Constraining the Rapid Construction of TAMU Massif at an ~145 Myr Old Triple Junction, Shatsky Rise

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Here we present new high-precision $^{40}Ar/^{39}Ar$ ages from Shatsky Rise, an oceanic plateau (2.7×10^6 km^3) composed of three large volcanic edifices: TAMU, ORI and Shirsov Massif. TAMU Massif (144.8 ± 1.2 Ma) was the first to form at the intersection of an ancient triple junction and is now considered to be the largest singular shield volcano ever to have formed on Earth [1]. ORI and Shirsov Massif appear to have formed later, following the northward migration of the Shatsky triple junction. However, it remains unclear whether mechanisms involved in the formation of this triple junction and related mid-ocean ridge volcanism created Shatsky Rise, or whether a plume source explains its significant size and volume. Our initial age determinations suggest TAMU Massif formed within 1 m.y. of the formation of the local oceanic crust (145 ± 1 Ma [2]). Results from the top of IODP Expedition 324 Hole U1350A at ORI Massif have magmatism occuring at 134 ± 1 Ma. At that time the triple junction had already migrated well north of Shirsov Massif. A dredged sample (TN037) from Toronto Ridge on TAMU is 128.2 ± 0.5 Ma. These ages reveal magmtism began with the rapid construction of TAMU massif and then continued or began again 16 m.y. later, after the triple junction migrated hundreds of kilometers to the north.

Overall, 50 groundmass and plagioclase separates from across Shatsky Rise and the related seamounts were meticulously picked, acid-leached and processed. Thirty-four samples were analyzed from TAMU massif (IODP Expedition 324 Site U1347 [n=17], ODP Leg 198 Site 1213B [n=14], and dredging cruise TN037 [n=3]). Seventeen samples were analyzed from ORI Massif (IODP Expedition 324- Sites U1349 and U1350 [n=16] and along the flank of the massif from TN037 [n=1]). Four samples were analyzed from Shirsov Massif (IODP Expedition 324 Site U1346). Samples were variably altered and were treated with an extensive acid leaching regimen[3], including an extra 2 x 15 minutes of 5% HF treatments for plagioclase grains. Samples were then analyzed on an Argus VI noble gas multi-collector mass spectrometer in the $^{40}Ar/^{39}Ar$ Geochronology Lab at Oregon State University.

[1] Sager *et al* (2013) *Nature Geosci.* doi:10.1038/ngeo1934.
[2] Müller *et al* (2008) *Geochem., Geophy., Geosyst.* **9**
[3] Koppers *et al* (2004) *Geochem., Geophy., Geosyst.* **5.**