Dear Walter D'Alessandro

Thank you for your highly professional and constructive comments and suggestions, which are of great value to us in improving the quality of our manuscript. After carefully reading your comments, we have made a reply to your comments point-by-point under the discussion of all manuscript authors. The main replies are as follows:

Major revisions include:

1. Correction of sample collection time: We apologize for marking the wrong sampling time in Table 1 (marked time, March 2024, **the actual sampling time, March 2023**). The wrong timing brings huge ambiguity to the manuscript. After correcting the sampling time, the main line logic of the article is as follows:

These evidences constitute a complete chain of causality from the source (evaporite) to the process (water-rock reaction balance disrupted by the earthquake) to the response (abnormal groundwater ion concentration).

2. Use "**groundwater**" instead of "**geothermal water**" to define the sample in this study. We collected 16 groundwater samples from SF and EAFZ within a month of the earthquake. The principle of sample collection is to collect if we can. Because the overall temperature is low, we think it is more reasonable to use "groundwater" instead of "geothermal water".

3. We have given **a complete explanation of the pre-earthquake hydrochemical data** in the manuscript.

4. We supplement the analysis method and data quality control description

5. We rearranged the logic of the article to make the expression clearer

6. We have made a full explanation of some misunderstandings

7. We explain the possible “overestimation of the heat storage temperature” and analyze that the heat storage temperature estimate has little effect on the conclusion of our core conclusions.

8. We plan to conduct additional experiments on the samples, including **radioactive Sr isotopes** and **S isotopes**, to support our argument with more evidence.

Since there are diagrams in the complete reply draft, we put the complete reply draft in the form of an attachment on the website system. If you have any questions or suggestions about the manuscript, we sincerely invite you to keep discussing with us. Thank you for constructive review comments.

Thank you and best regards.

Point-by-point response to comments:

Note: *Italic blue* is the comment. Black is the reply, and **important sentences are bolded and underlined**.

The manuscript "Gypsum as a potential tracer of earthquake: a case study of the Mw7.8 earthquake in the East Anatolian Fault Zone, southeastern Turkey" by Luo et al. presents the results of sampling campaign of groundwaters in the area of the two strong earthquakes that hit heavily Turkey in February 2023. Only the analytical results (major ions, trace elements and water isotopes) of samples collected about one year after the quakes are considered, which is a strong limitation of this study. I feel that this study cannot be published in this form.

Reply: Thanks. First of all, let's correct an error in Table 1 in manuscript. Our sampling time is **March 2023**, which is **one month** after the earthquake, not **one year**. We apologize for the sampling time error in manuscript (Table 1) and thank you for your careful correction. Therefore, combined with the **groundwater characteristics within one month after the earthquake**, **groundwater data before the earthquake** (obtained from literature research), and **macro anomalies before the earthquake** (whitening and turbidity), we believe that the evidence is sufficient to prove our view that the earthquake has broken the water-rock balance between gypsum and groundwater, and gypsum has the potential to act as an earthquake tracer.

In light of your suggestion, however, we are also considering the need to find **more evidence** to support our conclusion. Therefore, we are conducting **Radioactive Sr isotope** and **S isotope** analysis on our samples. 1) Radioactive Sr isotope is a good source indicator.

The radioactive Sr isotope composition of shallow gypsum dissolution and deep fluid is obviously different, so the radioactive Sr isotope may well restrict the source area of groundwater. 2) S isotope is the main constituent element of gypsum, and the S isotope composition of igneous rock ($\delta^{34}S$ = -5~10‰) is lower than that of evaporite ($\delta^{34}S$ > 10‰), so S isotope can better distinguish the S of evaporite and igneous rock.

Major comments:

Lines 33-36 (abstract): This is one of the most critical claims made by the authors. "Specially, significant gypsum dissolution was observed at HS05, HS09 and HS14 before and after the earthquake, suggesting that the earthquake broke the balance of water-rock reaction and promoted the dissolution of gypsum." In the paper only the results of the analyses of the samples taken one year after the earthquakes are discussed. How should it be possible to evidence variations "before and after the earthquake" if only one sample was taken?

