Crustal contamination of the upper mantle: Evidence from ophiolites

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Our studies of podiform chromitites in the Luobusa ophiolite, Tibet and the Semail ophiolite, Oman provide evidence that their mantle sources were contaminated by crustal minerals. The chromitites contain rounded, reworked grains of zircon, corundum, quartz, feldspar, diopside and amphibole(?). These are associated with moissanite (SiC), graphite, PGE minerals, rutile, Fe, Ti and Si alloys and native elements. Careful sample collection and preparation, and duplication of results in several laboratories rule out natural or anthropogenic contamination.

The zircon grains range from 20 to 300 µ across, are typically well rounded and have complex internal zonation. Rare grains are subhedral and have regular, concentric zoning. Some contain inclusions of quartz, rutile, orthoclase, mica, ilmenite or apatite. in situ $^{206}Pb/^{238}U$ dates by SIMS for the Luobusa zircons are very heterogeneous and range from 1657-549 Ma, far older than the ophiolite (~120 Ma), clearly indicating a mixed population of crustal protoliths.

The grains of quartz, corundum, feldspar and diopside range from 0.1 - 0.5 mm and are moderately to well rounded.

The morphology, composition and age of these minerals strongly suggest that they were originally derived from reworked sedimentary or metamorphic material transported into the mantle by subduction and later incorporated into the chromitites. Their occurrence with ultrahigh pressure minerals such as diamond, and coesite in the Luobusa ophiolite suggests derivation from depths of at least 100 km.

Olmec serpentinitic pieces from La Merced: isotopic and geochemical constraints

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Geoarcheology and petrological methods

The olmec (1,200 B.C. to 400 B.C.) was the first mesoamerican culture, characterized by extensive use of serpentinites (Heizer, 1961; Rodríguez and Ortiz, 2001). To know the geological provenance were performed XRF, ICP-MS, EM-WDS, and thermal ionization MS (Rb-Sr and Sm-Nd isotopic systems) on 17 archeological samples (SAO) from La Merced and 15 geological (GS) from Mexico and Guatemala.

Discussion of results

Mineralogy and geochemical composition (V, Zr, Zn, Cr, Ti; REE series) show a better correlation among SAO and GS from south Mexico. Likewise, Sr isotopic ratios for SAO $^{87}Sr/^{86}Sr$ (0.70567-0.71258) and the Nd isotopic system displays ε-Nd values from -5.4 to +6.6 $_{(today)}$.

Conclusions

Petrological information indicate that only the Sierra de Juárez geological samples have affinities to the SAO objects from La Merced; near Vista Hermosa fault.

References

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