Geophysical Research Abstracts
Vol. 19, EGU2017-17065-7, 2017
EGU General Assembly 2017

Structure, petrology and U–Pb zircon age of Mesoproterozoic nepheline syenites from the Rengali Province, eastern India: Implications for their petrogenesis and geodynamic evolution

Janisar M Sheikh (1), Anil K Champati (1), Suresh C Patel (1), Naraga Prabhakar (1), and Axel Gerdes (2)

(1) Department of Earth Sciences, I.I.T. Bombay, Powai, Mumbai, 400076, India (janisar.sk@iitb.ac.in), (2) Institute of Geosciences, Goethe University, Altenhoferallee 1, 60438 Frankfurt, Germany

Three Mesoproterozoic nepheline syenite intrusions, namely Chhatabar, Lodhajhari and Baradangua intrusions, have been concordantly emplaced within a polydeformed and amphibolite facies metamorphosed sedimentary sequence (quartzites and mica schists) in the Rengali Province, eastern India. The metasedimentary sequence and the nepheline syenite intrusions both record three phases of folding (F_1, F_2 and F_3). The penetrative fabric in quartzites is a schistosity (S_{1SS}), while that in mica schists is a crenulation cleavage (S_{2SS}), which has transposed to S_{1SS}. The nepheline syenite intrusions exhibit magmatic to solid state deformation structures and microstructures. Magmatic layering in the rocks is commonly transposed by a prominent schistosity (S_{1NN}). Fold geometries and deformation fabrics of the metasedimentary sequence and the nepheline syenites indicate that the latter were emplaced syntectonically during F_1 folding of the metasedimentary sequence.

The dominant rock type in the intrusions is nepheline syenite, while nepheline monzosyenite and nepheline monzodiorite occur in subordinate amounts in the form of centimeter to metre scale layers. Essential felsic minerals in the rocks are microcline ($Or_{88-92}Ab_{8-12}$) and nepheline, while sodic plagioclase ($Ab_{88-96}An_{4-12}Or_{0.3-1.4}$) is additionally present in nepheline monzosyenite and nepheline monzodiorite. End member compositions of nephelines ($Ne_{77-80}Ks_{17-20}Qtz_{1.6-3.6}An_{0.5-2.6}$) fall below the 500^oC isotherm in the nepheline-kalsilite-quartz projection from anorthite which indicates low temperature re-equilibration of the mineral after magmatic crystallization. Common mafic minerals in the rocks include biotite and amphibole, the latter being taramite in nepheline syenite, and hastingsite in nepheline monzosyenite and nepheline monzodiorite. Melt-present deformation microstructures which indicate syntectonic emplacement of the intrusions include late magmatic grains of nearly pure albite ($Ab_{98-99}An_{0.8-1.5}Or_{0.2-0.6}$) and titanite in fracture-controlled openings in primary microcline and amphibole, respectively. Trace element analyses of the rocks show elevated concentrations of $LILE$ and $HFSE$, near chondritic to superchondritic ratios of $Nb/Ta(16-28)$ and $Zr/Hf(31-78)$, and REE patterns with enrichment of $LREE$ over $HREE$ ($La_N/Yb_N = 4.5-70$) and small or no Eu anomaly ($Eu/Eu^* = 0.3-2.0$) which indicate derivation of the parental melt by low degree of partial melting of an enriched mantle source. Pyrolite-normalized spidergrams show positive $Nb-Ta$ anomalies, and negative $Sr-Ba$ anomalies which argue against a subduction related origin of the rocks.

Igneous zircons from the intrusions have been dated at 1322 ± 8 Ma ($U-Pb$ concordant age, LA-ICP-MS). Electron microprobe $U-Th-Pb$ dating of monazites from mica schists in the metasedimentary sequence yield peak metamorphic age in the range of 1283 ± 13 Ma to 1333 ± 11 Ma which indicates synchronism of the nepheline syenite magmatism and sillimanite grade regional metamorphism of the metasedimentary sequence. Contrary to the common belief that nepheline syenite plutons in eastern India were emplaced in intra-continental rifts and subsequently deformed by continental collision, we propose a geodynamic scenario in which the nepheline syenites of the Rengali Province have been emplaced in localised domains of extension in an overall transpressional regime.