Reply: Thanks. Sorry again for the error in sampling time in manuscript (Table 1). The exact date of our sample is March 2023. Therefore, our data can be representative of groundwater characteristics after the earthquake. Pre-earthquake data mainly come from *Yuce, G., Italiano, F., D'Alessandro, W., Yalcin, T. H., Yasin, D. U., Gulbay, A. H., Ozyurt, N. N., Rojay, B., Karabacak, V., Bellomo, S., Brusca, L., Yang, T., Fu, C. C., Lai, C. W., Ozacar, A., and Walia, V.: Origin and interactions of fluids circulating over the Amik Basin (Hatay, Turkey) and relationships with the hydrologic, geologic and tectonic settings, Chemical Geology, 388, 23-39, 2014.* After carefully checking the GPS coordinates given in the literature, we can confirm that HS14 is **kirikhan well** (A15), HS15 is **Tahtakopru**

(A12/13), and HS16 is **Kuzey Tepe** (A40) (Table 1). Compared with the literature data, the concentration of SO_4^{2-} and Ca^{2+} in sample HS14 increased.

Table 1 Sample points and data for this study and literature

This study					Yuce et al., 2014					
Long(°)	Lat(°)	No.	SO_4^{2-} (mg/L)	Ca^{2+}(mg/L)	Long(°)	Lat(°)	No.	SO_4^{2-} (mg/L)	Ca^{2+}(mg/L)	Site name
36.3738	36.5036	HS14	316.61	151.43	36.3741	36.5034	A15	101	87.1	kirikhan well
36.1637	36.3833	HS15	1.21	55.55	36.1636	36.3835	A12/13	0.2	44.7	Tahtakopru
36.1472	36.2737	HS16	75.9	73.35	36.1471	36.2738	A40	361	41.1	Kuzey Tepe

Pre-seismic mean values of SO_4^{2-} and Ca^{2+} are from Baba et al., 2019. But you mentioned that our average is inconsistent with the data in the Baba et al., 2019. We apologize for any confusion caused by not clearly stating how the data was referenced. Our average does refer to Baba et al., 2019, but not entirely. **We only cite data from sample points close to EAFZ**. The reason for this: Baba et al 2019 evaluated geothermal resources throughout southeastern Turkey. If we average all the data, this is obviously not reasonable. Moreover, **it can also be seen from Baba et al., 2019 that there is a big difference between geothermal resources near EAFZ and those far away from EAFZ (Fig. 1).** Geothermal resources near EAFZ are mainly medium and low temperature. Therefore, when considering the EAFZ pre-earthquake SO_4^{2-} and Ca^{2+} concentrations, **we only chose the average values of 1, 2, 3, 4, 7, 9, 26 and 27 in the paper as the pre-earthquake concentrations (Fig. 2 and Table 2)**.

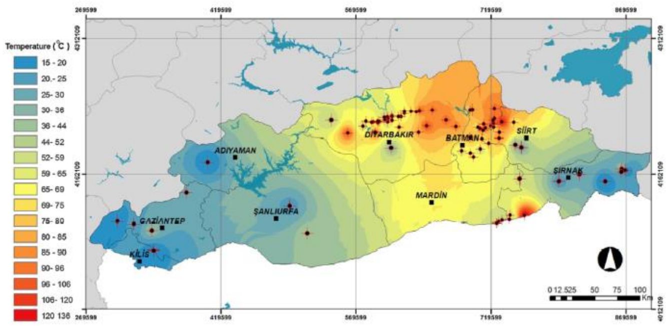

Fig. 1: Temperature distribution map of geothermal resources in southeast Turkey. Screenshot from *Baba, A., Şaroğlu, F., Akkuş, I., Özel, N., Yeşilnacar, M. İ., Nalbantçılar, M. T., Demir, M. M., Gökçen, G., Arslan, Ş., Dursun, N., Uzelli, T., and Yazdani, H.: Geological and hydrogeochemical properties of geothermal systems in the southeastern region of Turkey, Geothermics, 78, 255-271, 2019.*

