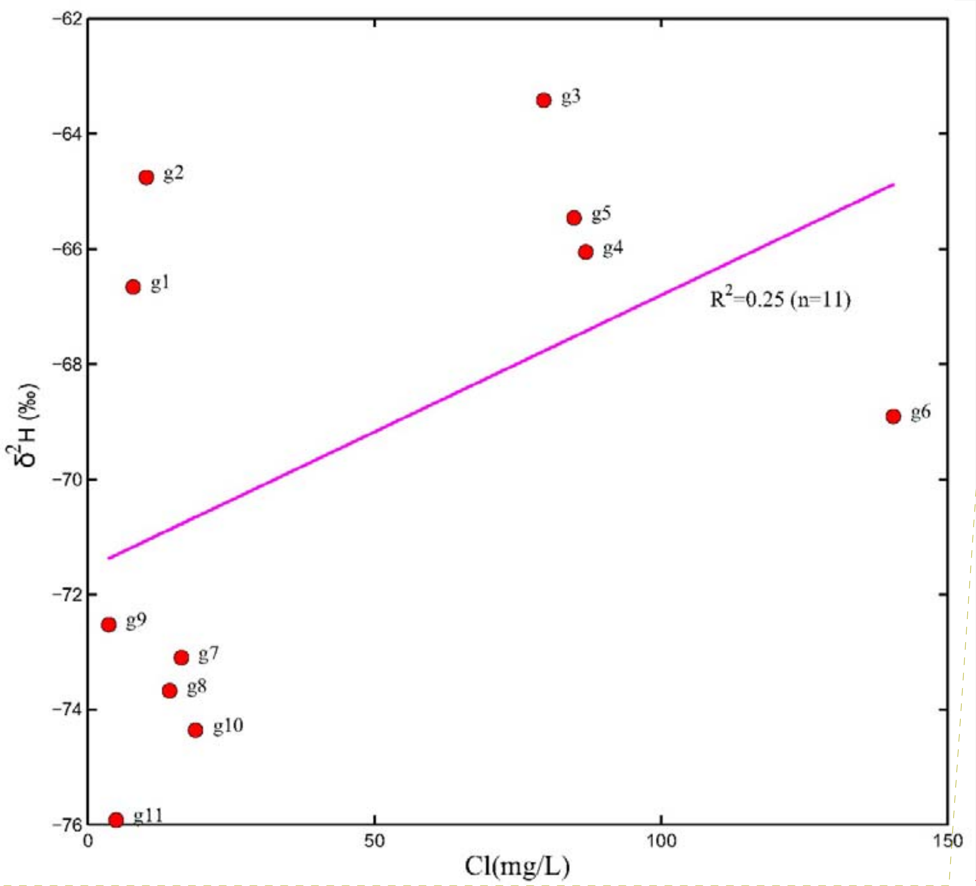

~~**Fig. 12.**Variations of $\delta^{18}O$ (a) and δ^2H(b) in the groundwaters versus their distances away from the groundwater sample g1 along the palaeo river channel (PCSX) from south to north.~~ The dashed line in (c) and (d) represents the corresponding values of the spring water sample s2, and ~~which is just well~~ divides~~d~~ ~~the~~ samples into the NPCSX and ~~the~~ SPCSX parts.

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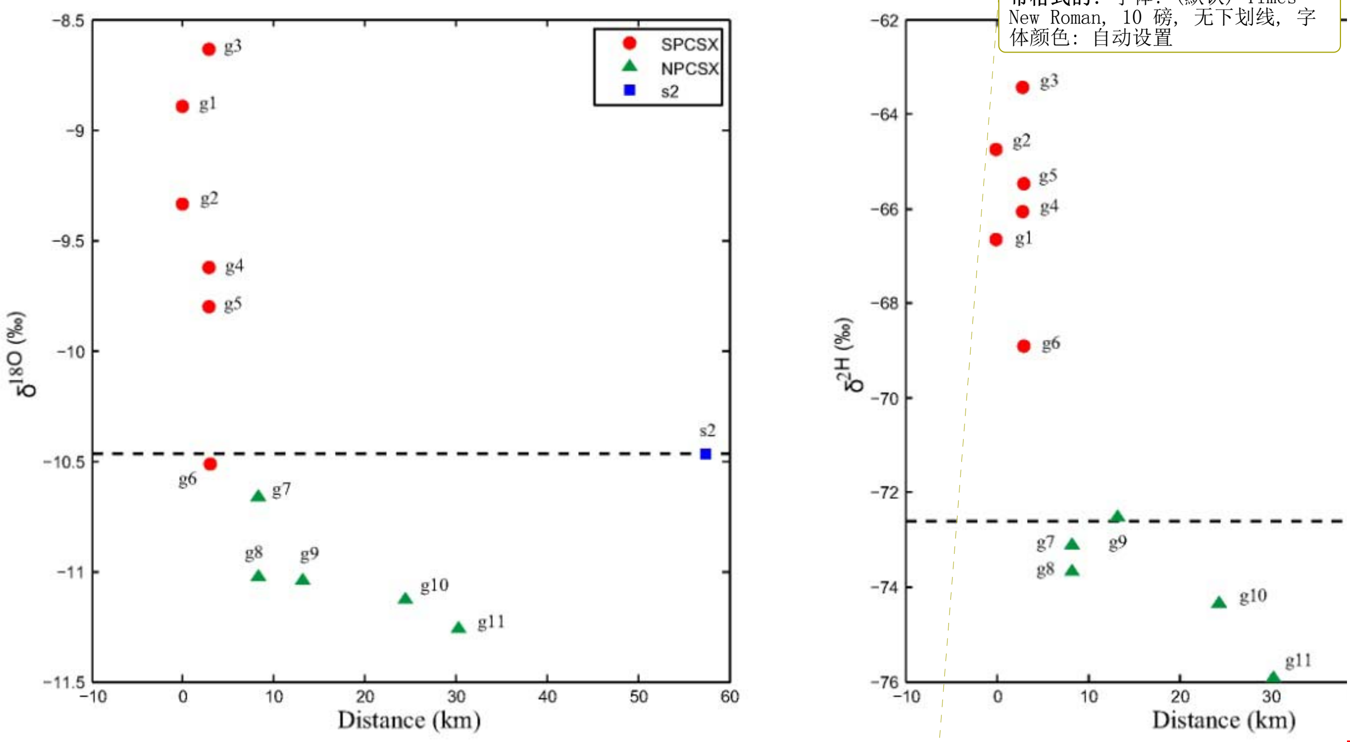

Fig. 13. The bivariate plots of δ^{2}H(a) and δ^{18}O (b) vs. deuterium excess for the groundwaters in the PCSX area. (e)

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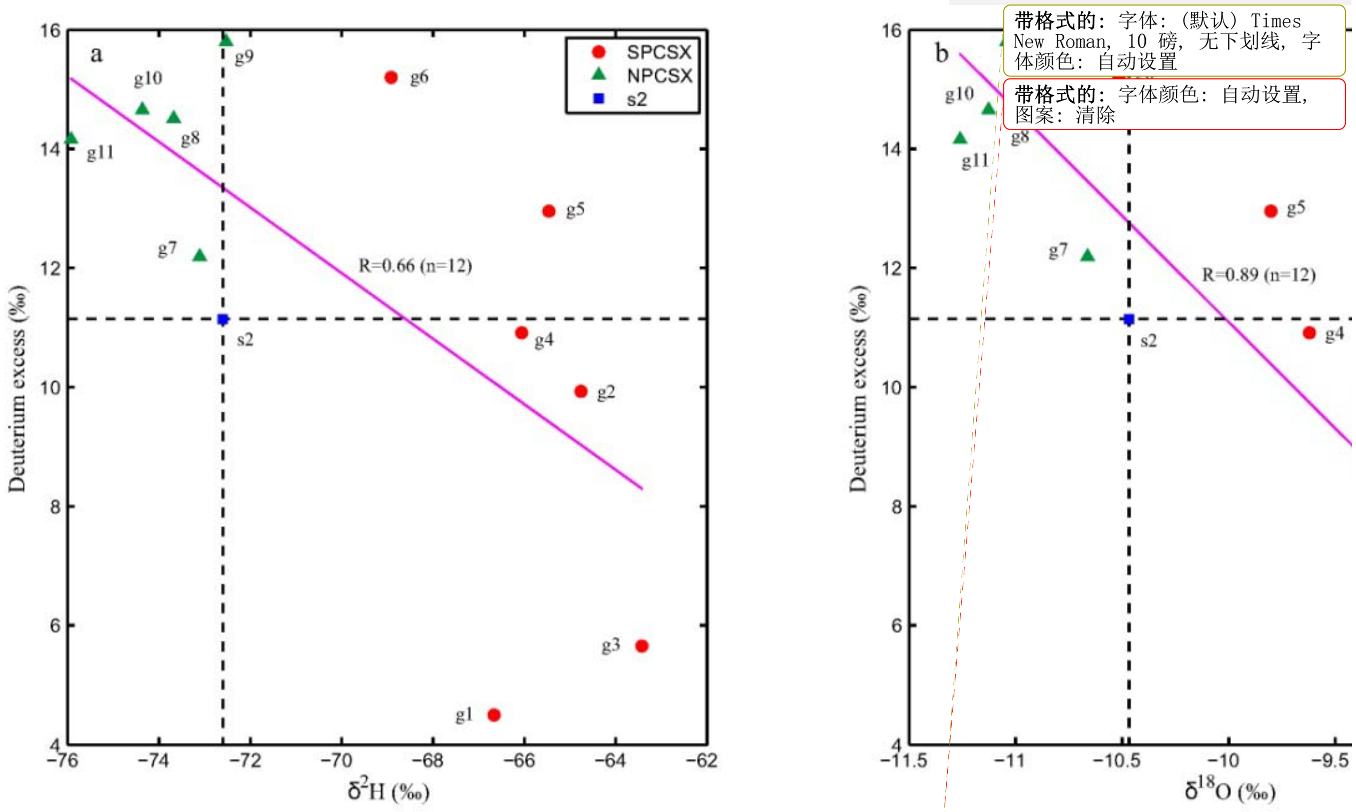

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~~Fig. 14.~~ Variations of tritium contents vs. deuterium excess ~~(a) and TDS (b)~~ for the groundwater samples in the study area. The sample g6 was omitted due to ~~excluded because of~~ its potential contaminationi~~ed~~on.

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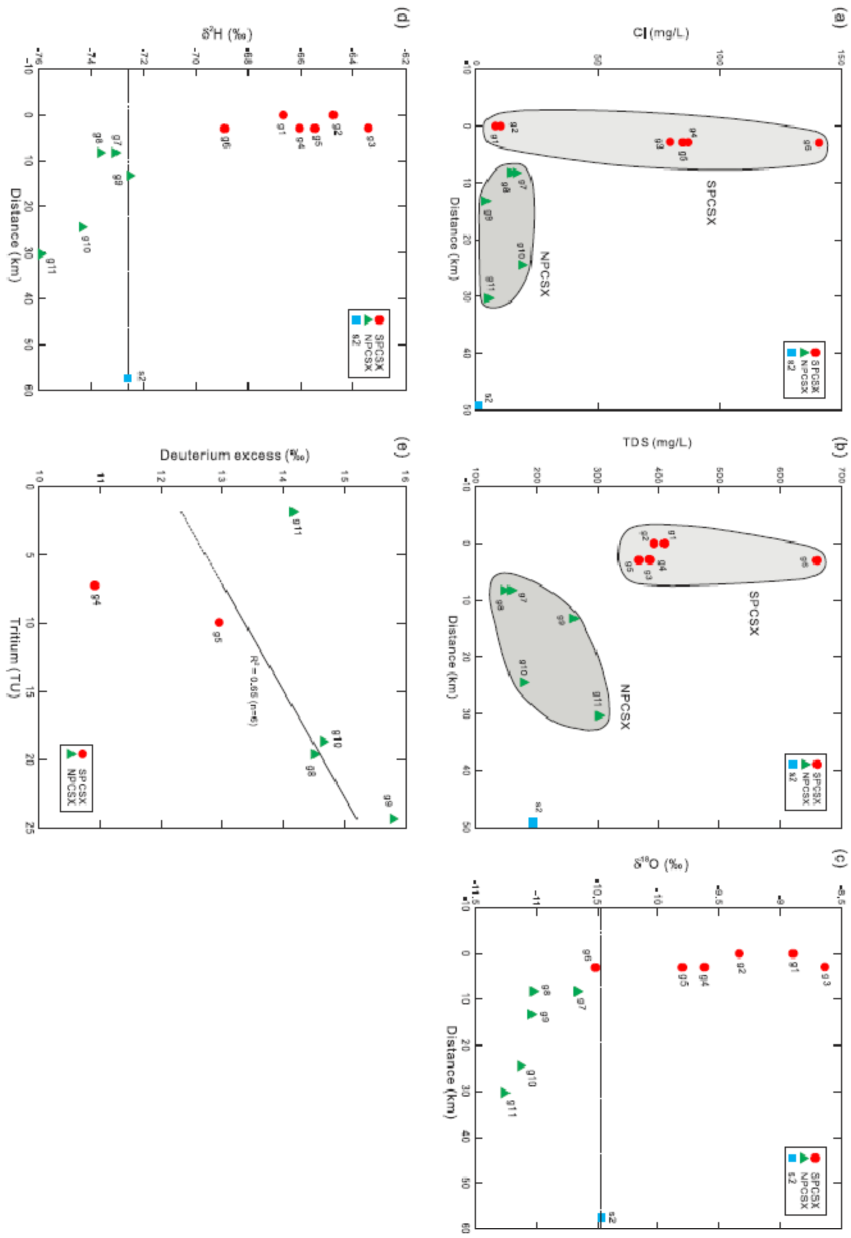

