SO201 – First age data on magmatic rocks from the Stalemate Fracture Zone (NW Pacific) obtained during SO201-1b KALMAR cruise

Krasnova E.[1], Portnyagin M.[1,2], Silantiev S.[1], Werner R.[2], Hauff F.[2], Hoernle K.[2]

[1] V.I.Vernadsky Institute of Geochemistry and Analytical Chemistry RAS, Kosygin St. 19, 119991 Moscow, Russia

[2] GEOMAR Helmholtz Center for Ocean Research Kiel, Wischhofstr. 1-3, 24148 Kiel, Germany

The Northwestern Pacific is one of the least studied regions in the world's oceans where, except of the Emperor Seamounts, no age and compositional data for the igneous oceanic basement existed prior to KALMAR SO201 expeditions. A major tectonic feature in the NW Pacific is the Stalemate Fracture Zone, where a variety of volcanic and plutonic rocks from all layers of the oceanic lithosphere were dredged during Leg 1b in the summer of 2009.

Biotite-bearing diorites, unusual for oceanic lithosphere, were dredged at station DR7 in association with more typical MORB-type dolerites. The study presented here was aimed at obtaining absolute ages for the diorites in order to confirm or disprove their origin in the extinct Kula-Pacific spreading center. Rb-Sr age dating was performed for sample DR7-12 consisting of 75% plagioclase, 13% biotite, 6% amphibole, 4% pyroxene, and 1% Fe oxide. Isotope analyses were performed in the Vernadsky Institute, Moscow using isotope dilution technique described by Kostitsyn et al. (1995). Isotope measurements were performed with a multi-collector thermal ionization mass-spectrometer TRITON TI. Uncertainty of 87Rb/86Sr determination is c. 1%.

The Rb-Sr isochron was constrained on four data points representing analyses of bulk rock, plagioclase separate, and two separates of biotite of different size fraction. The isochron yields an age of 62.5±1.4 My with initial (87Sr/86Sr)0 = 0.70427±0.00012 (Fig. 1) providing the first determination of absolute age for igneous rocks in the NW Pacific.

Taking into account the significant amount of diorite fragments obtained at station DR7, their geochemical variability and the age which is much older than that of the Aleutian Arc (Jicha et al., 2006), we conclude that the diorites are unlikely to represent ice rafted material. We interpret them as in situ rocks formed at the Kula-Pacific spreading center. The origin of a relatively high initial 87Sr/86Sr of the diorites compared to typical MORB indicates an enriched source, which is different from that of the MORB-type basalts predominating in the Stalemate Fracture Zone and requires further investigation.

According to Lonsdale (1988), spreading of the Kula-Pacific Rift stopped at 43 Ma and thus constrains the minimum possible age of rocks within the Stalemate Fracture Zone. The age of diorites from the Stalemate Fracture Zone is consistent with their origin at the Kula-Pacific Rift and confirms left lateral movement along the fracture zone. Taking into account the present location of station DR7 and magnetic anomalies on the Pacific Plate to the north from DR7, the offset along the fracture zone can be estimated to about 200 km.

In conclusion, absolute Rb-Sr age data confirm the origin of diorites in the former Kula-Pacific spreading center and provide the first absolute age determination for the ocean floor in the NW Pacific. This data can be used in regional plate-tectonic reconstructions and allow us to estimate the possible offset along the Stalemate Fracture Zone to be ~200 km. The source and processes responsible for the origin of trace-element and isotopically enriched diorites containing abundant hydroxyl-bearing minerals (biotite, amphibole) at the Kula-Pacific spreading center remain unclear and will be the focus of future investigations.

REFERENCES

Jicha, B.R., Scholl, D.W., Singer, B.S., Yogodzinski, G.M., Kay, S.M., 2006. Revised age of Aleutian Island Arc formation implies high rate of magma production. Geology 34, 661-664.

Lonsdale, P. (1988). Paleogene history of the Kula plate: Offshore evidence and onshore implications. Geological Society of America Bulletin 100, 733-754.

Kostitsyn, Y. A., Kovalenko, V. I.,Yarmolyuk, V. V., 1995. Rb-Sr Isotopic Dating of Ary-Bulak Ongonite Stock (East Transbaykalia). Doklady Akademii Nauk 343: 381-384.

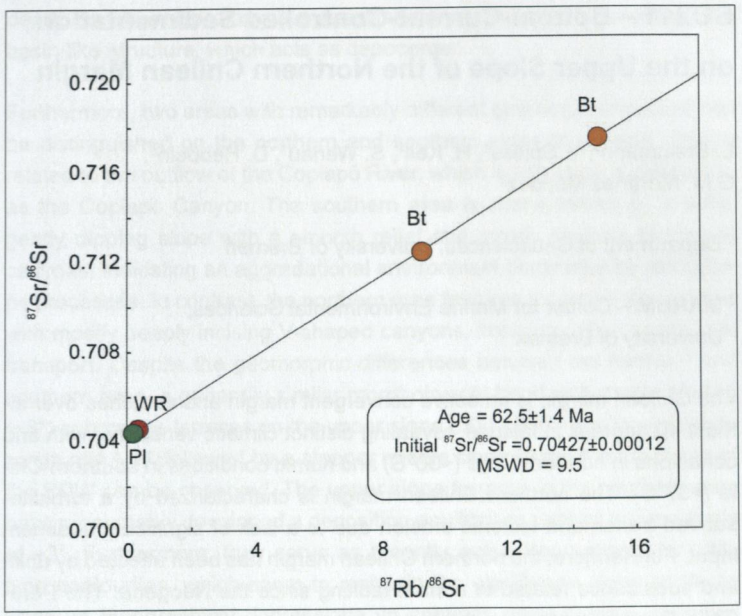

Figure 1. Rb-Sr isochron for diorite SO201-1b-DR7-12. Labels at data points denote analyses of whole rock (WR), plagioclase (Pl), biotite (Bt). Uncertainty of the isotope ratio determination is less than the symbol size.