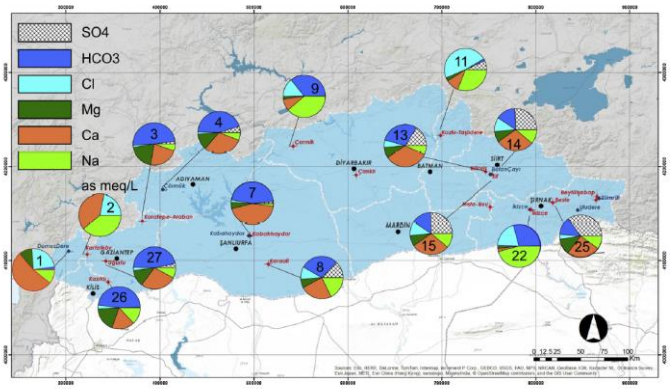

Fig. 2: Baba et al., 2019 sampling point distribution map. Screenshot from *Baba, A., Şaroğlu, F., Akkuş, I., Özel, N., Yeşilnacar, M. İ., Nalbantçılar, M. T., Demir, M. M., Gökçen, G., Arslan, Ş., Dursun, N., Uzelli, T., and Yazdani, H.: Geological and hydrogeochemical properties of geothermal systems in the southeastern region of Turkey, Geothermics, 78, 255-271, 2019.*

Table 2 Ion concentration before earthquake.

No.	Ca^{2+}(mg/L)	SO_4^{2-}(mg/L)
1	14.92	0.01
2	66.92	0.01
3	45.56	9.86

4	63.84	24.79
7	116.03	10.22
9	38.65	3.34
26	39.85	1.83
27	56.03	16.41
Average	55.23	8.31

Data from: *Baba, A., Şaroğlu, F., Akkuş, I., Özel, N., Yeşilnacar, M. İ., Nalbantçılar, M. T., Demir, M. M., Gökçen, G., Arslan, Ş., Dursun, N., Uzelli, T., and Yazdani, H.: Geological and hydrogeochemical properties of geothermal systems in the southeastern region of Turkey, Geothermics, 78, 255-271, 2019.*

Line 124: The authors should explain on which basis the 16 sampling sites have been chosen.

Reply: Thanks. Samples were collected from north to south along the EAFZ. All the places with springs were sampled. Considering the safety considerations after the earthquake, there may be some missing spring points compared with previous studies. But our sampling was done in conjunction with the post-earthquake research in Turkey. In addition to water sampling, Also analyzed the surface rupture and earthquake risk assessment (*Liang, P., Xu, Y., Zhou, X., Li, Y., Tian, Q., Zhang, H., Ren, Z., Yu, J., Li, C., Gong, Z., Wang, S., Dou, A., Ma, Z., and Li, J.: Coseismic surface ruptures of MW7.8 and MW7.5 earthquakes occurred on February 6, 2023, and seismic hazard assessment of the East Anatolian Fault Zone, Southeastern Turkiye, Science China Earth Sciences, doi: 10.1007/s11430-024-1457-7, 2024.*). Therefore, we can guarantee the representativeness and reliability of the samples in this study.

We added the description of the sampling point: "**HS01-HS04 was collected from west to east along SF. HS07-HS16 was collected from north to south along EAFZ (Fig. 1)**"

Line 124: the authors claim to have sampled hot springs but with the exception of the peculiar hyperalkaline spring HS15, which derive its increased temperature from deep circulation, no other sample could be called "hot". Furthermore, I would not define a well with water at 24 °C as geothermal well. Actually, in the results (line 144) the authors affirm that temperatures of the sampled waters are low.

Reply: Thanks. Indeed, the temperature of all samples in this study is low, indicating that EAFZ is a medium-low temperature hydrothermal system, which is also consistent with the research results of Baba et al., 2019. However, as you said, the temperature of the sample is really low. We also feel that the term "**geothermal water**" is not rigorous enough to describe our samples. Therefore, we considered using the more appropriate term "**groundwater**" to describe our samples. But in fact, whether groundwater or geothermal water, the core point of our manuscript is not contradictory. The use of groundwater chemistry and isotopes to study the water-rock balance before and after earthquakes is considered to be a very effective means (*e.g., Skelton, A., Andren, M., Kristmannsdottir, H., Stockmann, G., Morth, C.-M., Sveinbjoernsdottir, A., Jonsson, S., Sturkell, E., Gudorunardottir, H. R., Hjartarson, H., Siegmund, H., and Kockum, I.: Changes in groundwater chemistry before two consecutive earthquakes in Iceland, Nature Geoscience, 7, 752-756, 2014. and Tsunogai, U. and Wakita, H.: Precursory chemical changes in ground water: kobe earthquake, Japan, Science (New York, N.Y.), 269, 61-63, 1995.*). However, considering the influence of groundwater on many factors (e.g., temperature, pressure, climatic conditions, seasonal changes etc.), we have explained in the abstract and conclusion of the manuscript that gypsum needs to be considered more carefully.