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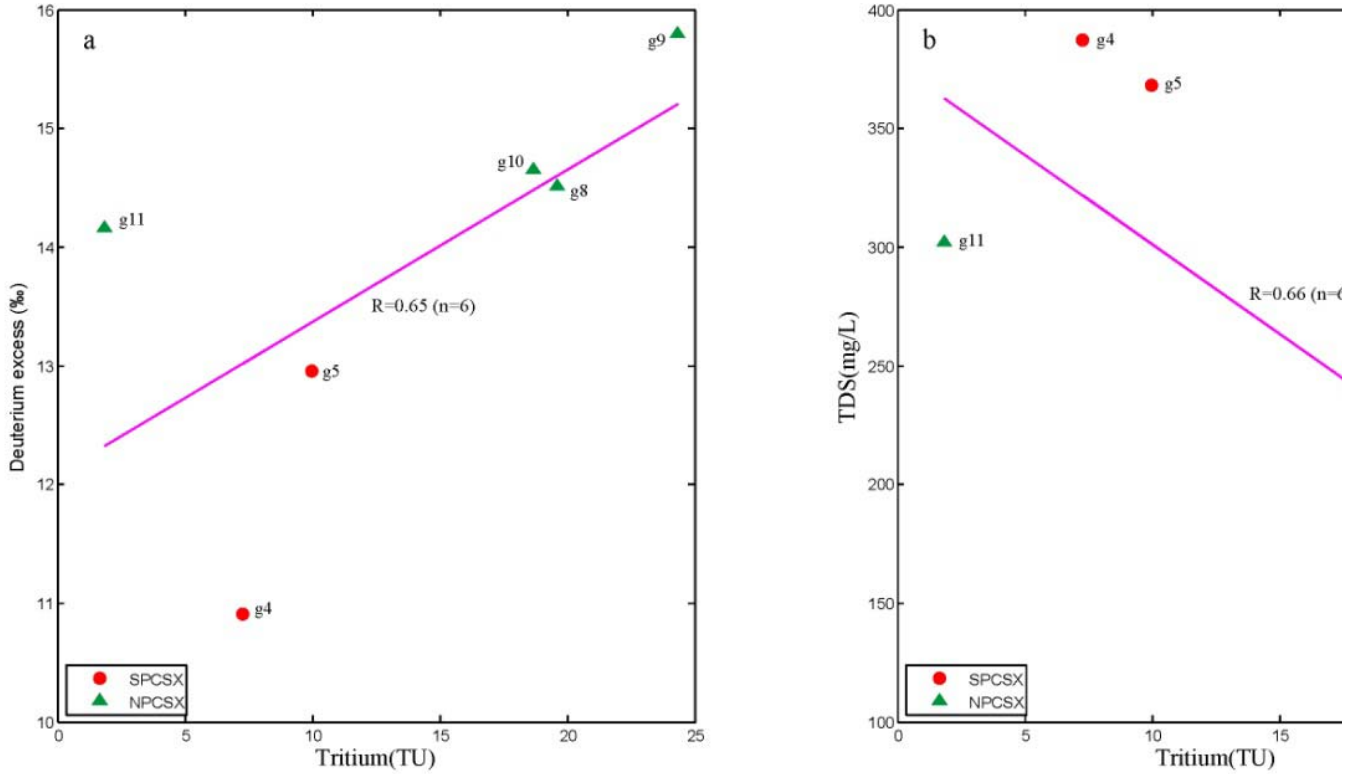

Fig. 115. Variation of the topographical elevation along the section S1 (see Fig. 1b) from the upstream of the Dali Lake to the location site of the spring water sample (s2) in the riverhead of the Xilamulun River. Note that no river water samples are shown in this figure.

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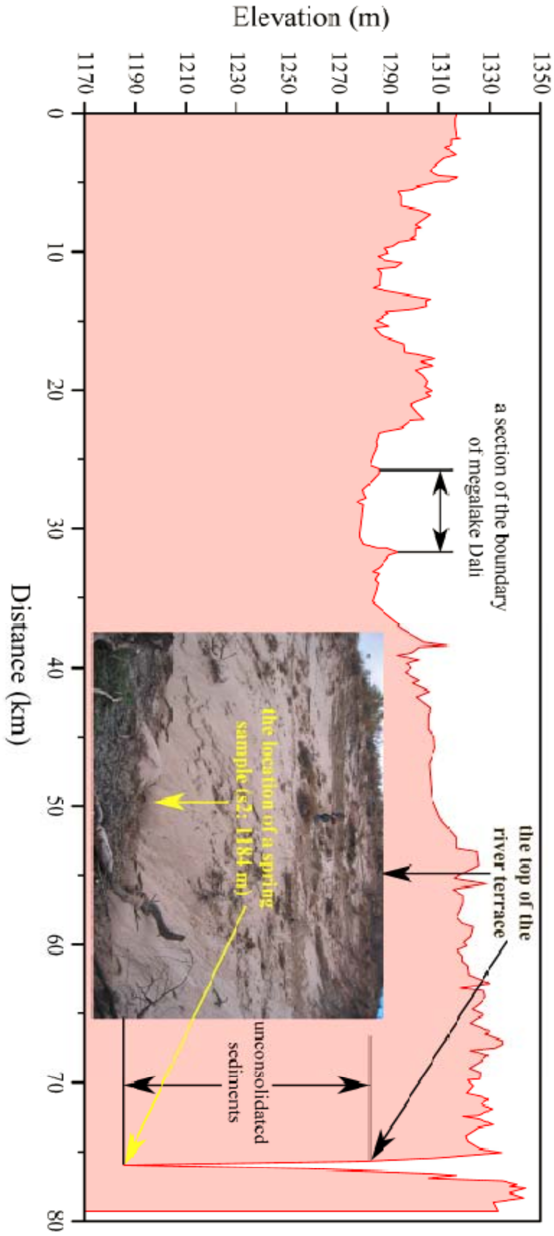

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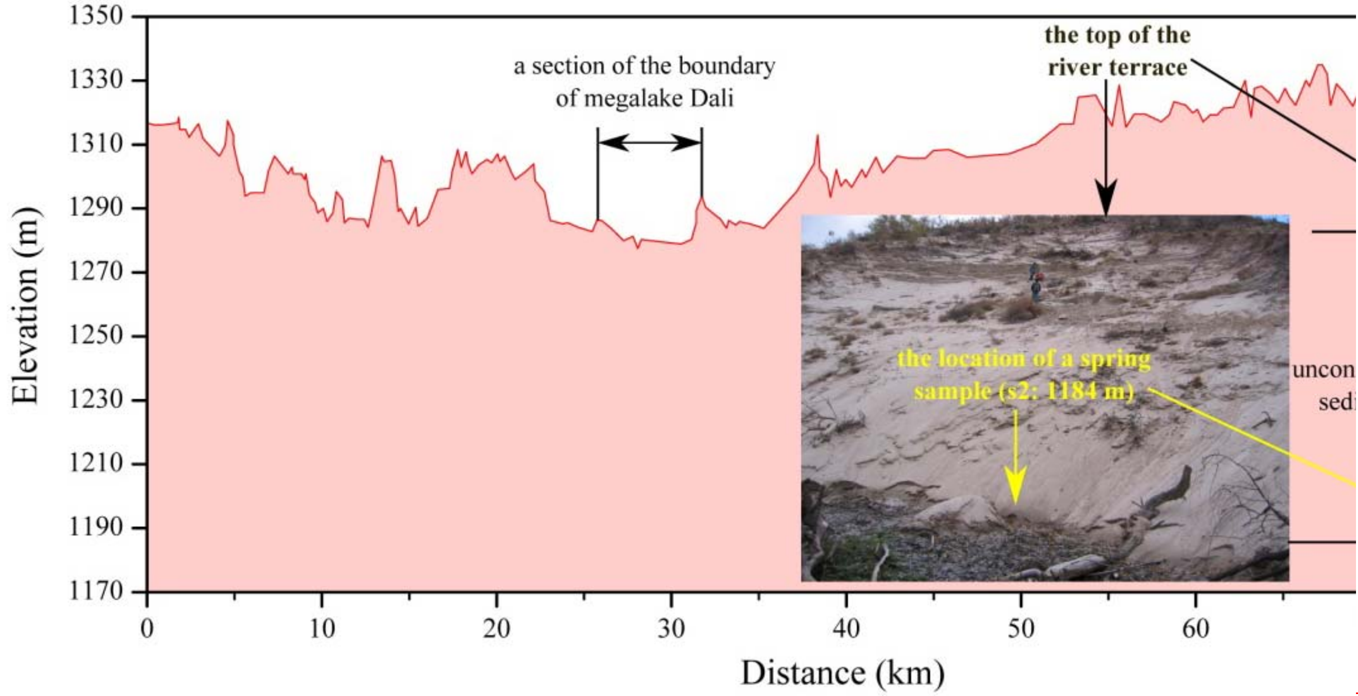

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Table Captions:

Table 1. The physical parameters measured for the natural water samples in the study area.

Sample ID	Water type	Latitude (N, degree)	Longitude (E, degree)	Elevation (m a.s.l)	Depth (m)	Temperature (°C)	pH	Eh (mV)	EC (μS/cm)	TDS (mg/L)	Salinity (%)	Alkalinity (meq/L)	Hardness (°dH)
g1	Groundwater	42.736306	116.747333	1396	12	5.8	6.72	3	769	410	0.6	5.47	9.42
g2	Groundwater	42.736306	116.747333	1396	26	6.0	6.91	-10	736	393	0.5	4.07	11.96
g3	Groundwater	42.760194	116.760139	1355	32	7.7	6.88	-6	725	384	0.5	2.39	11.94
g4	Groundwater	42.759694	116.760417	1360	7	10.0	6.74	1	725	387	0.5	2.20	12.28
g5	Groundwater	42.759556	116.760556	1362	27	7.6	6.46	16	691	368	0.5	2.23	15.57
g6	Groundwater	42.760111	116.760250	1365	7	10.3	6.26	22	1240	660	0.8	3.25	24.45
g7	Groundwater	42.806361	116.747806	1352	20	6.8	6.71	2	297	158	0.2	0.63	4.70
g8	Groundwater	42.806361	116.747806	1352	16	6.5	6.92	-8	276	147	0.2	0.58	5.00
g9	Groundwater	42.850333	116.735722	1347	30	7.2	6.74	-1	487	260	0.4	3.73	12.68
g10	Groundwater	42.949861	116.759194	1321	37	9.9	6.75	-2	337	179	0.2	1.66	7.23
g11	Groundwater	42.967111	116.827528	1317	60	8.6	6.99	-14	571	302	0.4	2.40	12.94
l1	Lake water	42.424611	116.769194	1368	/	16.9	9.44	-151	126	67	0.1	0.95	1.79
l2	Lake water	42.424611	116.769194	1368	/	19.6	9.18	-137	132	70	0.1	0.92	1.82
l3	Lake water	42.424611	116.757806	1365	/	20.2	7.38	-36	196	105	0.1	1.53	3.36
l4	Lake water	42.427083	116.757639	1366	/	20.5	7.87	-64	448	238	0.2	3.42	6.61
l5	Lake water	42.421806	116.756917	1360	/	20.1	8.23	-83	173	92	0.1	1.43	2.73
l6	Lake water	42.736389	116.747222	1374	/	10.7	8.35	-89	194	103	0.1	1.53	3.30
r1	River water	42.530917	116.641250	1355	/	20.6	7.31	-33	180	96	0.1	0.88	2.23
r2	River water	42.310883	116.494817	1231	/	14.9	7.67	-52	178	95	0.1	1.21	2.50
r3	River water	42.385778	116.886194	1362	/	9.5	7.62	-48	177	94	0.1	1.45	2.62
r4	River water	42.931417	117.585306	1217	/	10.5	7.97	-69	474	252	0.3	3.22	8.73
r5	River~~Lake~~ water	43.079083	117.457389	1006	/	12.9	7.87	-62	191	101	0.1	1.37	2.88
s1	Spring water	42.530917	116.641250	1359	/	20.9	6.63	5	165	88	0.1	0.40	1.81
s2	Spring water	42.965417	116.975361	1184	/	19.0	7.47	-46	371	195	0.2	1.07	6.40
p1	Precipitation	42.330750	116.551694	1260	/	20.2	4.61	109	78	42	0.0	/	0.61

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Table 2. The concentrations of major cations and anions measured for the water samples in the study area.

