



Contents lists available at ScienceDirect

Journal of Asian Earth Sciences

journal homepage: www.elsevier.com/locate/jseas

SHRIMP geochronology for the 1450 Ma Lakhna dyke swarm: Its implication for the presence of Eoarchaean crust in the Bastar Craton and 1450–517 Ma depositional age for Purana basin (Khariar), Eastern Indian Peninsula

Kamleshwar Ratre^{a,*}, Bert De Waele^b, Tapas Kumar Biswal^a, Suspa Sinha^a

^a Department of Earth Sciences, Indian Institute of Technology Bombay, Powai, Mumbai 400076, India

^b Principal Consultant (Geology), SRK Consulting, 10 Richardson Street, West Perth, WA 6005, Australia

ARTICLE INFO

Article history:

Available online xxx

Keywords:

Lakhna dyke swarm
Bastar Craton
Eastern Ghats Mobile Belt
Purana basin
Geochronology

ABSTRACT

Zircon U–Pb ages of the Mesoproterozoic dyke swarms (Lakhna dyke swarm) at the interface between the Eastern Ghats Mobile Belt and Bastar Craton of the Indian Peninsula are reported here to decipher the tectonic evolution of the region. The dyke swarm, which is dominantly N–S in orientation, has intruded the Bastar Craton at ca. 1450 Ma. The dykes vary in composition from dolerite to trachyte and rhyolite and have been emplaced in a continental anorogenic setting. The above age puts a lower time constraint on the sedimentary sequences of the Purana basin (Khariar basin) that have been deposited unconformably over the Bastar Craton. The shale member of the Khariar basin shows evidence of synsedimentary shearing suggesting that the sedimentation probably continued up to 517 Ma, the age of shearing and overthrusting of the granulite nappes of the Eastern Ghats Mobile Belt on the Craton. Further, the compression accompanying thrusting of the nappes, uplifted the Purana basins during inversion.

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1. Introduction

The tectonic evolution of Craton–Mobile Belt boundaries is often enigmatic, primarily due to shearing and thermal activities that repeatedly take place in such regions over large spans of time. The margin between the Archaean Bastar Craton and the Proterozoic Eastern Ghats Mobile Belt (EGMB) of the Indian Peninsula poses such a problem (Fig. 1a and b). The area close to the interface, which has been marked by the terrane boundary shear zone (TBSZ), is characterised by a wide range of rock types from Archaean to Cambrian in age, and from almost undeformed and unmetamorphosed to multiply deformed and highly metamorphosed lithologies. The present study focuses on the tectonic correlation between the Khariar basin, the Bastar Craton and the EGMB and is based on a field study and historic isotopic ages. We also report new SHRIMP ages of dykes intruded into the basement and the TBSZ, shedding more light on the tectonic evolution of the area.

2. Regional geology

The eastern part of the Indian Peninsula exposes three geologically distinct terrains; the Mesoproterozoic EGMB, the Archaean Bastar Craton and the Purana basins. The Purana basins fringe

the EGMB front (Fig. 1a). The EGMB runs over 1000 km along the east coast of India. It has been considered as a fragmented part of the ca. 1200 Ma old Rayner Complex of Enderby Land of East Antarctica, in the inferred Gondwana assembly (Yoshida, 1995). The EGMB consists of granulite facies rocks, namely charnockite, mafic granulite, calcic granulite, khondalite, graphitic gneiss and enderbite that have been intruded by several phases of granite, anorthosite and nepheline syenite. The Mobile Belt depicts a juxtaposition of several terranes along longitudinal and transverse shear zones (Fig. 1b). Some of the terranes show Archaean Sm–Nd model ages (ca. 2000–3200 Ma for the orthogneiss), however, the granulite metamorphism is broadly divided into three phases with ca. 1600 Ma, 1000 Ma and 600 Ma ages (Rickers et al., 2001; Dasgupta and Sengupta, 2003; Dobmeier et al., 2006; Biswal et al., 2007). The EGMB is juxtaposed with the Dharwar, Bastar and the Singhbhum Cratons of the Peninsula, with the line of juxtaposition being marked by the TBSZ, which shows a thrust slip character in the west and southwest and strike slip in the north. The Mobile Belt on the NW front displays a fold-thrust belt (ftb) structure consisting of a stack of granulitic thrust sheets with the TBSZ acting as a basal décollement. Based on the SHRIMP age of synkinematic nepheline syenite plutons (Biswal et al., 2007) emplaced along the TBSZ, a Pan-African age of juxtaposition of the EGMB with cratons of the Peninsula has been suggested.

The Bastar Craton consists of vast exposure of undeformed and unmetamorphosed ca. 2500 Ma old potassic granites. Gneissic xenoliths, varying in dimension from a few meters to hundreds

* Corresponding author.

E-mail addresses: kratre@iitb.ac.in (K. Ratre), bdewaele@srk.com.au (B. De Waele).