The methodological section has many limitations:

Lines 130-131: it is unclear if filtration has been made in the field and before acidifying the aliquot for cation analysis. Please specify

Reply: Thanks. Yes, **we confirmed filtering before testing**. The relevant description can be found in lines 130-131 of the original manuscript. We have extensive experience in groundwater and gas extraction. We can guarantee the reliability of sample collection methods and data.

Line 131: MAT 253 is a model, please specify the used technique

Reply: Thanks. We have added specific analytical method: "δD and $\delta^{18}O$ were determined by **zinc reducing tube sealing method** combined with MAT 253 (relative to Vienna Standard Mean Ocean Water (V - SMOW)). Precisions on the measured $\delta^{18}O$ and δD value was ±0.2% (2SD) and ±1% (2SD) respectively (Wang et al., 2010)."

Line 133: please specify the analysed species and the relative reproducibility and detection limits?

Reply: Thank you for pointing out the problem of the manuscript. We have added the reliability description of hydrochemistry and isotope analysis to the chapter of **Analytical methods**, the details are as follows:

16 samples of water were collected in EAFZ, including hot springs, geothermal wells and river water. HS01-HS04 was collected from west to east along SF. HS07-HS16 was collected from north to south along EAFZ (Fig. 1). Detailed sample collection and testing methods can be found at Luo et al. (2023). In short, the water sample was taken with a 50 mL clean polyethylene bottle and the temperature and pH of the water were measured and

recorded. Two samples are collected at each sampling site, one is added with ultrapure HNO_3 to analyse the cation content, and the other is used to analyse the anion content and isotopic composition. **All samples need to be pre-treated with a 0.45 μm filter membrane to remove impurities before being tested.** δD and $\delta^{18}O$ were determined by **zinc reducing tube sealing method** combined with MAT 253 (relative to Vienna Standard Mean Ocean Water (V - SMOW)). **Precisions on the measured $\delta^{18}O$ and δD value was ±0.2% (2SD) and ±1% (2SD) respectively (Wang et al., 2010)**. The cation **(Li^+, Na^+, K^+, $Ca^{2+}$and Mg^{2+})** and anion **(F^-, Cl^-, NO_3^- and SO_4^{2-})** were analysed by Dionex ICS-900 ion chromatograph (Thermo Fisher Scientific Inc.) **at the Earthquake Forecasting Key Laboratory of China Earthquake Administration, with the reproducibility within ±2% and detection limits 0.01 mg/L (Chen et al., 2015)**. HCO_3^- and CO_3^{2-} was determined by acid-base titration with a ZDJ-100 potentiometric titrator (reproducibility within ±2%). SiO_2 were analysed by inductively coupled plasma emission spectrometer Optima-5300 DV (PerkinElmer Inc.) (Li et al. 2021). Trace elements were analysed by Element XR ICP-MS at the Test Center of the Research Institute of Uranium Geology. Multielement standard solutions (IV-ICPMS 71A, IV-ICP-MS 71B and IV-ICP-MS 71D, iNORGANIC VENTURES) used for quality control. **The analytical error margin of major cations and trace elements were less than 10%)**.

Line 136: please specify the analysed trace elements and the relative reproducibility and detection limits?

Reply: Thanks. The specific types of trace elements are shown in Table 2 (manuscript), the detection limit is 0.001μg/L, and the analysis error accuracy is less than 10%

In the results the authors claim often that some element or ionic species is increased (sometimes adding obviously) but they do not specify with respect to what. Maybe they intend that the concentrations are high.

Reply: Thanks. In the Results section we are an objective description of the results based on the data. The words "increased" and " obviously " were also relative to other sample results. But, in fact, what we mean is, "relatively high," not " increased." We apologize for any confusion caused by the poor description of the results, and we have re-optimized the presentation and added a quantitative description of the increased concentrations. The revised expression is as follows:

The concentration of SO_4^{2-} range from 1.21 mg/L to 316.61 mg/L, and the concentration of SO_4^{2-} in some samples is relatively high (e.g. HS01 (287.74 ml/L), HS03 (103.56 ml/L), HS04 (229.75 ml/L), HS14 (316.61 ml/L)).