Sample	F^- (mg/L)	Cl^- (mg/L)	NO_2^- (mg/L)	NO_3^- (mg/L)	SO_4^{2-} (mg/L)	CO_3^{2-} (mg/L)	HCO_3^- (mg/L)	Li^+ (mg/L)	Na^+ (mg/L)	NH_4^+ (mg/L)	K^+ (mg/L)	Mg^{2+} (mg/L)	Ca^{2+} (mg/L)
g1	0.13	7.90	2.32	0.48	16.10	0.00	334.60	0.02	13.79	10.54	4.59	15.52	41.81
g2	0.21	10.21	0.00	6.15	70.61	0.10	247.70	0.02	13.36	6.56	3.45	17.91	56.04
g3	0.11	79.56	0.00	0.00	140.76	0.00	145.40	0.01	17.92	2.28	1.76	17.06	57.29
g4	0.10	86.90	0.00	5.73	164.80	0.00	133.70	0.02	18.02	0.00	2.02	18.50	57.32
g5	0.07	84.82	0.00	0.76	169.30	0.00	136.20	0.00	39.68	1.02	2.72	20.94	76.86
g6	0.07	140.54	0.00	110.77	228.80	0.00	198.20	0.00	79.80	0.00	29.47	29.25	126.68
g7	0.37	16.31	0.00	306.31	32.01	0.00	38.70	0.06	7.83	0.00	3.09	6.21	23.37
g8	0.29	14.28	0.00	35.49	29.89	0.00	35.50	0.02	16.21	0.11	3.38	6.44	25.14
g9	0.10	3.66	0.15	1.19	71.56	0.00	227.40	0.06	12.92	0.55	4.50	14.06	67.52
g10	0.24	18.80	0.00	49.49	9.97	0.00	101.10	0.00	18.54	0.00	2.09	7.92	38.68
g11	0.28	4.94	0.00	0.00	181.53	0.00	146.20	0.05	20.40	2.59	2.06	13.30	70.59
l1	0.16	3.15	0.00	0.07	4.32	0.00	57.90	0.01	5.42	0.00	0.86	3.24	7.49
l2	0.16	3.30	0.00	1.66	4.57	0.00	55.80	0.00	5.33	0.00	0.84	3.29	7.61
l3	0.11	3.27	0.00	0.61	2.33	0.00	93.30	0.01	5.88	0.00	1.19	5.68	14.66
l4	0.17	22.12	0.00	0.39	3.04	0.10	207.60	0.00	9.21	0.70	24.21	14.02	24.18
l5	0.09	6.24	0.00	0.65	2.97	0.10	86.80	0.01	6.72	0.00	1.16	4.91	11.41
l6	0.18	4.29	0.00	0.80	9.34	0.10	93.00	0.01	8.41	0.00	1.36	6.47	12.95
r1	0.30	5.76	0.00	2.38	26.67	0.30	52.40	0.01	7.15	0.00	2.99	3.41	10.34
r2	0.19	4.82	0.00	0.65	16.40	0.10	73.10	0.01	6.82	0.00	1.92	3.96	11.36
r3	0.64	5.46	0.00	0.43	5.57	0.00	88.10	0.01	7.11	0.00	1.13	4.04	12.06
r4	1.08	20.39	0.00	19.27	37.25	0.50	195.00	0.01	13.02	0.00	1.96	11.90	42.81
r5	0.19	4.10	0.00	1.08	15.57	0.00	82.60	0.01	6.71	0.00	2.08	4.38	13.40
s1	0.16	6.44	0.00	1.95	34.25	0.00	24.30	0.02	6.56	0.00	1.62	2.92	8.10
s2	0.05	0.98	0.00	0.45	17.15	0.00	64.90	0.02	9.87	0.00	3.32	9.10	30.79
p1	0.61	2.90	0.00	9.46	12.65	0.00	0.00	0.00	2.09	2.07	1.64	0.88	2.95

Table 3. The analytical data of stable and radioactive isotopes measured for the water samples in this study.

Sample ID	δD^{2}H (‰)	σ‰	δ^{18}O (‰)	σ‰	deuterium excess (d)	Tritium (^{3}H) (TU)
g1	-66.664	0.199	-8.895	0.026	4.496	/
g2	-64.758	0.291	-9.336	0.039	9.930	/
g3	-63.424	0.269	-8.635	0.008	5.656	/
g4	-66.055	0.149	-9.621	0.062	10.913	7.250
g5	-65.462	0.111	-9.802	0.027	12.954	9.975
g6	-68.913	0.287	-10.514	0.039	15.199	22.908
g7	-73.105	0.298	-10.662	0.041	12.191	/
g8	-73.676	0.220	-11.023	0.037	14.508	19.611
g9	-72.530	0.181	-11.041	0.015	15.798	24.345
g10	-74.362	0.201	-11.127	0.026	14.654	18.681
g11	-75.924	0.340	-11.260	0.015	14.156	1.860
l1	-53.128	0.229	-6.553	0.002	-0.704	/
l2	-50.721	0.304	-6.320	0.026	-0.161	/
l3	-42.877	0.239	-4.292	0.034	-8.545	/
l4	-34.155	0.243	0.381	0.040	-37.203	/
l5	-45.057	0.206	-4.987	0.009	-5.161	/
l6	-52.866	0.187	-6.150	0.049	-3.666	/
r1	-66.157	0.118	-10.069	0.015	14.395	/
r2	-64.996	0.148	-9.549	0.012	11.396	/
r3	-73.790	0.315	-11.083	0.021	14.874	/
r4	-85.155	0.244	-11.781	0.005	9.093	/
r5	-74.978	0.195	-10.084	0.003	5.694	/
s1	-70.832	0.074	-10.340	0.007	11.888	/
s2	-72.601	0.281	-10.468	0.046	11.143	/
p1	-47.435	0.374	-7.141	0.017	9.693	/

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Table 4. The statistical frequency of rainfall events being >20 mm per year during the recent 30 years from 1985 to 2014. The data come from the China Meteorological Data Sharing Service System.

Station	One time/year	Two times/year	Three times/year	Four times/year	Five times/year	Six times/year	Seven times/year	Mean times/year
Duolun	2	8	8	4	4	3	1	3.4
Xilinhaote	8	5	2	6	3	2	0	2.5

Table 5. The measured contents of tritium in the groundwater samples studied and the calculated ages of these samples.

Sample-ID	Tritium content (T.U.)	Possible ages (years)
g1	not measured	not clear
g2	not measured	not clear
g3	not measured	not clear
g4	7.25	20-40
g5	9.97	13-33
g6	22.91	0-20
g7	not measured	not clear
g8	19.61	0-20
g9	24.34	0-17
g10	18.68	0-22
g11	1.86	40-65

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带格式的 ... [1025]
带格式的 ... [1027]
带格式的 ... [1029]
带格式的 ... [1013]
带格式的 ... [1014]
带格式的：字体颜色：自动设置
带格式的 ... [1016]
带格式的 ... [1018]
带格式的 ... [1020]
带格式的 ... [1022]
带格式的 ... [1024]
带格式的 ... [1026]
带格式的 ... [1028]
带格式的 ... [1030]
带格式的 ... [1031]
带格式的 ... [1032]
带格式的：字体颜色：自动设置
带格式的 ... [1033]
带格式的 ... [1034]
带格式的 ... [1035]
带格式的 ... [1036]
带格式的 ... [1037]
带格式的 ... [1038]
带格式的 ... [1039]
带格式的 ... [1040]
带格式的 ... [1041]
带格式的 ... [1042]
带格式的：字体颜色：自动设置
带格式的 ... [1043]
带格式的 ... [1044]
带格式的 ... [1045]
带格式的 ... [1046]
带格式的 ... [1047]
带格式的 ... [1048]
带格式的 ... [1049]
带格式的 ... [1050]
带格式的 ... [1051]
带格式的 ... [1052]

页 14: [1] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 14: [2] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 14: [3] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 14: [4] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [5] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [6] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [7] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [8] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [9] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [10] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [11] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [12] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [13] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [14] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[15] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[16] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[17] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[18] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[19] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[20] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[21] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[22] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[23] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62：[24] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[25] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[26] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[27] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [28] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [29] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [30] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [31] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [32] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [33] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [34] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [35] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [36] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [37] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [38] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进, 不对齐到网格

页 62: [39] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [40] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [41] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [42] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [43] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [44] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [45] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [46] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [47] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [48] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [49] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [50] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [51] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [52] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [53] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [54] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[55] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[56] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[57] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[58] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[59] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[60] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[61] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[62] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[63] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[64] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[65] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[66] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[67] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [68] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [69] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [70] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [71] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [72] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [73] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [74] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [75] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [76] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [77] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [78] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [79] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [80] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [81] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [82] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [83] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进, 不对齐到网格

页 62: [84] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [85] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [86] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [87] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [88] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [89] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [90] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [91] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [92] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [93] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [94] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[95] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[96] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[97] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[98] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62：[99] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[100] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[101] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[102] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[103] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[104] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[105] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[106] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[107] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [108] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [109] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [110] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [111] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [112] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [113] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进, 不对齐到网格

页 62: [114] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [115] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [116] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [117] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [118] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [119] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [120] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [121] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 62: [122] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 62: [123] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 62: [124] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 62: [125] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 62: [126] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 62: [127] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 62: [128] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [129] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 62: [130] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 62: [131] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 62: [132] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 62: [133] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 62: [134] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[135] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[136] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[137] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[138] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[139] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[140] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[141] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[142] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[143] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62：[144] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[145] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[146] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[147] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [148] 带格式的	User	2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [149] 带格式的	User	2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [150] 带格式的	User	2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [151] 带格式的	User	2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [152] 带格式的	User	2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [153] 带格式的	User	2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [154] 带格式的	User	2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [155] 带格式的	User	2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [156] 带格式的	User	2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [157] 带格式的	User	2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [158] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进, 不对齐到网格

页 62: [159] 带格式的	User	2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [160] 带格式的	User	2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [161] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [162] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [163] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [164] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [165] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [166] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [167] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [168] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [169] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [170] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [171] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [172] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [173] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进, 不对齐到网格

页 62: [174] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[175] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[176] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[177] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[178] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[179] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[180] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[181] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[182] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[183] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[184] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[185] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[186] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[187] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [188] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [189] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [190] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [191] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [192] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [193] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [194] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [195] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [196] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [197] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [198] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [199] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [200] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [201] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [202] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [203] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [204] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [205] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [206] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [207] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [208] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [209] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [210] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [211] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [212] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [213] 带格式的	User	2018/6/30 17:02:00

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页 62: [214] 带格式的	User	2018/6/30 17:02:00

