Pb isotope ratios of the Nansatsu gold deposits, Kagoshima, Japan: Implication for gold mineralization

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Elucidating the origin of metals constituting the deposits can provide a crucial key constraint in exploration for new mineral deposits. It is previously considered that the epithermal deposits, one of the most important types of gold deposits, are formed by ore-forming fluids originated from magmatic water discharged from hydrous magmas and/or meteoric water evolved by circulation and reaction within the shallow crust. The fluids extract metals from magmas and/or host rocks and then move to the shallower part of the crust, resulting in deposition of valuable metals due to reduction of pressure and temperature [1]. The previous mineralization model has been proposed on the basis of isotopic study of relatively light elements (e.g., H and O) in the ore-forming fluids. However, recent isotopic studies on heavy metals (e.g., Pb, Sr and Nd) suggest the involvement of another important component, i.e., slab-derived fluid, to the formation of epithermal ore deposits [2].
To detect the source of metals contributing to the formation of epithermal gold deposits, Pb isotopes can provide direct and useful information. Our previous study of the Pb isotopic compositions of sulfide ores from the Akeshi gold deposit (one of the Nansatsu-type gold deposits) demonstrated that the ore samples show three different trends in $^{206}Pb/^{204}Pb$–$^{207}Pb/^{204}Pb$–$^{208}Pb/^{204}Pb$ isotopic compositional space [3]. Two of these trends were interpreted as influences of the bed rock and the slab-derived fluid from the Philippine sea plate. The results suggest that both the bed rock and the slab-derived fluid could have contributed to mineralization of the Akeshi gold deposit. The third trend, however, could not be explained by any geochemical end-member near the deposit.
In the present study, to cover a spatial variation in geochemical signatures, we newly analyzed the samples including bed rocks, host rocks, and sulfide ores from the Kasuga and Iwato gold deposits both in Kagoshima prefecture, which are also among the typical Nansatsu-type gold deposits. We will show the new analytical results, and discuss the origin of the Nansatsu-type gold deposits more comprehensively.

References

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キーワード：南薩型金鉱床、スラブ起源流体、鉛同位体比、鉱化流体、浅熱水性鉱床
Keywords: Nansatsu-type gold deposits, slab-derived fluid, Pb isotopic ratio, ore-forming fluid, epithermal deposits