In the same section they speak of geothermal water but they do not present any evidence that these are geothermal waters.

Reply: Thank you. We have replaced "**groundwater**" with "**geothermal water**" to make the expression more precise.

The discussion about the geothermal fluids has great limitations.

The authors do not present evidences that the sampled waters are, at least partially, fed by hydrothermal systems. The fact that in the area some geothermal system has been discovered and studied, does not mean that all groundwater samples taken in the area are fed by them. The temperatures of the collected samples are low and, as highlighted by the binary diagram of fig. 3 and the ternary diagram of fig. 4, their compositions do not reflect *high temperature interactions with the rocks. Also the silica geothermometers show low temperatures considering that for such systems equilibrium with chalcedony (or even christobalite or amorphous silica) should be taken into consideration.*

Reply: Thanks. We have already discussed this issue in the previous reply. **Hydrothermal systems** and **groundwater** do not affect our core point. Both geothermal water and groundwater chemical anomalies are considered to be effective means of earthquake early warning. Thanks for your suggestion to us, as mentioned earlier, we have considered using "**groundwater**" instead of "**geothermal water**" to define the samples for this study.

Especially the use of the mixing models has been made in the wrong way. Mixing models can be applied only to water samples that belong to the same system and not to water samples collected tens of km away from each other and for which no connection has been demonstrated.

Reply: Thanks. Although the spatial span of the samples in this study is very large (~270 km) (Fig. 1 and Fig. 6 in manuscript), all of them belong to EAFZ. It is difficult to directly conclude that there is no genetic connection between them.

In fact, both the estimation of heat storage temperature and the mixed model only play an auxiliary supporting role in our core view. **Our main concern is the anomaly of ion concentration caused by earthquake breaking the equilibrium of water-rock reaction**. As for whether deep geothermal fluids are involved? What's the mixing ratio? It's all secondary evidence. Deep fluids may bring SO_4^{2-} (H_2S oxidation), but a little Ca^{2+}. However, the correlation between Ca^{2+} and SO_4^{2-} was observed in EAFZ, and numerical simulations indicate that gypsum dissolution is indeed present (Fig. 7 in manuscript), coupled with the presence of large evaporite deposits in the ancient lacustrine sedimentary basin of Lake Amik. **These evidences constitute a complete chain of causality from the source (evaporite) to the process (water-rock reaction balance disrupted by the earthquake) to the response (abnormal groundwater ion concentration).**

Based on your comments, the geothermal properties of our samples are not strong and may not belong to hydrothermal systems. Therefore, we consider weakening the sections on heat storage, mixing ratio, and cycle depth. Delete this section or put in supplementary material. As for the problem of using mixed models incorrectly. We don't think it can be completely negative. At least these samples are in EAFZ. The overestimation may be possible at 382℃. But combined with the pre-seismic macroscopic anomaly of HS04, the content of SiO_2 (84.64mg/L) and the ion concentration anomalies of Ca^{2+}, SO_4^{2-}, Sr and Ba. We think it is sufficient to support the argument that the gypsum dissolution equilibrium was disturbed by the earthquake. Thank you.

The estimation of temperature for the "deep geothermal fluid" (please define) of 382 °C is absolutely unreliable. The sample was taken, as shown in the second video in the supporting information, from an artesian well (although in table 1 it is classified as spring). I think it is impossible that an artesian well, whose upflow is generally rapid, would have only 15 °C temperature if even only a small part of the water would come from a geothermal system with 382 °C.

Reply: Thanks. Indeed, 382 °C may be overestimated. But as in the previous reply. The heat storage temperature is only secondary evidence for us to determine whether the gypsum was affected by the earthquake. We have considered deleting this part of the discussion or put in supplementary materials. **The estimate of 382℃ is the HS04 sample from the epicenter, and the complex process after the earthquake may be the reason for our excessive estimate**. However, **HS14 shows a lower estimated temperature, with the mixed model estimating only 88 °C (Fig. 5b). We propose that HS14 may be affected by shallow gypsum dissolution, and this lower estimated temperature supports this conjecture**. Therefore, while 382 °C may not be rigorous enough, the estimation of HS14 supports our view.