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页 62：[215] 带格式的	User	2018/6/30 17:02:00

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页 62：[216] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[217] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[218] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62：[219] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[220] 带格式的	User	2018/6/30 17:02:00

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页 62：[221] 带格式的	User	2018/6/30 17:02:00

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页 62：[222] 带格式的	User	2018/6/30 17:02:00

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页 62：[223] 带格式的	User	2018/6/30 17:02:00

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页 62：[224] 带格式的	User	2018/6/30 17:02:00

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页 62：[225] 带格式的	User	2018/6/30 17:02:00

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页 62：[226] 带格式的	User	2018/6/30 17:02:00

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页 62：[227] 带格式的	User	2018/6/30 17:02:00

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页 62: [228] 带格式的 User 2018/6/30 17:02:00

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页 62: [229] 带格式的 User 2018/6/30 17:02:00

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页 62: [230] 带格式的 User 2018/6/30 17:02:00

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页 62: [231] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [232] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [233] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [234] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [235] 带格式的 User 2018/6/30 17:02:00

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页 62: [236] 带格式的 User 2018/6/30 17:02:00

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页 62: [237] 带格式的 User 2018/6/30 17:02:00

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页 62: [238] 带格式的 User 2018/6/30 17:02:00

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页 62: [239] 带格式的 User 2018/6/30 17:02:00

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页 62: [240] 带格式的 User 2018/6/30 17:02:00

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页 62: [241] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [242] 带格式的	User	2018/6/30 17:02:00

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页 62: [243] 带格式的	User	2018/6/30 17:02:00

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页 62: [244] 带格式的	User	2018/6/30 17:02:00

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页 62: [245] 带格式的	User	2018/6/30 17:02:00

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页 62: [246] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [247] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [248] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [249] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [250] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [251] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [252] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [253] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [254] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [255] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [256] 带格式的	User	2018/6/30 17:02:00

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页 62: [257] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [258] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [259] 带格式的	User	2018/6/30 17:02:00

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页 62: [260] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [261] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [262] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [263] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [264] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [265] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [266] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [267] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [268] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [269] 带格式的	User	2018/6/30 17:02:00

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页 62: [270] 带格式的	User	2018/6/30 17:02:00

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页 62: [271] 带格式的	User	2018/6/30 17:02:00

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页 62: [272] 带格式的	User	2018/6/30 17:02:00

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页 62: [273] 带格式的	User	2018/6/30 17:02:00

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页 62: [274] 带格式的	User	2018/6/30 17:02:00

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页 62: [275] 带格式的	User	2018/6/30 17:02:00

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页 62: [276] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [277] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [278] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [279] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [280] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [281] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [282] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [283] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [284] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [285] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [286] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [287] 带格式的	User	2018/6/30 17:02:00

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页 62: [288] 带格式的	User	2018/6/30 17:02:00

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页 62: [289] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [290] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [291] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [292] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [293] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [294] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[295] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[296] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[297] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[298] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[299] 带格式的	User	2018/6/30 17:02:00

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页 62：[300] 带格式的	User	2018/6/30 17:02:00

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页 62：[301] 带格式的	User	2018/6/30 17:02:00

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页 62：[302] 带格式的	User	2018/6/30 17:02:00

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页 62：[303] 带格式的	User	2018/6/30 17:02:00

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页 62：[304] 带格式的	User	2018/6/30 17:02:00

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页 62：[305] 带格式的	User	2018/6/30 17:02:00

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页 62：[306] 带格式的	User	2018/6/30 17:02:00

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页 62：[307] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [308] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [309] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [310] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [311] 带格式的	User	2018/6/30 17:02:00

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页 62: [312] 带格式的	User	2018/6/30 17:02:00

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页 62: [313] 带格式的	User	2018/6/30 17:02:00

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页 62: [314] 带格式的	User	2018/6/30 17:02:00

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页 62: [315] 带格式的	User	2018/6/30 17:02:00

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页 62: [316] 带格式的	User	2018/6/30 17:02:00

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页 62: [317] 带格式的	User	2018/6/30 17:02:00

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页 62: [318] 带格式的	User	2018/6/30 17:02:00

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页 62: [319] 带格式的	User	2018/6/30 17:02:00

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页 62: [320] 带格式的	User	2018/6/30 17:02:00

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页 62: [321] 带格式的	User	2018/6/30 17:02:00

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页 62: [322] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [323] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [324] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62: [325] 带格式的	User	2018/6/30 17:02:00

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页 62: [326] 带格式的	User	2018/6/30 17:02:00

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页 62: [327] 带格式的	User	2018/6/30 17:02:00

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页 62: [328] 带格式的	User	2018/6/30 17:02:00

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页 62: [329] 带格式的	User	2018/6/30 17:02:00

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页 62: [330] 带格式的	User	2018/6/30 17:02:00

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页 62: [331] 带格式的	User	2018/6/30 17:02:00

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页 62: [332] 带格式的	User	2018/6/30 17:02:00

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页 62: [333] 带格式的	User	2018/6/30 17:02:00

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页 62: [334] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[335] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[336] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[337] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[338] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62：[339] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 62：[340] 带格式的	User	2018/6/30 17:02:00

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页 62：[341] 带格式的	User	2018/6/30 17:02:00

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页 62：[342] 带格式的	User	2018/6/30 17:02:00

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页 62：[343] 带格式的	User	2018/6/30 17:02:00

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页 62：[344] 带格式的	User	2018/6/30 17:02:00

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页 62：[345] 带格式的	User	2018/6/30 17:02:00

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页 62：[346] 带格式的	User	2018/6/30 17:02:00

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页 62：[347] 带格式的	User	2018/6/30 17:02:00

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页 62: [348] 带格式的	User	2018/6/30 17:02:00

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页 62: [349] 带格式的	User	2018/6/30 17:02:00

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页 62: [350] 带格式的	User	2018/6/30 17:02:00

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页 62: [351] 带格式的	User	2018/6/30 17:02:00

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页 62: [352] 带格式的	User	2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 62: [353] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进, 不对齐到网格

页 62: [354] 带格式的	User	2018/6/30 17:02:00

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页 62: [355] 带格式的	User	2018/6/30 17:02:00

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页 62: [356] 带格式的	User	2018/6/30 17:02:00

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页 62: [357] 带格式的	User	2018/6/30 17:02:00

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页 62: [358] 带格式的	User	2018/6/30 17:02:00

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页 62: [359] 带格式的	User	2018/6/30 17:02:00

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页 62: [360] 带格式的	User	2018/6/30 17:02:00

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页 62: [361] 带格式的	User	2018/6/30 17:02:00

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页 62: [362] 带格式的	User	2018/6/30 17:02:00

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页 62: [363] 带格式的	User	2018/6/30 17:02:00

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页 62: [364] 带格式的	User	2018/6/30 17:02:00

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页 62: [365] 带格式的	User	2018/6/30 17:02:00

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页 62: [366] 带格式的	User	2018/6/30 17:02:00

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页 62: [367] 带格式的	User	2018/6/30 17:02:00

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页 62: [368] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62: [369] 带格式的	User	2018/6/30 17:02:00

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页 62: [370] 带格式的	User	2018/6/30 17:02:00

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页 62: [371] 带格式的	User	2018/6/30 17:02:00

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页 62: [372] 带格式的	User	2018/6/30 17:02:00

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页 62: [373] 带格式的	User	2018/6/30 17:02:00

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页 62: [374] 带格式的	User	2018/6/30 17:02:00

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页 62：[375] 带格式的	User	2018/6/30 17:02:00

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页 62：[376] 带格式的	User	2018/6/30 17:02:00

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页 62：[381] 带格式的	User	2018/6/30 17:02:00

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页 62：[382] 带格式的	User	2018/6/30 17:02:00

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页 62：[383] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 62：[384] 带格式的	User	2018/6/30 17:02:00

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页 62：[385] 带格式的	User	2018/6/30 17:02:00

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页 62：[386] 带格式的	User	2018/6/30 17:02:00

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页 62：[387] 带格式的	User	2018/6/30 17:02:00

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页 62: [388] 带格式的 User 2018/6/30 17:02:00

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页 62: [389] 带格式的 User 2018/6/30 17:02:00

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页 63: [399] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进, 不对齐到网格

页 63: [400] 带格式的 User 2018/6/30 17:02:00

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页 63: [420] 带格式的 User 2018/6/30 17:02:00

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页 63: [420] 带格式的	User	2018/6/30 17:02:00

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页 63: [421] 带格式的	User	2018/6/30 17:02:00

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页 63: [421] 带格式的	User	2018/6/30 17:02:00

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页 63: [422] 带格式的	User	2018/6/30 17:02:00

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页 63: [422] 带格式的	User	2018/6/30 17:02:00

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页 63: [423] 带格式的	User	2018/6/30 17:02:00

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页 63: [424] 带格式的	User	2018/6/30 17:02:00

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页 63: [424] 带格式的	User	2018/6/30 17:02:00

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页 63: [425] 带格式的	User	2018/6/30 17:02:00

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页 63: [425] 带格式的	User	2018/6/30 17:02:00

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页 63: [426] 带格式的	User	2018/6/30 17:02:00

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页 63: [427] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [428] 带格式的	User	2018/6/30 17:02:00

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页 63：[428] 带格式的	User	2018/6/30 17:02:00

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页 63：[429] 带格式的	User	2018/6/30 17:02:00

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页 63: [442] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [443] 带格式的 User 2018/6/30 17:02:00

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页 63：[454] 带格式的	User	2018/6/30 17:02:00

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页 63：[455] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 63：[455] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 63: [456] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 63: [457] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [458] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 63: [458] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 63: [459] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 63: [459] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 63: [460] 带格式的	User	2018/6/30 17:02:00

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页 63: [460] 带格式的	User	2018/6/30 17:02:00

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页 63: [461] 带格式的	User	2018/6/30 17:02:00

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页 63: [461] 带格式的	User	2018/6/30 17:02:00

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页 63: [462] 带格式的	User	2018/6/30 17:02:00

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页 63: [462] 带格式的	User	2018/6/30 17:02:00

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页 63: [463] 带格式的	User	2018/6/30 17:02:00

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页 63: [463] 带格式的 User 2018/6/30 17:02:00

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页 63: [464] 带格式的 User 2018/6/30 17:02:00

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页 63: [464] 带格式的 User 2018/6/30 17:02:00

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页 63: [465] 带格式的 User 2018/6/30 17:02:00

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页 63: [465] 带格式的 User 2018/6/30 17:02:00

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页 63: [466] 带格式的 User 2018/6/30 17:02:00

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页 63: [466] 带格式的 User 2018/6/30 17:02:00

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页 63: [467] 带格式的 User 2018/6/30 17:02:00

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页 63: [467] 带格式的 User 2018/6/30 17:02:00

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页 63: [468] 带格式的 User 2018/6/30 17:02:00

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页 63: [468] 带格式的 User 2018/6/30 17:02:00

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页 63: [469] 带格式的 User 2018/6/30 17:02:00

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页 63: [469] 带格式的 User 2018/6/30 17:02:00

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页 63: [470] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 63：[470] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 63：[471] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 63：[472] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63：[473] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 63：[473] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 63：[474] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 63：[474] 带格式的	User	2018/6/30 17:02:00

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页 63：[475] 带格式的	User	2018/6/30 17:02:00

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页 63：[475] 带格式的	User	2018/6/30 17:02:00

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页 63：[476] 带格式的	User	2018/6/30 17:02:00

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页 63：[476] 带格式的	User	2018/6/30 17:02:00

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页 63：[477] 带格式的	User	2018/6/30 17:02:00

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页 63：[477] 带格式的	User	2018/6/30 17:02:00

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页 63: [478] 带格式的	User	2018/6/30 17:02:00

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页 63: [478] 带格式的	User	2018/6/30 17:02:00

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页 63: [479] 带格式的	User	2018/6/30 17:02:00

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页 63: [479] 带格式的	User	2018/6/30 17:02:00

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页 63: [480] 带格式的	User	2018/6/30 17:02:00

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页 63: [480] 带格式的	User	2018/6/30 17:02:00

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页 63: [481] 带格式的	User	2018/6/30 17:02:00

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页 63: [481] 带格式的	User	2018/6/30 17:02:00

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页 63: [482] 带格式的	User	2018/6/30 17:02:00

