Significance of external morphology and chemistry of zircon for precise U-Pb geochronology

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U-Pb zircon geochronology by microbeam analysis, such as SIMS and LA-ICP-MS, has been improved and provided opportunities of discussion about more detailed geological event. However, the highly precise U-Pb age data yield an importance of confirming their accuracy and assaying incorporation of zircon antecryst and xenocryst. In this study, SHRIMP U-Pb geochronology and trace element chemistry of zircon and data processing method of the highly precise ages on the basis of external morphology and trace element abundance as well as statistics were applied to igneous rocks occurred in the Ishizuchi caldera in the Outer Zone of Southwest Japan.

The Ishizuchi caldera is composed mainly of ring dike complexes, major pyroclastic-flow deposits, and felsic intrusion. Zircon grains from the Bansyodani-biotite-rhyolite of the inner ring dike complex yielded unexpectedly scattered $^{206}Pb/^{238}U$ data and a weighted mean $^{206}Pb/^{238}U$ age of 14.78 ± 0.18 Ma (MSWD: 3.4). The zircon grains were devided into two types based on the external morphologies, namely sharply euhedral grains (Type-A) and relatively rounded edge of prism and pyramid ones (Type-B). Zircon chemistry supported the classification based on the morphology. Hf contents of Type-A zircons show higher than those of Type-B. C1 chondrite-normalized REE patterns of Type-A are characterized by a large fractionation between LREE and HREE and large negative Eu anomalies. In contrast, those of Type-B were enrichment of LREE and weaker negative Eu anomalies. The differences of zircon chemistry between Type-A and B reflect source melt composition which evolved with magma differentiation. The weighted mean age calculated from the Type-A zircons shows younger age of 14.21 ± 0.19 Ma and reliable data distribution (MSWD: 1.0). These results suggest that the Type-B grains are zircon antecrysts, which are rejected for U-Pb age calculation of the rhyolie.