The discussion about the sulfate anomalies is highly confusing. Many points are unclear or wrong.

Reply: Thanks. We adjusted the description of the manuscript to make the logic clearer.

Why are only samples HS05, HS09 and HS14 considered anomalous? HS01, HS03 and HS04 have also elevated sulfate values.

Reply: Thanks. This is actually a misunderstanding. The reason for the misunderstanding is that we failed to express it clearly in the manuscript, and there are logical problems. We consider optimizing the manuscript to eliminate misunderstandings. thank you!

We pointed out in the **Fig caption in Fig.6** that **only the spatial distribution characteristics of EAFZ samples**, namely HS07-HS16, were considered in Fig.6. The discussion here does not cover SF samples (HS01-HS04). We considered adding a note to the text of the manuscript to make the logic clear.

In fact, as you commented, HS01, HS03, HS04, HS05, HS09, HS14 all have SO_4^{2-} anomalies. However, the subsequent numerical simulation shows that the influencing factors of SO_4^{2-} concentration increase in **HS01, HS03 and HS04 are more complex and**

controlled by a variety of minerals (gypsum, calcite, dolomite, anorthite). However, SO_4^{2-} of HS05, HS09, HS14, especially HS14, is almost only controlled by gypsum (Fig. 7 in manuscript), and the influencing factors are relatively single. Therefore, HS14 is an important support for our main point, and the other points are ancillary.

Why should these high sulfate values be considered anomalous and induced by the earthquake? Sulfate dissolution from evaporite deposits within the aquifers is an ubiquitous process independent from seismic activity.

Reply: Thanks. The reason for your question is that we wrote down the sampling time incorrectly. I'm sorry. Our sampling time was within one month after the earthquake. **we determined that the earthquake was one of the factors affecting the gypsum. But as you commented, there are many factors affecting gypsum, and it can be disturbed without earthquakes. Therefore, we emphasize this concern in both the abstract and the conclusion, showing the limitations of gypsum as an indicator of earthquake warning.**

Why do the authors use these low averages for Ca (55.23 mg/L) and SO_4 (8.31 mg/L) concentrations before earthquake? Baba et al. (2019) in their paper report concentrations up to 773.56 mg/L for Ca and up to 1287.24 mg/L for SO_4 much higher than in the samples collected for this study.

Reply: Thanks. We have already replied to this comment before, and **we use the data near EAFZ**. For this doubt, we consider to explain in the text to eliminate misunderstandings.

Finally, the authors indicate the whitening and turbidity of the water in a sample as verification for the sulfate anomaly. But without analysis there is no possibility to affirm that such visual anomaly was due to gypsum dissolution.

Reply: Thanks. The best evidence is our analysis of water samples taken within a month of the earthquake. Your confusion is caused by our marking of the wrong sampling time. Sorry again.

Furthermore, the authors mistake the samples. The site with the high sulfate concentration is HS14, while the site to which the pictures of figure S1 and of video 01 refer is HS15 which has the lowest sulfate value (1.21 mg/L).

Reply: Thank you for pointing out this error, we have fixed it.

Lines 388-389: The authors presenting the data of a single sampling campaign have no evidence to affirm that "the geothermal fluid was diluted due to the infiltration of a large amount of shallow cold water after the double earthquakes in February 2023".

Reply: Thanks. As discussed earlier, we have considered replacing "geothermal water" with "groundwater", so we will reconsider this conclusion. Thank you for your highly professional and constructive comments. Thanks again.

Minor comments

Line 22: What do the authors mean with "systematic" which do not appear only in the abstract but has been repeated many times in the whole text?

Reply: Thanks. In your professional comment, we also believe that " systematic " may be a misnomer. We consider deleting the word.

Lines 24 and 25: The meaning of the sentence is obscure (reconstructed by earthquake?)

Reply: Thanks. This sentence was not clear enough, so we adjusted the expression: **In order to explore the relationship between groundwater anomaly and earthquake, we performed hydrochemical and isotopic analyses of groundwaters in the East Anatolian Fault Zone (EAFZ). The results show that groundwaters are affected by seismic activity.**

Line 29: the authors use often the term "abnormal" but they do never define with respect to what.