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页 63: [482] 带格式的	User	2018/6/30 17:02:00

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页 63: [483] 带格式的	User	2018/6/30 17:02:00

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页 63: [483] 带格式的	User	2018/6/30 17:02:00

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页 63: [484] 带格式的	User	2018/6/30 17:02:00

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页 63: [484] 带格式的	User	2018/6/30 17:02:00

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页 63: [485] 带格式的	User	2018/6/30 17:02:00

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页 63: [485] 带格式的	User	2018/6/30 17:02:00

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页 63: [486] 带格式的	User	2018/6/30 17:02:00

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页 63: [487] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [488] 带格式的	User	2018/6/30 17:02:00

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页 63: [488] 带格式的	User	2018/6/30 17:02:00

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页 63: [489] 带格式的	User	2018/6/30 17:02:00

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页 63: [489] 带格式的	User	2018/6/30 17:02:00

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页 63: [490] 带格式的	User	2018/6/30 17:02:00

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页 63: [490] 带格式的	User	2018/6/30 17:02:00

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页 63: [491] 带格式的	User	2018/6/30 17:02:00

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页 63: [491] 带格式的	User	2018/6/30 17:02:00

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页 63: [492] 带格式的	User	2018/6/30 17:02:00

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页 63：[492] 带格式的	User	2018/6/30 17:02:00

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页 63：[493] 带格式的	User	2018/6/30 17:02:00

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页 63：[494] 带格式的	User	2018/6/30 17:02:00

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页 63：[494] 带格式的	User	2018/6/30 17:02:00

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页 63：[495] 带格式的	User	2018/6/30 17:02:00

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页 63：[495] 带格式的	User	2018/6/30 17:02:00

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页 63：[496] 带格式的	User	2018/6/30 17:02:00

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页 63：[496] 带格式的	User	2018/6/30 17:02:00

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页 63：[497] 带格式的	User	2018/6/30 17:02:00

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页 63：[497] 带格式的	User	2018/6/30 17:02:00

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页 63：[498] 带格式的	User	2018/6/30 17:02:00

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页 63：[498] 带格式的	User	2018/6/30 17:02:00

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页 63: [499] 带格式的 User 2018/6/30 17:02:00

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页 63: [499] 带格式的 User 2018/6/30 17:02:00

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页 63: [500] 带格式的 User 2018/6/30 17:02:00

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页 63: [500] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 63: [501] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 63: [502] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进, 不对齐到网格

页 63: [503] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 63: [503] 带格式的 User 2018/6/30 17:02:00

无下划线, 字体颜色: 自动设置

页 63: [504] 带格式的 User 2018/6/30 17:02:00

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页 63: [504] 带格式的 User 2018/6/30 17:02:00

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页 63: [505] 带格式的 User 2018/6/30 17:02:00

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页 63: [505] 带格式的 User 2018/6/30 17:02:00

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页 63: [506] 带格式的 User 2018/6/30 17:02:00

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页 63: [506] 带格式的	User	2018/6/30 17:02:00

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页 63: [507] 带格式的	User	2018/6/30 17:02:00

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页 63: [507] 带格式的	User	2018/6/30 17:02:00

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页 63: [508] 带格式的	User	2018/6/30 17:02:00

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页 63: [508] 带格式的	User	2018/6/30 17:02:00

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页 63: [509] 带格式的	User	2018/6/30 17:02:00

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页 63: [509] 带格式的	User	2018/6/30 17:02:00

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页 63: [510] 带格式的	User	2018/6/30 17:02:00

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页 63: [510] 带格式的	User	2018/6/30 17:02:00

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页 63: [511] 带格式的	User	2018/6/30 17:02:00

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页 63: [511] 带格式的	User	2018/6/30 17:02:00

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页 63: [512] 带格式的	User	2018/6/30 17:02:00

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页 63: [512] 带格式的	User	2018/6/30 17:02:00

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页 63: [513] 带格式的	User	2018/6/30 17:02:00

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页 63：[513] 带格式的	User	2018/6/30 17:02:00

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页 63：[514] 带格式的	User	2018/6/30 17:02:00

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页 63：[514] 带格式的	User	2018/6/30 17:02:00

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页 63：[515] 带格式的	User	2018/6/30 17:02:00

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页 63：[515] 带格式的	User	2018/6/30 17:02:00

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页 63：[516] 带格式的	User	2018/6/30 17:02:00

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页 63：[517] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63：[518] 带格式的	User	2018/6/30 17:02:00

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页 63：[518] 带格式的	User	2018/6/30 17:02:00

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页 63：[519] 带格式的	User	2018/6/30 17:02:00

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页 63：[519] 带格式的	User	2018/6/30 17:02:00

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页 63：[520] 带格式的	User	2018/6/30 17:02:00

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页 63：[520] 带格式的	User	2018/6/30 17:02:00

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页 63: [521] 带格式的	User	2018/6/30 17:02:00

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页 63: [521] 带格式的	User	2018/6/30 17:02:00

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页 63: [522] 带格式的	User	2018/6/30 17:02:00

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页 63: [522] 带格式的	User	2018/6/30 17:02:00

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页 63: [523] 带格式的	User	2018/6/30 17:02:00

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页 63: [523] 带格式的	User	2018/6/30 17:02:00

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页 63: [524] 带格式的	User	2018/6/30 17:02:00

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页 63: [524] 带格式的	User	2018/6/30 17:02:00

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页 63: [525] 带格式的	User	2018/6/30 17:02:00

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页 63: [525] 带格式的	User	2018/6/30 17:02:00

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页 63: [526] 带格式的	User	2018/6/30 17:02:00

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页 63: [526] 带格式的	User	2018/6/30 17:02:00

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页 63: [527] 带格式的	User	2018/6/30 17:02:00

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页 63: [527] 带格式的	User	2018/6/30 17:02:00

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页 63: [528] 带格式的	User	2018/6/30 17:02:00

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页 63: [528] 带格式的	User	2018/6/30 17:02:00

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页 63: [529] 带格式的	User	2018/6/30 17:02:00

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页 63: [529] 带格式的	User	2018/6/30 17:02:00

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页 63: [530] 带格式的	User	2018/6/30 17:02:00

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页 63: [530] 带格式的	User	2018/6/30 17:02:00

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页 63: [531] 带格式的	User	2018/6/30 17:02:00

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页 63: [532] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [533] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 63: [533] 带格式的	User	2018/6/30 17:02:00

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页 63：[541] 带格式的	User	2018/6/30 17:02:00

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页 63：[541] 带格式的	User	2018/6/30 17:02:00

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页 63: [542] 带格式的	User	2018/6/30 17:02:00

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页 63: [546] 带格式的	User	2018/6/30 17:02:00

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页 63: [547] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [548] 带格式的	User	2018/6/30 17:02:00

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页 63: [548] 带格式的	User	2018/6/30 17:02:00

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页 63: [549] 带格式的	User	2018/6/30 17:02:00

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页 63: [549] 带格式的	User	2018/6/30 17:02:00

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页 63: [550] 带格式的	User	2018/6/30 17:02:00

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页 63: [550] 带格式的	User	2018/6/30 17:02:00

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页 63: [551] 带格式的	User	2018/6/30 17:02:00

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页 63: [551] 带格式的	User	2018/6/30 17:02:00

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页 63: [552] 带格式的	User	2018/6/30 17:02:00

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页 63: [552] 带格式的	User	2018/6/30 17:02:00

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页 63: [553] 带格式的	User	2018/6/30 17:02:00

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页 63: [553] 带格式的	User	2018/6/30 17:02:00

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页 63: [554] 带格式的	User	2018/6/30 17:02:00

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页 63: [554] 带格式的	User	2018/6/30 17:02:00

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页 63: [555] 带格式的	User	2018/6/30 17:02:00

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页 63: [555] 带格式的	User	2018/6/30 17:02:00

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页 63: [556] 带格式的	User	2018/6/30 17:02:00

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页 63：[556] 带格式的 User 2018/6/30 17:02:00

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页 63：[561] 带格式的 User 2018/6/30 17:02:00

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页 63：[562] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63：[563] 带格式的 User 2018/6/30 17:02:00

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页 63：[563] 带格式的 User 2018/6/30 17:02:00

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页 63: [564] 带格式的	User	2018/6/30 17:02:00

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页 63: [564] 带格式的	User	2018/6/30 17:02:00

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页 63: [565] 带格式的	User	2018/6/30 17:02:00

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页 63: [566] 带格式的	User	2018/6/30 17:02:00

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页 63: [566] 带格式的	User	2018/6/30 17:02:00

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页 63: [567] 带格式的	User	2018/6/30 17:02:00

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页 63: [567] 带格式的	User	2018/6/30 17:02:00

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页 63: [568] 带格式的	User	2018/6/30 17:02:00

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页 63: [568] 带格式的	User	2018/6/30 17:02:00

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页 63: [569] 带格式的	User	2018/6/30 17:02:00

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页 63: [569] 带格式的	User	2018/6/30 17:02:00

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页 63: [570] 带格式的	User	2018/6/30 17:02:00

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页 63: [570] 带格式的	User	2018/6/30 17:02:00

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页 63: [571] 带格式的	User	2018/6/30 17:02:00

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页 63: [571] 带格式的	User	2018/6/30 17:02:00

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页 63: [572] 带格式的	User	2018/6/30 17:02:00

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页 63: [572] 带格式的	User	2018/6/30 17:02:00

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页 63: [575] 带格式的	User	2018/6/30 17:02:00

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页 63: [575] 带格式的	User	2018/6/30 17:02:00

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页 63: [576] 带格式的	User	2018/6/30 17:02:00

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页 63: [577] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [578] 带格式的	User	2018/6/30 17:02:00

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页 63：[578] 带格式的	User	2018/6/30 17:02:00

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页 63：[579] 带格式的	User	2018/6/30 17:02:00

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页 63：[580] 带格式的	User	2018/6/30 17:02:00

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页 63：[580] 带格式的	User	2018/6/30 17:02:00

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页 63：[581] 带格式的	User	2018/6/30 17:02:00

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页 63：[581] 带格式的	User	2018/6/30 17:02:00

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页 63：[582] 带格式的	User	2018/6/30 17:02:00

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页 63：[582] 带格式的	User	2018/6/30 17:02:00

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页 63：[583] 带格式的	User	2018/6/30 17:02:00

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页 63: [585] 带格式的	User	2018/6/30 17:02:00

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页 63: [587] 带格式的	User	2018/6/30 17:02:00

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页 63: [589] 带格式的	User	2018/6/30 17:02:00

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页 63: [589] 带格式的	User	2018/6/30 17:02:00

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页 63: [590] 带格式的	User	2018/6/30 17:02:00

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页 63: [590] 带格式的	User	2018/6/30 17:02:00

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页 63: [591] 带格式的	User	2018/6/30 17:02:00

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页 63: [592] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [593] 带格式的	User	2018/6/30 17:02:00

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页 63: [593] 带格式的	User	2018/6/30 17:02:00

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页 63: [594] 带格式的	User	2018/6/30 17:02:00

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页 63: [594] 带格式的	User	2018/6/30 17:02:00

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页 63: [595] 带格式的	User	2018/6/30 17:02:00

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页 63: [596] 带格式的	User	2018/6/30 17:02:00

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页 63: [596] 带格式的	User	2018/6/30 17:02:00

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页 63: [598] 带格式的	User	2018/6/30 17:02:00

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页 63: [599] 带格式的	User	2018/6/30 17:02:00

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页 63：[600] 带格式的	User	2018/6/30 17:02:00

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页 63：[600] 带格式的	User	2018/6/30 17:02:00

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页 63：[601] 带格式的	User	2018/6/30 17:02:00

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页 63：[602] 带格式的	User	2018/6/30 17:02:00

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页 63：[602] 带格式的	User	2018/6/30 17:02:00

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页 63：[604] 带格式的	User	2018/6/30 17:02:00

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页 63：[604] 带格式的	User	2018/6/30 17:02:00

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页 63：[605] 带格式的	User	2018/6/30 17:02:00

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页 63：[605] 带格式的	User	2018/6/30 17:02:00

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页 63: [606] 带格式的 User 2018/6/30 17:02:00

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页 63: [607] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进, 不对齐到网格

页 63: [608] 带格式的 User 2018/6/30 17:02:00

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页 63: [608] 带格式的 User 2018/6/30 17:02:00

