Dear anonymous referee #2,

Comment 1:

- lines 87-91. Chemical types of spring waters The authors classificate the sampled waters in 7 groups using the Shoka Levs classification method, but they don't explain what are the principal water rock interaction processes generating these types of water. Looking at the data it seems that there are 3-4 main types of water while the other types are probably the result of mixing processes between the main types. A Piper or Langelier Ludwig diagram could show better the possible mixing processes. Furthermore a study of speciation-saturation indexes is needed.

Thank you very much for this suggestion. The reply to each comment is as followed:

The springs nos. 16-23 and 25 occur in granite (Figure 1), which had the similar higher concentrations of Na^+ and HCO_3^- because of the interaction between water and granite as the Eq. (2), and the higher concentrations of Ca^{2+} and Mg^{2+} for samples from the springs nos. 19, 23-24 should be attributed to water-rock interactions between the underlying Devonian carbonate and groundwater as the Eq. (3) and (4). In addition, Cl^- is known to be conservative and derive from the deep earth mainly (Chen et al., 2014). Chemical type for samples from the spring no. 16 was Na-Cl (HCO_3), with the Cl^- concentration as 336.2 mg/l (Table 1), which suggested upwelling of the deep-earth fluids into the spring, and resulted in high $^3He/^4He$ ratios (between 1.43 and 3.73Ra, Ra = 1.39×10^{-6}) (Zhou, 2011) and high temperatures (between 80.0◦C and 70.2◦C) for the springs (Table 1). The spring no. 24 is found in Carboniferous carbonate, the main components of the samples were Ca^{2+}, Mg^{2+} and HCO_3^- because of interaction between the groundwater and carbonate as the Eq. (3) and (4).

$$2NaAlSi_2O_3 + 3H_2O + CO_2 \rightarrow H_2Al_2Si_2O_3 \cdot H_2O + 4SiO_2 + 2Na^+ + HCO_3^- + OH^- \quad (1)$$

$$CaCO_3 + H_2O + CO_2 \rightarrow Ca^{2+} + 2HCO_3^- \quad (2)$$

$$MgCO_3 + H_2O + CO_2 \rightarrow Mg^{2+} + 2HCO_3^- \quad (3)$$

We had calculated the speciation-saturation indexes of calcite in water samples from the springs by the formula proposed by Oddo and Tomson, 1982. The speciation-saturation indexes ranged from -3.9 to -4.8, which indicated calcite in water samples from the springs were unsaturated.

We had made the modification in the text.

Comment 2:

- lines 93-94 – “The hydrochemical parameters of the spring waters before and after the Lushan M_S 7.0 earthquake evidently varied with the amplitudes ranging from -73.3 to 231.9 mg/L”. This sentence is not clear, how can a concentration have a negative value (-73.3 mg/L).

Thank you very much for this suggestion. The reply to each comment is as followed:

“The values ranged from -73.3 to 231.9 mg/L” was the varied amplitude of hydrochemical parameters of water samples from the springs compared to their first batch of water samples. The hydrochemical parameters of some water samples decreased before and after the earthquake, so the varied amplitudes were negative.

We had made the modification in the text.

Comment 3:

-line 98 and Fig.3 – not clear why the Guanding waters show a decrease in Na and TDS but an increase in Ca and HCO_3, dilution and simultaneous dissolution of calcite? Please explain better.

Thank you very much for this suggestion. The reply to each comment is as followed:

On the one hand, TDS of samples from the spring no. 16 increased as listed in the table, but we had made the mistake during drawing the diagram. So we have redrawn the diagram, and revised the text accordingly.

On the other hand, the high $^3He/^4He$ ratios (between 1.43 and 3.73Ra, Ra= 1.39×10^{-6}) of gas samples (Zhou, 2011) and high temperatures (between 44.8 and 83.0 C, Table 1) and concentrations of Na^+, Cl^- and SO_4^{2-} of water samples (Chen et al., 2014) from the springs nos. 16, 18 and 21 suggested the contribution of mantle fluids into the springs. Therefore, the decrease of concentrations of Na^+, Cl^- and SO_4^{2-} for samples from the springs nos. 16, 18 and 21 after the main shock may result from the influx of shallow waters depleted in Na^+, Cl^- and SO_4^{2-} relatively. There was a strong smell of rotten egg from the spring no. 22, which indicated a considerable H_2S content from the spring. Therefore, the increase of concentrations of Na^+ and SO_4^{2-} in samples from the spring no. 22 may be attributed to water-rock interactions between granite and groundwater enhanced by H_2S as the Eq. (5).

$$2NaAlSi_2O_3 + H_2O + H_2S + 4O_2 \rightarrow H_2Al_2Si_2O_3 + 4SiO_2 + 2Na^+ + SO_4^{2-} \qquad (5)$$

We had made the modification in the text.