Reply: Thanks. "Abnormal" refers to values that deviate from normal values. Divided into **time** and **space** outliers. In the manuscript, "anomaly" refers to spatial outliers. In particular, in Fig. 6, the mean values of Ca^{2+} and SO_4^{2-} (literature research) are compared with the temporal outliers in this study. The literature survey represents the data of the earthquake calm period, and this study represents the data of the earthquake active period.

Line 38: please define "shallow minerals".

Reply: Thanks. "Shallow minerals" is a relative term that generally refers to those minerals formed at or near the surface, mainly sedimentary rock related minerals. In this article mainly refers to gypsum. If "shallow mineral" is prone to ambiguity, **we consider directly replacing "shallow mineral" with "gypsum".**

Line 61: which evidence have the authors of a "geothermal fluids circulation"

Reply: Thanks. We have replaced "groundwater" with "geothermal water". Therefore, the geothermal water cycle is no longer considered

Line 69: please define the "geothermal fluid anomaly index"

Reply: Thanks. The “**geothermal fluid anomaly index**” may be a misnomer, and we consider replacing it with "**groundwater chemical and isotopic anomaly index** ". Refers to changes in the water chemistry and isotopic composition of groundwater caused by changes in the external environment.

Lines 70-71: the subject is missing in this sentence.

Reply: Thanks. We deleted that sentence.

Line 82: please define what a “tectonic collage” is.

Reply: Thanks. We have adjusted the expression of this sentence: “**Located at the intersection of Eurasia, Africa and Arabia, Turkey has a complex tectonic background**”.

Fig. 1a: altitude scale is missing.

Reply: Thanks. We added the altitude scale (Fig. 3).

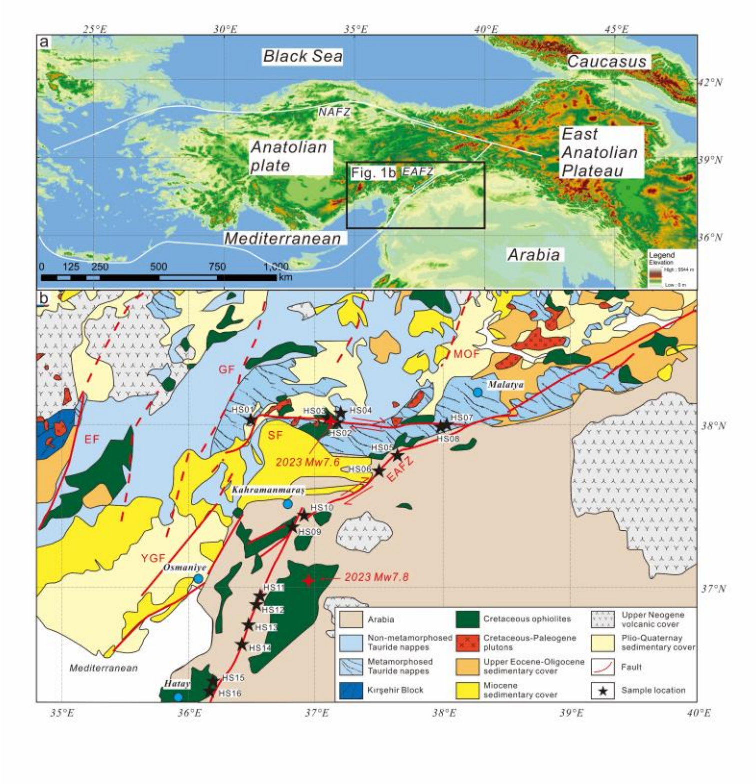

Fig. 3 Geological map after adding altitude scale.

Line 105: probably crystalline instead of crystallization.

Reply: Thanks. We changed crystalline instead of crystallization.

Line 145: in table 1 HS15 is considered a spring, which one is correct?

Reply: Thanks. We checked the sampling point. HS15 is spring.

Line 146: the authors claim that "the closer to the epicenter, the higher the SiO_2 content", which makes no sense. Firstly because the earthquakes were two and only one sample close to one of the epicenters has a higher SiO_2 value. Moreover, other two sampling points with low to very low SiO_2 concentrations have the same position as the "anomalous" one.

