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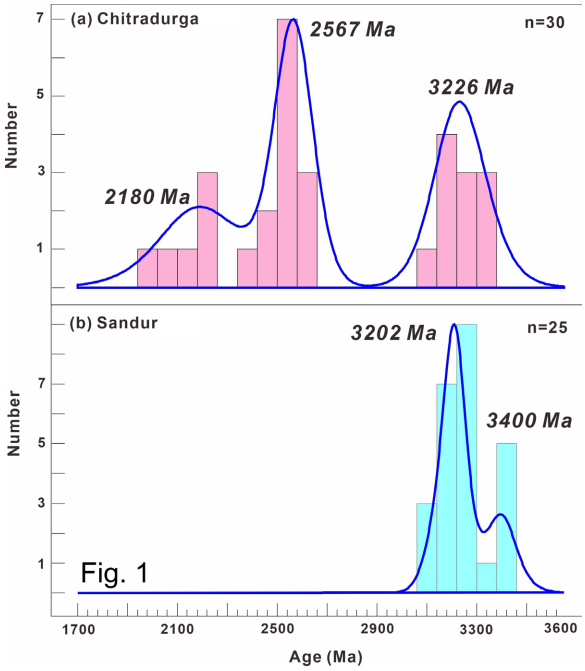
New detrital zircon records from the Paleo-Neoarchean manganiferous arenite-argillite sediments of Dharwar Craton, India

HARSHITHA REDDY[1], MANIKYAMBA CHAKRAVADHANULA[2], SANTOSH M[3,4] AND BING YU[5]

[1]CSIR-National Geophysical Research Institute
[2]National Geophysical Research Institute,(NGRI)
[3]University of Adelaide
[4]China University of Geosciences (Beijing)
[5]China University of Geosciences

Presenting Author: gangulalitty@gmail.com



Sedimentary processes operating from a source to sink greatly influence the metallogeny, biogeochemical processes and crustal evolution. The Neoarchean greenstone belts of western Dharwar Craton of southern India preserve a prolonged sedimentation history right from the initiation of Paleoarchean crust building processes. The Sandur, Chitradurga and Shimoga greenstone belts are distinctive in hosting a diverse array of clastic and chemical sediments including banded iron and manganese formations, stromatolitic carbonates and carbonaceous shales together representing a comprehensive picture of a deep basin to shallow shelf sequence of the Archean era represented by arenites, argillites, conglomerates that are associated with mafic-felsic volcanic rocks. In these greenstone belts, high grade manganese ore is preserved as diagenetic segregations within the clay deposits and the banded Fe-Mn horizons.

Here, we first time report the U-Pb detrital zircon ages of the manganiferous arenites and argillites which are the proto-ore for the Mn deposits of the Sandur and Chitradurga greenstone belts. The LA-ICP-MS studies on the detrital zircons reveal age clusters of 3.22, 2.56 and 2.18 Ga (Fig. 1) from Chitradurga belt which are morphologically elliptical to euhedral with oscillatory and sector zoning. The analysed zircons from Sandur belt unveil the ages of 3.4 and 3.2 Ga (Fig. 1) with similar morphologies. The obtained age data indicate a protracted time period of ~1000 Ma for the deposition of Manganese in these greenstone belts for which the hydrothermally derived Mn was deposited through the migrating seawaters at the shallow shelf as Mn arenite and argillites. The rare earth element (REE) patterns of the detrital zircons display depletion in light REE with prominent positive Ce and negative Eu anomalies. The zircon trace element geochemistry and their inter-relationships reflect a magmatic origin for the zircons from a mixed felsic-mafic source most probably from the basement TTG. The post depositional intense chemical alteration and kaolinitization led to the formation of pockets of high-grade Mn ore within the clays. The fluctuating acidic-alkaline conditions combined with the oxic-anoxic conditions of the Archean Sea water deposited these Fe-Mn sediments in the shallow shelf.