# Silicification of peridotites from the Stalemate Fracture Zone, NW Pacific: Tectonic and geochemical applications*

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One of the most significant achievements of the R/V Sonne cruise SO201-1b KALMAR is a very successful sampling at the Stalemate Fracture Zone (SFZ) because no data on bedrocks existed for this area in the NW Pacific. Bathymetric surveying during the cruise confirmed earlier data that SFZ includes a partially disintegrated NW-SE trending transverse ridge situated along fracture zone. Dredging during the SO201-1b was performed at several locations on the northern slope of the ridge. Dredge 37 was carried out just north of the characteristic bend of the ridge where SFZ turns clockwise to NNW-SSE as it approaches the Aleutian trench (FS Sonne Fahrbericht, 2009). The dredge track sampled the east-facing slope from 4,360 to 3,995 mbsl and recovered highly altered rocks, which were recognized at onboard examination to have ultramafic protoliths of mantle origin (dunites, harburguites and lherzolites), testifying to significant vertical uplift along the fault that probably also enhanced deep fluid migration.

Data on geochemistry and petrology of these ultramafic rocks obtained in the IFM-GEOMAR as well as in the Vernadsky Institute during the last year are presented in work by Krasnova et al. (2011, this volume). The close association of dunites and moderately depleted lherzolites in the SFZ has been interpreted to result from interaction of lherzolitic shallow mantle with Ti- and Na-rich melts that leaded to reactive replacement of lherzolites by dunites along the melt channels. On the later stage, both dunites and lherzolites were modified by seawater alteration. Although extensive alteration is typical for abyssal peridotites, a very enigmatic geochemical feature of the rocks formed after dunites is their extremely low MgO (1.4-10.2 wt.%) and high $SiO_2$ (71-89 wt.%) contents. We assign this phenomenon to specific and rare type of low temperature sea-floor alteration (silification). Possible mechanism and processes responsible for the silification of the SFZ dunites are discussed in this presentation.

Comparative analyses of co-variations between $SiO_2$ (presumably, the most mobile major component in the system) and major and trace element contents in studied rocks allow us to outline some geochemical and mineralogical trends related to silification of the SFZ dunites. (1) Co-variations of $SiO_2$ vs. Sc, Zr and Ti contents confirm primary dunitic origin of these strongly altered ultramafic rocks. (2) Co-variations between $SiO_2$ and Ni, MgO, and LOI (weight loss on ignition) evidence for low temperature dehydration (e.g. deserpentinization) of dunitic serpentinites. Such geochemical features as mentioned above for the SFZ dunites were not described in abyssal peridotites from the contemporary oceanic basins, where relatively high silica content in so called soap-stones originates by talc formation. Dislike talk-bearing soap-stones, the SFZ dunites are composed by quartz (!), chlorite, spinel (relic) and serpentine (trace).

Other remarkable peculiarity of the ultramafic assemblage obtained at the site DR37 is close association of strongly silificated dunites and non-silificated spinel lherzolites. This contrasting assemblage implies three possible scenarios: (i) a very different, perhaps, spatially heterogeneous conditions of alteration for dunites and lherzolites, (ii) different position of

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dunites and lherzolites in geological sequence, (iii) different age of alteration for dunites and lherzolites.

Our next step to reconstruct the processes and conditions leading to silification of the SFZ dunites will be numerical simulation. To model the complex processes of seawater-rock interaction, we are going to use thermodynamic calculations with kinetic parameters implemented within the computer program GEOCHEQ (thermodynamic data base derived from SUPCRT92) (Mironenko et al., 2008). The simulations will be performed for a range of P-T and time conditions using the least altered SVZ peridotite composition and the seawater and/or its fluid derivatives as starting materials. The data obtained by the modeling are anticipated to suggest new interpretations for the currently enigmatic silification of the SFZ dunites and will be reported at the workshop.

***References***

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