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页 63: [609] 带格式的 User 2018/6/30 17:02:00

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页 63: [609] 带格式的 User 2018/6/30 17:02:00

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页 63: [610] 带格式的 User 2018/6/30 17:02:00

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页 63: [610] 带格式的 User 2018/6/30 17:02:00

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页 63: [611] 带格式的 User 2018/6/30 17:02:00

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页 63: [611] 带格式的 User 2018/6/30 17:02:00

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页 63: [612] 带格式的 User 2018/6/30 17:02:00

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页 63: [612] 带格式的 User 2018/6/30 17:02:00

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页 63: [613] 带格式的 User 2018/6/30 17:02:00

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页 63: [619] 带格式的 User 2018/6/30 17:02:00

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页 63: [619] 带格式的 User 2018/6/30 17:02:00

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页 63: [620] 带格式的 User 2018/6/30 17:02:00

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页 63：[620] 带格式的	User	2018/6/30 17:02:00

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页 63：[621] 带格式的	User	2018/6/30 17:02:00

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页 63：[622] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63：[623] 带格式的	User	2018/6/30 17:02:00

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页 63：[623] 带格式的	User	2018/6/30 17:02:00

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页 63：[624] 带格式的	User	2018/6/30 17:02:00

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页 63：[624] 带格式的	User	2018/6/30 17:02:00

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页 63：[625] 带格式的	User	2018/6/30 17:02:00

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页 63：[625] 带格式的	User	2018/6/30 17:02:00

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页 63：[626] 带格式的	User	2018/6/30 17:02:00

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页 63：[627] 带格式的	User	2018/6/30 17:02:00

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页 63：[627] 带格式的	User	2018/6/30 17:02:00

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页 63: [628] 带格式的 User 2018/6/30 17:02:00

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页 63: [628] 带格式的 User 2018/6/30 17:02:00

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页 63: [630] 带格式的 User 2018/6/30 17:02:00

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页 63: [630] 带格式的 User 2018/6/30 17:02:00

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页 63: [634] 带格式的 User 2018/6/30 17:02:00

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页 63: [634] 带格式的	User	2018/6/30 17:02:00

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页 63: [635] 带格式的	User	2018/6/30 17:02:00

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页 63: [635] 带格式的	User	2018/6/30 17:02:00

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页 63: [636] 带格式的	User	2018/6/30 17:02:00

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页 63: [637] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [638] 带格式的	User	2018/6/30 17:02:00

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页 63: [638] 带格式的	User	2018/6/30 17:02:00

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页 63: [639] 带格式的	User	2018/6/30 17:02:00

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页 63: [639] 带格式的	User	2018/6/30 17:02:00

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页 63: [640] 带格式的	User	2018/6/30 17:02:00

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页 63: [640] 带格式的	User	2018/6/30 17:02:00

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页 63: [641] 带格式的	User	2018/6/30 17:02:00

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页 63: [641] 带格式的	User	2018/6/30 17:02:00

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页 63: [642] 带格式的	User	2018/6/30 17:02:00

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页 63：[642] 带格式的	User	2018/6/30 17:02:00

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页 63：[643] 带格式的	User	2018/6/30 17:02:00

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页 63：[643] 带格式的	User	2018/6/30 17:02:00

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页 63：[644] 带格式的	User	2018/6/30 17:02:00

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页 63：[644] 带格式的	User	2018/6/30 17:02:00

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页 63：[645] 带格式的	User	2018/6/30 17:02:00

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页 63：[645] 带格式的	User	2018/6/30 17:02:00

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页 63：[646] 带格式的	User	2018/6/30 17:02:00

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页 63：[646] 带格式的	User	2018/6/30 17:02:00

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页 63：[647] 带格式的	User	2018/6/30 17:02:00

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页 63：[647] 带格式的	User	2018/6/30 17:02:00

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页 63：[648] 带格式的	User	2018/6/30 17:02:00

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页 63：[648] 带格式的	User	2018/6/30 17:02:00

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页 63: [649] 带格式的	User	2018/6/30 17:02:00

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页 63: [649] 带格式的	User	2018/6/30 17:02:00

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页 63: [650] 带格式的	User	2018/6/30 17:02:00

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页 63: [650] 带格式的	User	2018/6/30 17:02:00

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页 63: [651] 带格式的	User	2018/6/30 17:02:00

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页 63: [652] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [653] 带格式的	User	2018/6/30 17:02:00

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页 63: [653] 带格式的	User	2018/6/30 17:02:00

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页 63: [654] 带格式的	User	2018/6/30 17:02:00

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页 63: [654] 带格式的	User	2018/6/30 17:02:00

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页 63: [655] 带格式的	User	2018/6/30 17:02:00

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页 63: [655] 带格式的	User	2018/6/30 17:02:00

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页 63: [656] 带格式的	User	2018/6/30 17:02:00

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页 63: [656] 带格式的	User	2018/6/30 17:02:00

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页 63: [657] 带格式的	User	2018/6/30 17:02:00

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页 63: [657] 带格式的	User	2018/6/30 17:02:00

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页 63: [658] 带格式的	User	2018/6/30 17:02:00

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页 63: [658] 带格式的	User	2018/6/30 17:02:00

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页 63: [659] 带格式的	User	2018/6/30 17:02:00

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页 63: [659] 带格式的	User	2018/6/30 17:02:00

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页 63: [660] 带格式的	User	2018/6/30 17:02:00

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页 63: [660] 带格式的	User	2018/6/30 17:02:00

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页 63: [661] 带格式的	User	2018/6/30 17:02:00

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页 63: [661] 带格式的	User	2018/6/30 17:02:00

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页 63: [662] 带格式的	User	2018/6/30 17:02:00

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页 63: [662] 带格式的	User	2018/6/30 17:02:00

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页 63: [663] 带格式的	User	2018/6/30 17:02:00

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页 63：[663] 带格式的	User	2018/6/30 17:02:00

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页 63：[664] 带格式的	User	2018/6/30 17:02:00

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页 63：[664] 带格式的	User	2018/6/30 17:02:00

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页 63：[665] 带格式的	User	2018/6/30 17:02:00

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页 63：[665] 带格式的	User	2018/6/30 17:02:00

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页 63：[666] 带格式的	User	2018/6/30 17:02:00

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页 63：[667] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63：[668] 带格式的	User	2018/6/30 17:02:00

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页 63：[668] 带格式的	User	2018/6/30 17:02:00

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页 63：[669] 带格式的	User	2018/6/30 17:02:00

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页 63：[669] 带格式的	User	2018/6/30 17:02:00

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页 63：[670] 带格式的	User	2018/6/30 17:02:00

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页 63：[670] 带格式的	User	2018/6/30 17:02:00

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页 63: [671] 带格式的 User 2018/6/30 17:02:00
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页 63: [677] 带格式的 User 2018/6/30 17:02:00
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页 63: [677] 带格式的	User	2018/6/30 17:02:00

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页 63: [678] 带格式的	User	2018/6/30 17:02:00

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页 63: [678] 带格式的	User	2018/6/30 17:02:00

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页 63: [680] 带格式的	User	2018/6/30 17:02:00

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页 63: [681] 带格式的	User	2018/6/30 17:02:00

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页 63: [682] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [683] 带格式的	User	2018/6/30 17:02:00

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页 63: [683] 带格式的	User	2018/6/30 17:02:00

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页 63: [684] 带格式的	User	2018/6/30 17:02:00

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页 63: [685] 带格式的	User	2018/6/30 17:02:00

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页 63：[685] 带格式的	User	2018/6/30 17:02:00

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页 63：[686] 带格式的	User	2018/6/30 17:02:00

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页 63：[687] 带格式的	User	2018/6/30 17:02:00

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页 63：[690] 带格式的	User	2018/6/30 17:02:00

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页 63：[690] 带格式的	User	2018/6/30 17:02:00

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页 63：[691] 带格式的	User	2018/6/30 17:02:00

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页 63：[691] 带格式的	User	2018/6/30 17:02:00

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页 63: [692] 带格式的	User	2018/6/30 17:02:00

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页 63: [692] 带格式的	User	2018/6/30 17:02:00

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页 63: [693] 带格式的	User	2018/6/30 17:02:00

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页 63: [693] 带格式的	User	2018/6/30 17:02:00

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页 63: [694] 带格式的	User	2018/6/30 17:02:00

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页 63: [694] 带格式的	User	2018/6/30 17:02:00

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页 63: [695] 带格式的	User	2018/6/30 17:02:00

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页 63: [695] 带格式的	User	2018/6/30 17:02:00

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页 63: [696] 带格式的	User	2018/6/30 17:02:00

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页 63: [697] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [698] 带格式的	User	2018/6/30 17:02:00

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页 63: [698] 带格式的	User	2018/6/30 17:02:00

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页 63: [699] 带格式的	User	2018/6/30 17:02:00

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页 63: [699] 带格式的	User	2018/6/30 17:02:00

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页 63: [700] 带格式的	User	2018/6/30 17:02:00

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页 63: [701] 带格式的	User	2018/6/30 17:02:00

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页 63: [701] 带格式的	User	2018/6/30 17:02:00

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页 63: [702] 带格式的	User	2018/6/30 17:02:00

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页 63: [702] 带格式的	User	2018/6/30 17:02:00

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页 63: [703] 带格式的	User	2018/6/30 17:02:00

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页 63: [703] 带格式的	User	2018/6/30 17:02:00

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页 63: [704] 带格式的	User	2018/6/30 17:02:00

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页 63: [704] 带格式的	User	2018/6/30 17:02:00

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页 63: [705] 带格式的	User	2018/6/30 17:02:00

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页 63: [705] 带格式的	User	2018/6/30 17:02:00

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页 63: [706] 带格式的	User	2018/6/30 17:02:00

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页 63：[706] 带格式的	User	2018/6/30 17:02:00

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页 63：[707] 带格式的	User	2018/6/30 17:02:00

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页 63：[707] 带格式的	User	2018/6/30 17:02:00

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页 63：[708] 带格式的	User	2018/6/30 17:02:00

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页 63：[708] 带格式的	User	2018/6/30 17:02:00

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页 63：[709] 带格式的	User	2018/6/30 17:02:00

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页 63：[709] 带格式的	User	2018/6/30 17:02:00

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页 63：[710] 带格式的	User	2018/6/30 17:02:00

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页 63：[710] 带格式的	User	2018/6/30 17:02:00

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页 63：[711] 带格式的	User	2018/6/30 17:02:00

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页 63：[712] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63：[713] 带格式的	User	2018/6/30 17:02:00

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页 63：[713] 带格式的	User	2018/6/30 17:02:00

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页 63: [714] 带格式的	User	2018/6/30 17:02:00

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页 63: [714] 带格式的	User	2018/6/30 17:02:00

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页 63: [715] 带格式的	User	2018/6/30 17:02:00

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页 63: [715] 带格式的	User	2018/6/30 17:02:00

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页 63: [716] 带格式的	User	2018/6/30 17:02:00

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页 63: [716] 带格式的	User	2018/6/30 17:02:00

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页 63: [717] 带格式的	User	2018/6/30 17:02:00

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页 63: [717] 带格式的	User	2018/6/30 17:02:00

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页 63: [718] 带格式的	User	2018/6/30 17:02:00

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页 63: [718] 带格式的	User	2018/6/30 17:02:00

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页 63: [719] 带格式的	User	2018/6/30 17:02:00

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页 63: [719] 带格式的	User	2018/6/30 17:02:00

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页 63: [720] 带格式的	User	2018/6/30 17:02:00

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页 63：[720] 带格式的	User	2018/6/30 17:02:00

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页 63：[721] 带格式的	User	2018/6/30 17:02:00

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页 63：[721] 带格式的	User	2018/6/30 17:02:00

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页 63：[722] 带格式的	User	2018/6/30 17:02:00

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页 63：[723] 带格式的	User	2018/6/30 17:02:00

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页 63：[723] 带格式的	User	2018/6/30 17:02:00

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页 63：[724] 带格式的	User	2018/6/30 17:02:00

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页 63：[724] 带格式的	User	2018/6/30 17:02:00

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页 63：[725] 带格式的	User	2018/6/30 17:02:00

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页 63：[725] 带格式的	User	2018/6/30 17:02:00

