

Analytical considerations for Re-Os analysis of organic-rich sediments

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Recent advances in analytical and mass spectrometry protocols for ^{187}Re - ^{187}Os analysis have led to accurate age determinations for organic-rich sediments (Cohen et al., 1999; Creaser, 2002; Creaser et al., submitted). Although hydrogenous Re and Os in organic-rich sediments are associated with organic matter some imprecision in the Re-Os dates may be directly related to Re and Os present in non-hydrogenous (detrital) components. Rhenium and Os analysis of organic-rich sedimentary rocks are typically conducted using a whole rock sample. In order to eliminate any non-hydrogenous Re and Os component from the analysis the organic matter needs to be analyzed separately. Organic matter can be isolated from the whole rock matrix using a HF-BF₃ technique (Robl and Davis, 1993) and has recently been employed by Ripley et al. (2001). This method was applied to the black shale unit of the Exshaw Formation, Canada. Whole rock Re-Os analyses of this unit gave a date (358.8 ± 8.9 Ma, MSWD = 1.8) in agreement with its known age constraints of the Upper Devonian (Famennian) *expansa* zone to Lower Mississippian (Tournaisian) *duplicata* zone (Creaser, 2002). However, the Re-Os data for the organic matter yield a date of 449 ± 220 Ma (MSWD = 616). The isolated organic matter gave similar $^{187}\text{Os}/^{188}\text{Os}$ values, but with significant lower $^{187}\text{Re}/^{188}\text{Os}$ values (60-600) found in comparison to the whole rock analyses. It is apparent that the HF-BF₃ method has altered the Re-Os isotope systematics during the chemical isolation of the organic matter. Rhenium contents of 8 to 37 ng (n=7) in HF leachate experiments suggest Re is being leached from the organic material during the silicate dissolution stage. It is therefore proposed that the HF-BF₃ technique not be used to isolate organic matter for Re-Os analyses, and care should be taken when ascribing scatter in Re-Os analyses of organic matter isolated by HF-BF₃ to geological processes.

References

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Sr, Nd and Os isotopic systematics of Nikubuchi ultramafic complex in central Shikoku, Japan

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Introduction and geological settings

Several aspects of the genesis of ultramafic rocks in subduction zone complexes are not well understood. We have carried out a detailed Sr, Nd and Os isotopic systematics of Nikubuchi ultramafic complex belonging to the Sanbagawa metamorphic belt in central Shikoku, Japan. The isotopic ratios were analyzed by positive and negative thermal ionization mass spectrometry at Nagoya University. Trace and major element compositions were determined by ID-MS, INAA and XRF.

The Nikubuchi ultramafic complex witnessed granulite facies (pre-Sanbagawa) and epidote-amphibolite facies (Sanbagawa) metamorphic events. However, the pre-Sanbagawa mineralogy is preserved in the complex and has been studied for their isotopic composition in the present work. Mineralogical and petrological studies (Yokoyama, 1980) show that the pre-Sanbagawa rocks were once subjected to deep seated subduction. The Sanbagawa epidote-amphibolite facies metamorphism (at Cretaceous) took place after exhumation.

Result

The $^{87}\text{Sr}/^{86}\text{Sr}$ and $^{143}\text{Nd}/^{144}\text{Nd}$ ratios are around 0.7045 and 0.51295, respectively. The values are quite homogeneous in spite of their mineralogical variations. Apparently the isotopic compositions have been homogenized by later metamorphic event. On the other hand, the $^{187}\text{Os}/^{188}\text{Os}$ ratios vary from 0.1 to 0.7. The ratios are apparently higher than those reported for common peridotite, whereas the Os abundances are lower than the common peridotite.

These isotopic signatures suggest that the Nikubuchi ultramafic complex possibly represents a fragment of chamber cumulate formed during deep seated subduction.

Reference

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