

3.2-3.0Ga Sm-Nd age of gabbro-anorthositic rocks from the Nuasahi and Mayurbhanj Complexes (eastern India): Major mafic magmatic event in the Singhbhum Craton and associated Ni-Cu-(PGE) sulphide mineralization

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The Nuasahi and Mayurbhanj Complexes and related magmatic ore deposits (e.g., chromite, magnetite, Ni-Cu-(PGE) sulphides) were formed during major ultramafic-mafic magmatic activity in the Singhbhum Craton in eastern India. The Nuasahi Complex is characterized by a lower ultramafic unit that includes three chromitite ore bands within serpentinized dunite, and a PGE-rich breccia zone that occurs in the lower part of the upper gabbro overlying the ultramafic unit. The breccia zone contains Ni-Cu-(PGE) sulfide rich chromitite breccia with high Pd concentrations. The magnetite band in the upper part of the Nuasahi gabbro is also Pd-rich and is associated with minor sulphides. In contrast, the magnetite band in the Mayurbhanj Complex is devoid of any sulphide minerals but the lower gabbro-noritic unit contains a pyrite-dominated sulphide mineral assemblage with accessory magnetite. A Sm-Nd whole-rock errorchron for the upper gabbroic-anorthosites of the Mayurbhanj Complex yielded an age of 3022 ± 180 Ma (MSWD = 72) with an initial $^{143}\text{Nd}/^{144}\text{Nd} = 0.50849 \pm 0.00017$. This corresponds to an $\epsilon_{\text{Nd}(o)}$ value of -4.4 ± 3.3 , suggesting possible derivation from an enriched or crustally contaminated source. When samples of the lower gabbro-norites are included with the upper gabbroic-anorthosites from the Mayurbhanj Complex the quality of the correlation is degraded, suggesting that the lower gabbro-norites have been perturbed. The gabbroic samples of the Nuasahi Complex also yield a poorly defined correlation line with a corresponding age of ~ 3300 Ma with a large error. If all samples of this study from both the Nuasahi and Mayurbhanj Complexes are included in the Sm/Nd diagram, a line with an age of 3208 ± 270 Ma is obtained. Though poorly constrained, the similarity between the Sm-Nd ages of the two igneous complexes signifies a large-scale mafic magmatic event in the Singhbhum Craton in the Mesoarchean era (3200 – 2800 Ma), contemporaneous with similar mafic activity occurring elsewhere in Indian and worldwide ancient cratons. Significant magmatic ore deposits in association with ultramafic-mafic magmatism are present globally during this particular era, and recognition of the similar timing of the magmatic event enhances the exploration potential of these rocks in the Singhbhum Craton.