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页 63：[726] 带格式的	User	2018/6/30 17:02:00

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页 63：[727] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63：[728] 带格式的	User	2018/6/30 17:02:00

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页 63：[728] 带格式的	User	2018/6/30 17:02:00

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页 63：[729] 带格式的	User	2018/6/30 17:02:00

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页 63：[730] 带格式的	User	2018/6/30 17:02:00

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页 63：[730] 带格式的	User	2018/6/30 17:02:00

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页 63：[731] 带格式的	User	2018/6/30 17:02:00

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页 63：[731] 带格式的	User	2018/6/30 17:02:00

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页 63：[732] 带格式的	User	2018/6/30 17:02:00

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页 63：[732] 带格式的	User	2018/6/30 17:02:00

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页 63：[733] 带格式的	User	2018/6/30 17:02:00

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页 63：[733] 带格式的	User	2018/6/30 17:02:00

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页 63：[734] 带格式的	User	2018/6/30 17:02:00

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页 63：[734] 带格式的	User	2018/6/30 17:02:00

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页 63: [735] 带格式的 User 2018/6/30 17:02:00

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页 63: [735] 带格式的 User 2018/6/30 17:02:00

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页 63: [736] 带格式的 User 2018/6/30 17:02:00

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页 63: [736] 带格式的 User 2018/6/30 17:02:00

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页 63: [737] 带格式的 User 2018/6/30 17:02:00

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页 63: [737] 带格式的 User 2018/6/30 17:02:00

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页 63: [738] 带格式的 User 2018/6/30 17:02:00

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页 63: [738] 带格式的 User 2018/6/30 17:02:00

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页 63: [739] 带格式的 User 2018/6/30 17:02:00

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页 63: [739] 带格式的 User 2018/6/30 17:02:00

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页 63: [740] 带格式的 User 2018/6/30 17:02:00

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页 63: [740] 带格式的 User 2018/6/30 17:02:00

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页 63: [741] 带格式的 User 2018/6/30 17:02:00

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页 63: [742] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [743] 带格式的	User	2018/6/30 17:02:00

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页 63: [743] 带格式的	User	2018/6/30 17:02:00

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页 63: [744] 带格式的	User	2018/6/30 17:02:00

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页 63: [744] 带格式的	User	2018/6/30 17:02:00

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页 63: [745] 带格式的	User	2018/6/30 17:02:00

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页 63: [745] 带格式的	User	2018/6/30 17:02:00

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页 63: [746] 带格式的	User	2018/6/30 17:02:00

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页 63: [746] 带格式的	User	2018/6/30 17:02:00

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页 63: [747] 带格式的	User	2018/6/30 17:02:00

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页 63: [747] 带格式的	User	2018/6/30 17:02:00

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页 63: [748] 带格式的	User	2018/6/30 17:02:00

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页 63: [748] 带格式的	User	2018/6/30 17:02:00

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页 63: [749] 带格式的	User	2018/6/30 17:02:00

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页 63: [749] 带格式的	User	2018/6/30 17:02:00

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页 63: [750] 带格式的	User	2018/6/30 17:02:00

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页 63: [750] 带格式的	User	2018/6/30 17:02:00

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页 63: [751] 带格式的	User	2018/6/30 17:02:00

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页 63: [751] 带格式的	User	2018/6/30 17:02:00

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页 63: [752] 带格式的	User	2018/6/30 17:02:00

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页 63: [752] 带格式的	User	2018/6/30 17:02:00

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页 63: [753] 带格式的	User	2018/6/30 17:02:00

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页 63: [753] 带格式的	User	2018/6/30 17:02:00

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页 63: [754] 带格式的	User	2018/6/30 17:02:00

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页 63: [754] 带格式的	User	2018/6/30 17:02:00

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页 63: [755] 带格式的	User	2018/6/30 17:02:00

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页 63: [755] 带格式的	User	2018/6/30 17:02:00

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页 63: [756] 带格式的	User	2018/6/30 17:02:00

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页 63: [757] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [758] 带格式的	User	2018/6/30 17:02:00

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页 63: [758] 带格式的	User	2018/6/30 17:02:00

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页 63: [759] 带格式的	User	2018/6/30 17:02:00

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页 63: [759] 带格式的	User	2018/6/30 17:02:00

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页 63: [760] 带格式的	User	2018/6/30 17:02:00

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页 63: [760] 带格式的	User	2018/6/30 17:02:00

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页 63: [761] 带格式的	User	2018/6/30 17:02:00

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页 63: [761] 带格式的	User	2018/6/30 17:02:00

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页 63: [762] 带格式的	User	2018/6/30 17:02:00

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页 63: [762] 带格式的	User	2018/6/30 17:02:00

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页 63: [763] 带格式的	User	2018/6/30 17:02:00

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页 63: [763] 带格式的	User	2018/6/30 17:02:00

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页 63: [764] 带格式的	User	2018/6/30 17:02:00

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页 63: [764] 带格式的	User	2018/6/30 17:02:00

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页 63: [765] 带格式的	User	2018/6/30 17:02:00

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页 63: [765] 带格式的	User	2018/6/30 17:02:00

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页 63: [766] 带格式的	User	2018/6/30 17:02:00

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页 63: [766] 带格式的	User	2018/6/30 17:02:00

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页 63: [767] 带格式的	User	2018/6/30 17:02:00

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页 63: [767] 带格式的	User	2018/6/30 17:02:00

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页 63: [768] 带格式的	User	2018/6/30 17:02:00

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页 63: [768] 带格式的	User	2018/6/30 17:02:00

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页 63: [769] 带格式的	User	2018/6/30 17:02:00

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页 63: [769] 带格式的	User	2018/6/30 17:02:00

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页 63: [770] 带格式的	User	2018/6/30 17:02:00

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页 63：[770] 带格式的	User	2018/6/30 17:02:00

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页 63：[771] 带格式的	User	2018/6/30 17:02:00

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页 63：[772] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63：[773] 带格式的	User	2018/6/30 17:02:00

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页 63：[773] 带格式的	User	2018/6/30 17:02:00

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页 63：[774] 带格式的	User	2018/6/30 17:02:00

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页 63：[774] 带格式的	User	2018/6/30 17:02:00

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页 63：[775] 带格式的	User	2018/6/30 17:02:00

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页 63：[775] 带格式的	User	2018/6/30 17:02:00

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页 63：[776] 带格式的	User	2018/6/30 17:02:00

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页 63：[776] 带格式的	User	2018/6/30 17:02:00

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页 63：[777] 带格式的	User	2018/6/30 17:02:00

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页 63：[777] 带格式的	User	2018/6/30 17:02:00

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页 63: [778] 带格式的 User 2018/6/30 17:02:00

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页 63: [778] 带格式的 User 2018/6/30 17:02:00

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页 63: [779] 带格式的 User 2018/6/30 17:02:00

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页 63: [781] 带格式的 User 2018/6/30 17:02:00

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页 63: [781] 带格式的 User 2018/6/30 17:02:00

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页 63: [782] 带格式的 User 2018/6/30 17:02:00

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页 63: [782] 带格式的 User 2018/6/30 17:02:00

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页 63: [783] 带格式的 User 2018/6/30 17:02:00

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页 63: [783] 带格式的 User 2018/6/30 17:02:00

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页 63: [784] 带格式的 User 2018/6/30 17:02:00

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页 63: [784] 带格式的	User	2018/6/30 17:02:00

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页 63: [785] 带格式的	User	2018/6/30 17:02:00

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页 63: [785] 带格式的	User	2018/6/30 17:02:00

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页 63: [786] 带格式的	User	2018/6/30 17:02:00

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页 63: [787] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 63: [788] 带格式的	User	2018/6/30 17:02:00

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页 63: [788] 带格式的	User	2018/6/30 17:02:00

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页 63: [789] 带格式的	User	2018/6/30 17:02:00

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页 63: [789] 带格式的	User	2018/6/30 17:02:00

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页 63: [790] 带格式的	User	2018/6/30 17:02:00

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页 63: [790] 带格式的	User	2018/6/30 17:02:00

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页 63: [791] 带格式的	User	2018/6/30 17:02:00

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页 63: [791] 带格式的	User	2018/6/30 17:02:00

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页 63: [792] 带格式的	User	2018/6/30 17:02:00

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页 63：[792] 带格式的	User	2018/6/30 17:02:00

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页 63：[793] 带格式的	User	2018/6/30 17:02:00

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页 63：[793] 带格式的	User	2018/6/30 17:02:00

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页 63：[794] 带格式的	User	2018/6/30 17:02:00

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页 63：[794] 带格式的	User	2018/6/30 17:02:00

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页 63：[795] 带格式的	User	2018/6/30 17:02:00

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页 63：[795] 带格式的	User	2018/6/30 17:02:00

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页 63：[796] 带格式的	User	2018/6/30 17:02:00

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页 63：[796] 带格式的	User	2018/6/30 17:02:00

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页 63：[797] 带格式的	User	2018/6/30 17:02:00

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页 63：[797] 带格式的	User	2018/6/30 17:02:00

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页 63：[798] 带格式的	User	2018/6/30 17:02:00

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页 63：[798] 带格式的	User	2018/6/30 17:02:00

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页 63: [799] 带格式的	User	2018/6/30 17:02:00

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页 63: [799] 带格式的	User	2018/6/30 17:02:00

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页 63: [800] 带格式的	User	2018/6/30 17:02:00

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页 63: [800] 带格式的	User	2018/6/30 17:02:00

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页 64: [801] 带格式的	User	2018/6/30 17:02:00

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页 64: [802] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [803] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [804] 带格式的	User	2018/6/30 17:02:00

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页 64: [804] 带格式的	User	2018/6/30 17:02:00

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页 64: [805] 带格式的	User	2018/6/30 17:02:00

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页 64: [805] 带格式的	User	2018/6/30 17:02:00

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页 64: [806] 带格式的	User	2018/6/30 17:02:00

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页 64: [806] 带格式的	User	2018/6/30 17:02:00

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页 64: [807] 带格式的	User	2018/6/30 17:02:00

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页 64: [807] 带格式的	User	2018/6/30 17:02:00

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页 64: [808] 带格式的	User	2018/6/30 17:02:00

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页 64: [808] 带格式的	User	2018/6/30 17:02:00

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页 64: [809] 带格式的	User	2018/6/30 17:02:00

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页 64: [809] 带格式的	User	2018/6/30 17:02:00

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页 64: [810] 带格式的	User	2018/6/30 17:02:00

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页 64: [810] 带格式的	User	2018/6/30 17:02:00

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页 64: [811] 带格式的	User	2018/6/30 17:02:00

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页 64: [811] 带格式的	User	2018/6/30 17:02:00

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页 64: [812] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 64: [813] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [814] 带格式的	User	2018/6/30 17:02:00

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页 64: [815] 带格式的	User	2018/6/30 17:02:00

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页 64：[816] 带格式的	User	2018/6/30 17:02:00

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页 64：[817] 带格式的	User	2018/6/30 17:02:00

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页 64：[818] 带格式的	User	2018/6/30 17:02:00

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页 64：[819] 带格式的	User	2018/6/30 17:02:00

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页 64：[820] 带格式的	User	2018/6/30 17:02:00

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页 64：[821] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64：[822] 带格式的	User	2018/6/30 17:02:00

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页 64：[823] 带格式的	User	2018/6/30 17:02:00

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页 64：[824] 带格式的	User	2018/6/30 17:02:00

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页 64：[825] 带格式的	User	2018/6/30 17:02:00

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页 64：[826] 带格式的	User	2018/6/30 17:02:00

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页 64：[827] 带格式的	User	2018/6/30 17:02:00

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页 64：[828] 带格式的	User	2018/6/30 17:02:00

