Diversity of Sr isotopic compositions of hot spring and volcanic lake waters from Zao volcanic area

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87Sr/86Sr isotopic analyses were carried out for hot spring water, volcanic lake water, and some rocks in Zao volcanic area to investigate the origin of Sr and water-rock interaction.

Based on Sr isotopic and major chemical compositions, various hot spring water and volcanic lake water in this area are divided into three types. TypeI is characterized by high Mg,Ca-SO4,Cl abundances, and their 87Sr/86Sr ratios are around 0.7053. Zao hot spring water belongs to this type. TypeII is characterized by high Ca-SO4 concentrations, and their 87Sr/86Sr ratios range from 0.7039 to 0.7043. Waters from the volcanic lake and Shinfunkiko hot spring belong to this type. TypeIII is characterized by high Na,Ca-HCO3,SO4 contents, and their 87Sr/86Sr compositional range is 0.7070-0.7073. Waters from Gaga, Aone, and Togatta hot spring belong to this type.

The 87Sr/86Sr ratio of basement pre-Tertiary granite is 0.7068, and the value of plagioclase separated from the granite is 0.7064. Whereas Tertiary sedimentary rocks show such a wide range of 87Sr/86Sr ratio as 0.7054-0.7202. The 87Sr/86Sr ratios of the Quaternary volcanic rocks range from 0.7038 to 0.7044.

The 87Sr/86Sr ratio of TypeI is similar to the average value of the pre-Tertiary granite and the Quaternary volcanic rocks. Therefore soluble Sr in TypeI might have been derived from both the pre-Tertiary granite and Quaternary volcanic rocks. Sr in TypeII might have been derived from the Quaternary volcanic rocks because the 87Sr/86Sr ratios of TypeII are similar to these of the Quaternary volcanic rocks. The 87Sr/86Sr ratio of TypeIII is higher and it is within the range of Tertiary sedimentary rocks; they should be the source of the Sr of TypeII.

SO4/Cl ratio of TypeI is lower than TypeII. Judging from the chemical characteristic and geological structure of this area, TypeI might be the residual liquid phase derived from hot water boiled in a reservoir. High SO4/Cl ratio of TypeII can be explained by low Cl. Because Cl can be strongly partitioned into liquid phase while boiling.