

Geochemistry and petrogenesis of the Nagar Parkar Igneous Complex, Tharparkar, Sindh

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Covering 480 km², the Nagar Parkar area in southeastern Sindh is part of the Thar Desert adjacent to the Runn of Kutchh. The area is occupied by a variety of magmatic rocks referred to as the Nagar Parkar Igneous Complex. At least six phases are recognizable: 1) basement rocks (oldest), 2) riebeckite aegirine grey granite, 3) biotite-hornblende pink granite, 4) acid dyke, 5) rhyolite “plug”, and 6) basic dykes (youngest). Of these, the last three are insignificant in volume. Radiometric dates are lacking but the grey and pink granites are petrographically comparable to the Siwana and Jalore plutons, respectively, emplaced in the Malani volcanic series. Based on these similarities and proximity, it is thus suggested that the phase 2 to 6 bodies in the Nagar Parkar may belong to the Late Proterozoic (720 – 745 Ma) Malani magmatism that covers large areas in western Rajasthan. Khan et al. (2007) have reported a $745 \pm 30 - 755 \pm 22$ Ma UThPb age on monazite from the pink granite.

The basement comprises deformed and epidote-amphibolite facies metamorphosed rocks ranging from mafic to granodioritic composition. They appear to be the products of crystallization differentiation of calc-alkaline magma of island arc affinity. The phase 2 to 5 rocks, forming stock-size plutons to minor dykes, range from peralkaline (most common) to peraluminous granites, microgranites, rhyolite and trachyte. They display very similar trace element characteristic and classify as typical within plate, A-type granitoid. Their trace element patterns are akin to those of Mull (Scotland), Skaergaard (Greenland), and Sabaloka (sudan) granites, which are emplaced in attenuated to normal continental crust.

The basic dykes are divisible into hornblende-bearing (dioritic/lamprophyric) and pyroxene-bearing (doleritic) types. Both are alkaline and show some chemical resemblance to continental alkaline basalts. Significantly, the mantle-normalized diagrams of the basic dykes are similar to those of the main granites except for relatively lower concentrations of trace and rare earth elements. This similarity provides a strong argument in favour of derivation of the parent magmas of phase 2 to 6 rocks from the upper mantle. However, during ascent, the magmas that produced the granitic rocks were contaminated with crustal material. In terms of tectonic evolution, the Nagar Parkar region appears to be a composite terrane that developed initially as an island arc. It was accreted to other terranes to constitute a Precambrian continental crust. During the collision it may have experienced deformation and metamorphism in epidote-amphibolite facies. During the Late Proterozoic, the terrane played host to continental magmatism related to epeirogenic uplift (doming) and extension.

Reference:

Khan, T., Murata, M. and Oto, A., 2007. Internat. Assoc. Gondwana Res. 4, Conf. Series, 92-93.