Eel larvae may hatch in the surface layer near the West Mariana Ridge: Ion microprobe $\delta^{18}O$ analysis with 7 μm spatial resolution in glass eel otoliths

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The spawning of anguillid eels has been a matter of speculation for many years, because adult eels had never been seen or captured in the spawning area. Mature Japanese eels, *Anguilla japonica*, were first caught near the West Mariana Ridge in 2008, which includes three shallow seamounts, and several days old preleptocephali have been collected near this ridge during several spawning seasons. However, the depth at which spawning occurs is still in question. In this study, we applied ion microprobe analysis with high spatial resolution of 7μm diameter for the core of otoliths from glass eels to reveal their hatching temperature and depth. We first determined the relation between ambient water temperature and otolith $\delta^{18}O$ in glass eels, using 25 aragonic otoliths of glass eels reared under constant water temperatures of 15, 20, 25 and 30°C for 30 days (four to seven otoliths for each temperature). The otolith increment precipitated at the beginning of each rearing was marked by alizarine complexone, and $\delta^{18}O$ analysis was conducted outside of the marking using a CAMECA IMS-1280. 12 otoliths of wild eels collected from the Tone River estuary, central Japan were also used for the analysis of otolith cores.

Temperature-dependent fractionation of $\delta^{18}O$ (‰ PDB) in otoliths was found with a fairly good correlation ($\delta^{18}O$ (otolith) = 0.8398±0.131T °C, $r^2 = 0.944$) for $\delta^{18}O$ (H_2O)=0 SMOW. Spot to spot reproducibility (2SD) of the standard was 0.2-0.6 ‰, small enough to resolve a change in an individual ambient water temperature of less than 1.5°C. The $\delta^{18}O$ of otolith cores ranged from -2.70 to -2.42 with a mean of 2.56 (2SD =0.11), corresponding to a temperature range of 24.0 to 27.0°C (mean= 26.0°C). The range of water temperature corresponds to water depths from 150 to 170 m near the West Mariana Ridge, strongly suggesting that eel larvae hatch in the surface water of the spawning area.

Re-Os and PGE of Neoarchean websterite xenoliths and diamondiferous lamprophyres

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The Mesoarchean to Neoarchean Michipicoten greenstone belt (MGB), in the Wawa area of the Superior Province, hosts numerous 2.68 Gyr old lamprophyre dikes containing abundant ultramafic xenoliths and the world's oldest igneous diamonds. The lamprophyres are calc-alkaline or shoshonitic and occur only in the youngest of three volcanic units in the MGB. The entrained ultramafic xenoliths are compositionally websteritic and recrystallized to assemblages of actinolite +/- talc. This locality is well-suited to exploring deep-seated petrogenetic processes beneath greenstone belts, the possible subduction origin of diamond, and processes related to incipient cratonization.

Lamprophyres are enriched in the incompatible PGE (Pt, Pd) and depleted in the compatible PGE (Os, Ir, Ru); websterites are the reverse. All samples have low Re content and low $^{187}Re/^{188}Os$ (lamprophyres 0.14 - 0.30; websterites 0.03 - 0.06) for accurate initial $^{187}Os/^{188}Os$. Initial $^{187}Os/^{188}Os$ of the lamprophyres range from 0.114 to 0.122 which is enriched by 4-10% over Neoarchean chondritic mantle and confirm that the lamprophyres originated from subduction-fluid enriched mantle. The websterites have Re-Os and PGEs more like peridotites than pyroxenites. Their low initial $^{187}Os/^{188}Os$ (0.106 - 0.114) overlaps the composition of peridotite xenoliths in Kirkland Lake kimberlites and the initial isotopic composition of Abitibi komatiites.

The two websterites with lower Os content (1.1 - 1.6 ppb) have PGE patterns and Os isotopic compositions suggesting they could be komatiitic-melt-infiltrated mantle if not high pressure cumulates. The websterite with the highest Os content (3.7 ppb) has a depleted PGE pattern like on-craton southern African xenoliths and a low Os isotopic composition like Mesoarchean depleted mantle. Such mantle could have been a host for diamonds prior to their entrainment in lamprophyric magma. Reworking and incorporation of Mesoarchean depleted residues generated during 2.9 Ga komatiite melting may have been essential to form Neoarchean subcontinental mantle keels and permit sampling of diamonds by lamprophyric magma.