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页 64: [829] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [830] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [831] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [832] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [833] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [834] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [835] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [836] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [837] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [838] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [839] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [840] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [841] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [842] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [843] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [844] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [845] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [846] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [847] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [848] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [849] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [850] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [851] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [852] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [853] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [854] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [855] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[856] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[857] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[858] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[859] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[860] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[861] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64：[862] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[863] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[864] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[865] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[866] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[867] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[868] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [869] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [870] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [871] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [872] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [873] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [874] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [875] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [876] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [877] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [878] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [879] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [880] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [881] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [882] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [883] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [884] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [885] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [886] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [887] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [888] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [889] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [890] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [891] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [892] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [893] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [894] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [895] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[896] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[897] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[898] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[899] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[900] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[901] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64：[902] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[903] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[904] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[905] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[906] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[907] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[908] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [909] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [910] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [911] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [912] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [913] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [914] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [915] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [916] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [917] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [918] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [919] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [920] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [921] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [922] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [923] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [924] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [925] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [926] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [927] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [928] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [929] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [930] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [931] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [932] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [933] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [934] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [935] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [936] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [937] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [938] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [939] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [940] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [941] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [942] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [943] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [944] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [945] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [946] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [947] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [948] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [949] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [950] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [951] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [952] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [953] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [954] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [955] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [956] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [957] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [958] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [959] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [960] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [961] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [962] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 64: [963] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 64: [964] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 64: [965] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [966] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 64: [967] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 64: [968] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 64: [969] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 64: [970] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 64: [971] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 64: [972] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 64: [973] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [974] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色: 自动设置

页 64: [975] 带格式的 User 2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[976] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[977] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[978] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[979] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[980] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[981] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64：[982] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[983] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[984] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[985] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[986] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[987] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64：[988] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [989] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [990] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [991] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [992] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [993] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [994] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [995] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [996] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [997] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [998] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [999] 带格式的	User	2018/6/30 17:02:00

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页 64: [1000] 带格式的	User	2018/6/30 17:02:00

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页 64: [1001] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 64: [1002] 带格式的 User 2018/6/30 17:02:00

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页 64: [1003] 带格式的 User 2018/6/30 17:02:00

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页 64: [1004] 带格式的 User 2018/6/30 17:02:00

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页 64: [1005] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 64: [1006] 带格式的 User 2018/6/30 17:02:00

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页 64: [1007] 带格式的 User 2018/6/30 17:02:00

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页 64: [1008] 带格式的 User 2018/6/30 17:02:00

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页 64: [1009] 带格式的 User 2018/6/30 17:02:00

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页 64: [1010] 带格式的 User 2018/6/30 17:02:00

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页 64: [1011] 带格式的 User 2018/6/30 17:02:00

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页 65: [1012] 带格式的 User 2018/6/30 17:02:00

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页 65: [1013] 带格式的 User 2018/6/30 17:02:00

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页 65: [1014] 带格式的 User 2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 65: [1015] 带格式的 User 2018/6/30 17:02:00

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页 65：[1015] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 65：[1016] 带格式的	User	2018/6/30 17:02:00

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页 65：[1016] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 65：[1017] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 65：[1017] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 65：[1018] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 65：[1018] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 65：[1019] 带格式的	User	2018/6/30 17:02:00

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页 65：[1019] 带格式的	User	2018/6/30 17:02:00

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页 65：[1020] 带格式的	User	2018/6/30 17:02:00

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页 65：[1020] 带格式的	User	2018/6/30 17:02:00

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页 65：[1021] 带格式的	User	2018/6/30 17:02:00

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页 65：[1021] 带格式的	User	2018/6/30 17:02:00

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页 65: [1022] 带格式的	User	2018/6/30 17:02:00

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页 65: [1022] 带格式的	User	2018/6/30 17:02:00

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页 65: [1023] 带格式的	User	2018/6/30 17:02:00

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页 65: [1023] 带格式的	User	2018/6/30 17:02:00

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页 65: [1024] 带格式的	User	2018/6/30 17:02:00

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页 65: [1024] 带格式的	User	2018/6/30 17:02:00

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页 65: [1025] 带格式的	User	2018/6/30 17:02:00

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页 65: [1025] 带格式的	User	2018/6/30 17:02:00

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页 65: [1026] 带格式的	User	2018/6/30 17:02:00

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页 65: [1026] 带格式的	User	2018/6/30 17:02:00

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页 65: [1027] 带格式的	User	2018/6/30 17:02:00

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页 65: [1027] 带格式的	User	2018/6/30 17:02:00

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页 65: [1028] 带格式的	User	2018/6/30 17:02:00

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页 65: [1028] 带格式的	User	2018/6/30 17:02:00

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页 65: [1029] 带格式的	User	2018/6/30 17:02:00

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页 65: [1029] 带格式的	User	2018/6/30 17:02:00

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页 65: [1030] 带格式的	User	2018/6/30 17:02:00

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页 65: [1030] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 65: [1031] 带格式的	User	2018/6/30 17:02:00

无下划线，字体颜色：自动设置

页 65: [1032] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 65: [1033] 带格式的	User	2018/6/30 17:02:00

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页 65: [1033] 带格式的	User	2018/6/30 17:02:00

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页 65: [1034] 带格式的	User	2018/6/30 17:02:00

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页 65: [1034] 带格式的	User	2018/6/30 17:02:00

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页 65: [1035] 带格式的	User	2018/6/30 17:02:00

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页 65: [1035] 带格式的	User	2018/6/30 17:02:00

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页 65: [1036] 带格式的	User	2018/6/30 17:02:00

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页 65：[1036] 带格式的	User	2018/6/30 17:02:00

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页 65：[1037] 带格式的	User	2018/6/30 17:02:00

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页 65：[1037] 带格式的	User	2018/6/30 17:02:00

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页 65：[1038] 带格式的	User	2018/6/30 17:02:00

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页 65：[1038] 带格式的	User	2018/6/30 17:02:00

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页 65：[1039] 带格式的	User	2018/6/30 17:02:00

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页 65：[1039] 带格式的	User	2018/6/30 17:02:00

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页 65：[1040] 带格式的	User	2018/6/30 17:02:00

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页 65：[1040] 带格式的	User	2018/6/30 17:02:00

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页 65：[1041] 带格式的	User	2018/6/30 17:02:00

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页 65：[1042] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 65：[1043] 带格式的	User	2018/6/30 17:02:00

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页 65：[1043] 带格式的	User	2018/6/30 17:02:00

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页 65: [1044] 带格式的　　User　　2018/6/30 17:02:00

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页 65: [1044] 带格式的　　User　　2018/6/30 17:02:00

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页 65: [1045] 带格式的　　User　　2018/6/30 17:02:00

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页 65: [1045] 带格式的　　User　　2018/6/30 17:02:00

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页 65: [1046] 带格式的　　User　　2018/6/30 17:02:00

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页 65: [1046] 带格式的　　User　　2018/6/30 17:02:00

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页 65: [1047] 带格式的　　User　　2018/6/30 17:02:00

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页 65: [1047] 带格式的　　User　　2018/6/30 17:02:00

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页 65: [1048] 带格式的　　User　　2018/6/30 17:02:00

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页 65: [1048] 带格式的　　User　　2018/6/30 17:02:00

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页 65: [1049] 带格式的　　User　　2018/6/30 17:02:00

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页 65: [1049] 带格式的　　User　　2018/6/30 17:02:00

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页 65: [1050] 带格式的　　User　　2018/6/30 17:02:00

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页 65: [1050] 带格式的	User	2018/6/30 17:02:00

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页 65: [1051] 带格式的	User	2018/6/30 17:02:00

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页 65: [1052] 带格式的	User	2018/6/30 17:02:00

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页 65: [1053] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 65: [1054] 带格式的	User	2018/6/30 17:02:00

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页 65: [1054] 带格式的	User	2018/6/30 17:02:00

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页 65: [1055] 带格式的	User	2018/6/30 17:02:00

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页 65: [1055] 带格式的	User	2018/6/30 17:02:00

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页 65: [1056] 带格式的	User	2018/6/30 17:02:00

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页 65: [1057] 带格式的	User	2018/6/30 17:15:00

定义网格后不调整右缩进，不对齐到网格

页 65: [1058] 带格式的	User	2018/6/30 17:02:00

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页 65: [1058] 带格式的	User	2018/6/30 17:02:00

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页 65: [1059] 带格式的	User	2018/6/30 17:02:00

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页 65: [1059] 带格式的	User	2018/6/30 17:02:00

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页 65：[1060] 带格式的	User	2018/6/30 17:02:00

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页 65：[1060] 带格式的	User	2018/6/30 17:02:00

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页 65：[1061] 带格式的	User	2018/6/30 17:02:00

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页 65：[1061] 带格式的	User	2018/6/30 17:02:00

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页 65：[1062] 带格式的	User	2018/6/30 17:02:00

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页 65：[1062] 带格式的	User	2018/6/30 17:02:00

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页 65：[1063] 带格式的	User	2018/6/30 17:02:00

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页 65：[1063] 带格式的	User	2018/6/30 17:02:00

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页 65：[1064] 带格式的	User	2018/6/30 17:02:00

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页 65：[1064] 带格式的	User	2018/6/30 17:02:00

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页 65：[1065] 带格式的	User	2018/6/30 17:02:00

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页 65：[1065] 带格式的	User	2018/6/30 17:02:00

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页 65：[1066] 带格式的	User	2018/6/30 17:02:00

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页 65: [1066] 带格式的	User	2018/6/30 17:02:00

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页 65: [1067] 带格式的	User	2018/6/30 17:02:00

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页 65: [1067] 带格式的	User	2018/6/30 17:02:00

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页 65: [1068] 带格式的	User	2018/6/30 17:02:00

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页 65: [1068] 带格式的	User	2018/6/30 17:02:00

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页 65: [1069] 带格式的	User	2018/6/30 17:02:00

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页 65: [1069] 带格式的	User	2018/6/30 17:02:00

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页 65: [1070] 带格式的	User	2018/6/30 17:02:00

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页 65: [1070] 带格式的	User	2018/6/30 17:02:00

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页 65: [1071] 带格式的	User	2018/6/30 17:02:00

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页 65: [1071] 带格式的	User	2018/6/30 17:02:00

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页 65: [1072] 带格式的	User	2018/6/30 17:02:00

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页 65: [1072] 带格式的	User	2018/6/30 17:02:00

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页 65: [1073] 带格式的	User	2018/6/30 17:02:00

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页 65: [1073] 带格式的	User	2018/6/30 17:02:00

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页 65: [1074] 带格式的	User	2018/6/30 17:02:00

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页 65: [1074] 带格式的	User	2018/6/30 17:02:00

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页 65: [1075] 带格式的	User	2018/6/30 17:02:00

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页 65: [1075] 带格式的	User	2018/6/30 17:02:00

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页 65: [1076] 带格式的	User	2018/6/30 17:02:00

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页 65: [1076] 带格式的	User	2018/6/30 17:02:00

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页 65: [1077] 带格式的	User	2018/6/30 17:02:00

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页 65: [1077] 带格式的	User	2018/6/30 17:02:00

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页 65: [1078] 带格式的	User	2018/6/30 17:02:00

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页 65: [1078] 带格式的	User	2018/6/30 17:02:00

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页 65: [1079] 带格式的	User	2018/6/30 17:02:00

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页 65: [1079] 带格式的	User	2018/6/30 17:02:00

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页 65：[1080] 带格式的	User	2018/6/30 17:02:00

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页 65：[1080] 带格式的	User	2018/6/30 17:02:00

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页 65：[1081] 带格式的	User	2018/6/30 17:02:00

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页 65：[1081] 带格式的	User	2018/6/30 17:02:00

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页 65：[1082] 带格式的	User	2018/6/30 17:02:00

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页 65：[1082] 带格式的	User	2018/6/30 17:02:00

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页 65：[1083] 带格式的	User	2018/6/30 17:02:00

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页 65：[1083] 带格式的	User	2018/6/30 17:02:00

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页 65：[1084] 带格式的	User	2018/6/30 17:02:00

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页 65：[1084] 带格式的	User	2018/6/30 17:02:00

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页 65：[1085] 带格式的	User	2018/6/30 17:02:00

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页 65：[1085] 带格式的	User	2018/6/30 17:02:00

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页 65：[1086] 带格式的	User	2018/6/30 17:02:00

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页 65: [1086] 带格式的	User	2018/6/30 17:02:00

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页 65: [1087] 带格式的	User	2018/6/30 17:02:00

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页 65: [1087] 带格式的	User	2018/6/30 17:02:00

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页 65: [1088] 带格式的	User	2018/6/30 17:02:00

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页 65: [1088] 带格式的	User	2018/6/30 17:02:00

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页 65: [1089] 带格式的	User	2018/6/30 17:02:00

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页 65: [1089] 带格式的	User	2018/6/30 17:02:00

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