Comment 4:

- Fig 3 – Why the four diagrams of Fig.3 don't show the full data set? In the Ca diagram are shown the data of 7 springs (but only 3 for SO_4), in the HCO_3 and TDS diagrams are shown the data of 6 springs and in the Cl and Na diagram only four springs are shown.

Thank you very much for this suggestion. The reply to each comment is as followed:

The data of samples from some springs had no obviously variations before and after the earthquake. In order to ensure the concision for the diagrams, the data with little variation were not shown in the diagrams.

We had made the modification in the text.

Comment 5:

- Conclusions. The observed changes in groundwater composition are clearly related to the seismic event, but are a consequence of the seismic event rather than a precursor of it. The authors talk invoke in general terms the water rock interaction processes in order to explain some chemical changes, but show only the overall reaction of $CaCO_3$ dissolution.

Thank you very much for this suggestion. The reply to each comment is as followed:

Actually, the latest data were measured in 2010, and there were no obviously hydrochemical variations before the main shock. However, the hydrochemical anomalies were observed 3-5 days after the main shock, and the amplitudes were obviously, as high as 231.9 mg L^{-1}. Usually, hydrochemical anomalies related to earthquake can continue to about one month after the main shock (Du et al., 2008), such as those related to the Wenchuan M_S 8.0 earthquake with the epicenter 300km northeast to that of the Lushan M_S 7.0 earthquake (Chen et al., 2014). Therefore, the observed hydrochemical anomalies after the Lushan M_S 7.0 earthquake could be the continued precursory related to the main shock.

In addition, 36 aftershocks with M_L higher than 4.0 occurred within 5 days after the main shock. Therefore, the aftershocks could have play an important role in producing the hydrochemical anomalies observed after the main shock.

We had made the modification in the text.

Comment 6:

TECHNICAL CORRECTIONS Fig.3 – The figure show four diagrams. Please add a, b, c, d, to the diagrams.

Thank you very much for this suggestion. The reply to each comment is as followed:

We have added a, b, c, d, to the diagrams.

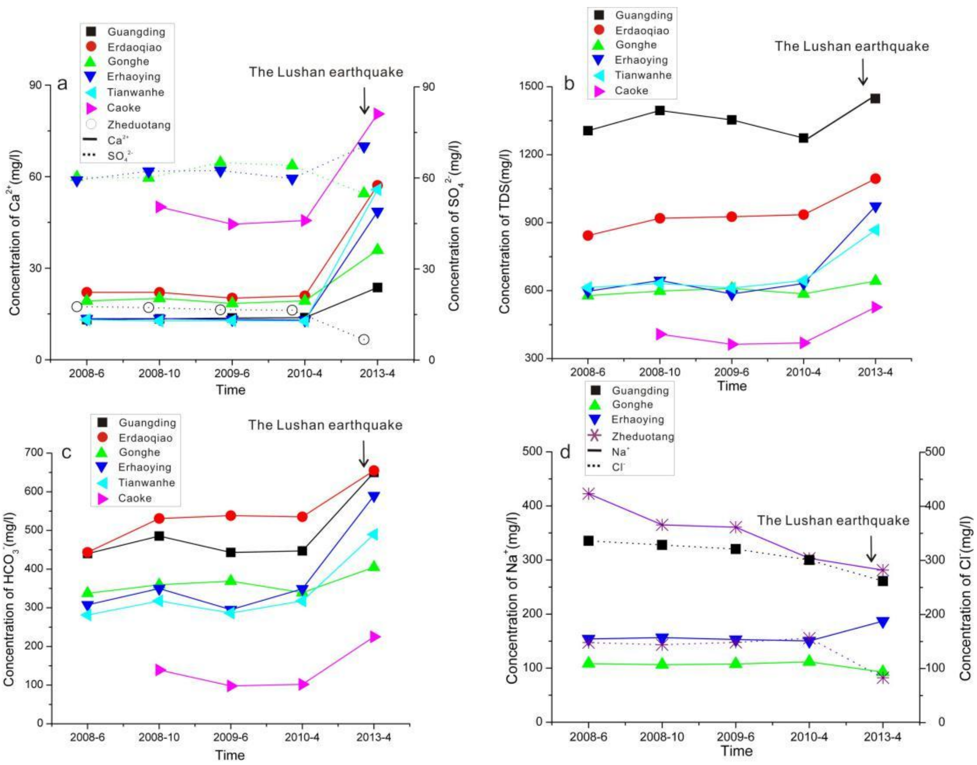

Fig. 3. Temporal ion variations of the spring waters before and after the Lushan earthquake.