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Petrology, phase equilibria and In-situ U-Th-Pbtotal monazite geochronology of metasedimentary rocks from Pranhita-Godavari Basin and its implication in Mesoproterozoic-Neoproterozoic Supercontinent Assembly

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The Pakhal basin occurs as two parallel NW-SE trending sub-basins (Western and Eastern) located at the East-Dharwar Craton (EDC) and the Bastar Craton junction. The metasedimentary rocks exposed at the western side of the basin are known as the Pakhal belt, whereas those exposed on the eastern sides are known as the Albaka belt. The aggregate thickness of the sediments is nearly 6000 meters. Researchers have studied the geochemical affinities of Pakhal and Albaka rock, which proved to be crucial to understand the basin-architecture, source of sediments, and basin evolution in the context of rifting of the Dharwar and the Bastar craton However, the timing of inversion of tectonics and subsequent basin convergence is not studied.

Xenoliths of metasedimentary rocks are exposed within the EDC granites near the Pakhal basin. Aggregates of biotite, muscovite, plagioclase, and quartz constitute these metasedimentary rocks. Monazite, zircon, and iron-oxide are present as accessory minerals. The X_{Mg} Biotite (22 Opfu) varies from 0.86-0.10 and Ti content of biotite varies between 0.26-0.34 apfu. The mica is mostly muscovite with mean Si (22 Opfu.) content of 6.28 apfu. The X_{Ab} of plagioclase is constrained to be 0.97 apfu. The P-T conditions of metasedimentary xenoliths are constrained by using conventional geothermobarometers and P-T pseudosection analysis. The Ti content in biotite yield peak temperature 650^0C for the stabilization of biotite. The P-T pseudosection analysis and subsequent modeling of compositional parameters imply a temperature window of 600-700 ^{0}C and pressure 0.6-1.0 GPa for the stability of biotite-muscovite-plagioclase-quartz assemblages. ~ 50 µm monazites grains are dispersed throughout the studied sample. The ThO_2 content in the monazite grains varies between 1.7-5.8 wt%. Compositionally, the monazite grains are mostly La-Ce-Nd monazite in a tripartite classification. In a histogram distribution, the U-Th-Pb total spot ages exhibit two prominent peaks, at ~ 1295 Ma and ~ 1111 Ma. When combined with the P-T pseudosection analysis, the monazite ages imply rifting and opening the basin at ~ 1295 Ma. The ~ 1111 Ma monazite growth is correlated with granite emplacement and amalgamation of the Dharwar and the Bastar craton during Neoproterozoic Rodinia assembly.