

New SHRIMP U–Pb zircon dates from the Singhbhum Craton, Jharkhand-Orissa region, India

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Abstract

The first ion-microprobe U-Pb zircon geochronology results arising from an international multi-disciplinary collaborative study of the Precambrian geological evolution of Singhbhum Craton of eastern India are reported. Ortho-amphibolite and metasedimentary rocks of the Older Metamorphic Group (OMG), the oldest recognized and mapped unit of the craton, have been intruded by the tonalities of the Older Metamorphic Tonalite Group (OMTG). An igneous crystallization age based on weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ dates obtained for zircon populations of 3380 ± 11 Ma (all uncertainties cited are at 95% confidence) was obtained for a sample of dark greenish grey, foliated medium- and even-grained hornblende-biotite granodiorite of the OMTG sampled near Jaganathpur. Following deformation and metamorphism to upper amphibolite grade, extensive granitic rocks of the Singhbhum, Bonai and Kaptipada Granitoid Complexes were intruded into the OMG and OMTG. An igneous crystallization $^{207}\text{Pb}/^{206}\text{Pb}$ date of 3326 ± 5 Ma was obtained for dark grey, weakly foliated medium- and even-grained biotite-muscovite monzogranite (phase 2) of the Singhbhum Granitoid Complex sampled near Rairangpur. BIF, argillaceous and subordinate arenaceous sedimentary and mafic volcanic rocks of the Iron Ore Group (IOG) were subsequently deposited onto the craton and are at generally low metamorphic grade. An unfoliated, medium-grained pegmatitic biotite granodiorite overlain by conglomerate of the IOG and sampled near Nayadhi village gave a $^{207}\text{Pb}/^{206}\text{Pb}$ igneous crystallization date of 3285 ± 7 Ma. This date is interpreted to provide a minimum age for IOG components within this basin. Zircons extracted from a fine-grained, feldspar-porphyrific dacite tuff sampled near village of Golabhand yielded a weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ date of 2806 ± 6 Ma, interpreted as the time of igneous crystallization of the tuff. Pelitic and arenaceous sedimentary rocks, mafic sills and minor felsic volcanic rocks of the Singhbhum Group overlie the northern boundary of the craton, with the prominent Singhbhum Shear Zone delineating the boundary of the craton and the Singhbhum Mobile Belt. Three major mafic-ultramafic volcanic sequences, Simlipal, Dhanjori and Dalma, have been recognized within the Singhbhum Group. However, no reliable radiometric ages have previously been available and depositional ages ranging from 3.1 to 1.0 Ga have been inferred for these sequences. A weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ date of 1631 ± 6 Ma, interpreted as the time of igneous crystallization, was obtained for an unfoliated rhyolite from base of Chandil Formation, near the stratigraphic contact with the upper Dalma Volcanics. This result confirms that the stratigraphically upper parts of the Singhbhum Group were deposited during the Mesoproterozoic era. Further work in the Singhbhum Craton building on the strengths of this international collaborative effort is planned for the future.