Preserving Fertile MORB Mantle in the Continental Lithosphere

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The shallow mantle beneath the Tariat region of central Mongolia is composed predominantly of fertile peridotite [1]. Of over 110 peridotite xenoliths recently collected from four localities in the Tariat region, over 90% are lherzolites. The remainder include subequal amounts of harzburgite and veined pyroxenite-peridotites. The median Mg#, Al_2O_3, and CaO contents of the Tariat collection are 89.4, 3.87 and 3.23, respectively. Modeling major element compositions indicate that most samples experienced 0-6% partial melt removal at 1 GPa [2]. Clinopyroxenes, on average, are moderately LREE depleted (average chondrite normalized La/Sm = 0.45). Most whole rocks show small, if any, depletions in Re and Pd compared to other HSE. $^{187}Os/^{188}Os$ for samples with more than 3.2% Al_2O_3 range only from 0.126 to 0.131. Samples with Al_2O_3 ranging from 3.1 to 1% Al_2O_3 define a correlation with $^{187}Os/^{188}Os$ suggesting an "alumichron" age of ~2 Ga. The most refractory samples, however, show no correlation with Os isotopic composition, with $^{187}Os/^{188}Os$ from 0.114 to 0.128; they also are commonly enriched in iron and LREE. In contrast to the indicators of fertility in most samples, new Sr, Nd and Hf isotopic data for acid-leached clinopyroxene separates from fertile lherzolites plot within the range of modern MORB with $^{87}Sr/^{86}Sr$ from 0.7021 to 0.7026 and εNd from +7.7 to +9.8, overlapping earlier results [3] and εHf from +13.3 to +18.5. One metasomatized harzburgite gives $^{87}Sr/^{86}Sr$ (0.7045) and εNd (+1.5), within the range seen for Cenozoic Mongolian basaltic volcanism [4], but retains a high εHf of +11.5, which suggests recent overprinting of Sr and Nd, but less so Hf, by melts similar to the regionally widespread basalts. The crustal section in this part of the Central Asia Orogenic Belt consists of various terranes mainly accreted in the Paleozoic [5]. The composition of the mantle lithosphere beneath at least the Tariat region suggests that a significant slice of fertile MORB mantle was accreted with the overlying crust, perhaps allowing an unusually clear look at a section of convecting asthenosphere less altered than typical of exposed abyssal peridotites.

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Nitrogen in bivalve shell & soft tissues: Implications for N sequestration and cycling in coastal waters

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There is growing interest in the role of bivalve shellfish in biofiltration, particularly with regard to N sequestration and removal from coastal waters. We quantified N assimilation into tissues of several bivalve species, linking N to anthropogenic sources for management, and defining timescales of N sequestration or removal that may affect ecosystem functions (particularly biogeochemical cycling). These data are important as urbanization and other human activities increasingly alter food supply and habitat for bivalves and we recognize historical global loss of commercial bivalves, due to combined habitat loss and over harvest. We found that N assimilated into bivalves largely depended on food quantity and quality, which determined growth (rate of N assimilation) and %N content in both soft tissues and shell. N assimilation rates & %N are at least affected by species-specific physiology, feeding habits, ontogeny and genetics, and cannot be generalized due to site-specific variation in food supply and environmental attributes. Similarly, biodeposition that allows N sequestration via burial or biogeochemical processes depended on food quantity and quality as well as environmental variation. Stable isotope analysis was used to successfully link biological responses to anthropogenic N sources across temporal and spatial scales, even when effects on growth or survival were not measurable. More data are needed to define timescales of sequestration, particularly in older reefs and for deposited shell. Ultimately these data can be combined from different regions to estimate global losses of N sequestration capacity through time due to bivalve depletion and predict capacity of sequestration or removal through restoration and farming activities. Interestingly, external N loading appears to have a positive influence on N removal capacity of bivalves by increasing growth rates and N storage in tissues, but external N loaded is greater than enhanced N sequestration and removal capacity in most cases, particularly in areas with increasingly limited available habitat.

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