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Distribution and formation of highly saline water in the northwest plain of Aso caldera, south Japan

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The Aso caldera is one of the largest calderas and the sources of water in the caldera are classified into roughly two types: One of low concentration Ca-HCO_3 type, originating from the caldera somma and one of high of the Ca-SO_4 type, with elevated concentrations and a diverse origin like hydrothermal springs and seeping groundwater northwest plain in the Aso caldera (Hosono et al., 2018). Seeping groundwater in this area contains elevated concentrations of SO_4, Cl, B and Li, attributed to volcanic fluids. However, the detailed areal distribution of this seeping groundwater remains partly unclear because of limited the number of springs and wells .

One of important features of high saline groundwater in the northwestern plain is its high concentrations of metals such as iron and manganese. The areal distribution of springs and wells of high concentration groundwater seems to overlap with an area where limonite ore deposits occur. It is suggested that ore forming metals are precipitated from fluids (90 ka ~ present) and are distributed horizontally close to the surface (a few meters in thickness), due the high saline waters in this area. Therefore, the areal distribution of high saline groundwaters seeping into the caldera floor maybe characterized using the distribution of limonite deposits.

Iron and manganese concentrations in the high saline waters are higher than in other hydrothermal and hot spring waters in the area.

$\delta^{34}S$ and $\delta^{18}O_{SO4}$ systematics indicate the possibility of incorporation of water from a reducing environment from a deeper aquifer.

The study of the subsurface structure in the northwest of the Aso Caldera suggests existence of partial melt at 10 km depth or more. This partial crustal melt maybe different from that of the central volcano in the Aso Caldera. It is suggested that this heat source with highly concentrated hydrothermal components triggered the formation of high saline water in northwestern plain area causing both surface limonite deposition high saline seepage water with metal-enriched deep fluids.

References

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