Reply: Thanks. We deleted that sentence

Lines 154-156: the sentence "The δ18O and δD of samples varied from –11.30‰ to –6.55‰ and –65.43‰ to –34.43‰ respectively, which is near to the global meteoric water line (GMWL) (Craig, 1961) (Fig. 3), suggesting their meteoric water origin" has no sense. The regression line obtained plotting both $\delta^{18}O$ and δD values in a graph can be close to GMWL.

Reply: Thanks. We deleted that sentence.

Line 159: what type of Statistical analysis?

Reply: Thanks. We have changed the word "statistical analysis" to "box-plot analysis" to make the expression more specific.

Line 160: please define "fluid activity elements".

Reply: Thanks. We adjusted the expression and used proper nouns: Fluid-mobile element (FME).

Line 161: I do not understand what the authors mean with "are at historic highs versus". If the authors mean that the concentrations are higher than in the past, then the fig. S2 does *not prove nothing. Al and Ba are below the median value of the literature data while the remaining are around the median value not showing particularly high values. Furthermore, it is unclear which data are compared in fig. S2 with the present data.*

Reply: Thanks. There is indeed ambiguity in the expression here, so we consider deleting the analysis of the packing diagram to make the manuscript more brief and clear.

Table 1: please indicate the coordinates with at least 4 digits after the comma, with only two digits it's impossible to obtain a reliable position. Looking at Fig. 1, the indicated coordinates of HS05 are clearly wrong.

Reply: Thanks. We adjusted the accuracy of the latitude and longitude to keep 4 decimal places.

Line 190: the highest values do not belong to samples collected closer to the sea.

Reply: Thanks. It's not rigorous enough. We've improved the sentence: "**The highest value of δD (–34.43‰)and $\delta^{18}O$ (–6.55‰) at the southwest of EAFZ, which is close to the Mediterranean Sea, indicating that it originates from the recharge of the evaporation of the Mediterranean Sea (Fig.3)**"

Line 190: $\delta^{18}O$ and δD values are inverted.

Reply: Thank you. We've corrected it

Line 212: magma mixing with geothermal fluids generally end in a volcanic explosion which is not the case here.

Reply: Thanks. It is true that magma usually accompanies volcanic activity. However, there may also be deep partial melting process in the deep fracture zone. For the sake of rigor, we consider using "partial melting" instead of "magma mixing".

Lines 224-225: the sampling sites are tens of km far from the Mediterranean coastline, how and why should they be "obviously contaminated by Mediterranean Sea water"?

Reply: Thanks. It is tens of kilometers from the Mediterranean Sea, but from a geological perspective, it is very small. In the manuscript, our conclusions may be too arbitrary. We should consider the contribution of evaporites such as rock and salt. So, based on your comments, we've adjusted the sentence: "**HS16, the sample with the highest concentration, was collected at the southwest of EAFZ, which was obviously contaminated by Mediterranean Sea and/or halite. There is no signal of deep fluid or magma source.**"

Line 226: which previous study? Please add a reference.

Reply: Thanks. That sentence doesn't make sense. We deleted it.

Line 233: pollution is a term connected to an anthropogenic origin, so please use the term contamination instead.

Reply: Thank you. We changed the word "pollution" to " contamination."

Lines 233-236: I do not understand the meaning of this sentence.

Reply: Thanks. We adjusted the expression to make the meaning clearer: "**In addition, water is much less transferable than gas, which makes deep geothermal water may not be able to rise along the fault to the shallow crust or surface like geothermal gas.**"

Lines 290-292: the two processes are not alternative. Serpentinization includes secondary minerals precipitation.

Reply: Thanks. We adjusted the expression to make the meaning clearer: "**Compared with other samples, the ion concentration of HS15 is significantly reduced, which may**

indicate the precipitation of potential secondary minerals (e.g., calcite). Therefore, we conjecture that serpentinization and secondary mineral precipitation such as: calcite or magnesite (Aydin et al., 2020; Cipolli et al., 2004) may be responsible for the increase in pH (Huang; et al., 2023)."

Finally, I would signal a possible conflict of interest being the handling editor of the same institution of one the corresponding author.

Reply: Thanks. China University of Geosciences (Beijing) and China University of Geosciences (Wuhan) are two independent universities with no conflict of interest.