

## **Archaean Dharwar craton in India: An ideal terrane to understand the early Earth's surface environment and origin of life**

M. SATISH-KUMAR <sup>1</sup>, \* MISHIMA, Kaoru <sup>2</sup>, KOINUMA, Kentaro <sup>1</sup>, UENO, Yuichiro <sup>2</sup> and HOKADA, Tomokazu<sup>3</sup>

<sup>1</sup>Department of Geology, Faculty of Science, Niigata University, Niigata 950-2181, Japan

<sup>2</sup>Department of Earth and Planetary Sciences, Tokyo Institute of Technology, Tokyo, Japan.

<sup>3</sup>National Institute of Polar Research, Tachikawa, Tokyo, Japan

\* satish@geo.sc.niigata-u.ac.jp

Earth's surface environment and the evolution of life in the Hadean and Archaean times has always been an intriguing topic of debate among the scientific community because of the sparsely remaining rock record. Geochemical records including the isotopic compositions of several elements have been critically used as proxies for understanding how the Earth evolved in the early stage. For example carbon isotopes were considered as most convincing (but controversial too) evidence for distinguishing biotic and abiotic origin of carbon in the Archaean, whereas multiple sulfur isotopes played a crucial role in our understanding of changes in atmospheric oxygen content. Here I attempt to showcase the Archean schist belts in Dharwar craton, in southern India, especially the Chitradurga Schist belt, Southern India, where the rock records date back to 3.0 to 2.6Ga. A compilation of available geological and geochemical results indicate that the Chitradurga schist belt is an ideal geological entity to study the environment in the "pre-great oxidation event" period.

The Archaean strata of the Dharwar comprises of Sargur supracrustals, the peninsular gneiss complex and the Dharwar Supergroup. The Dharwar Supergroup is further subdivided into the Bababudan and Chitradurga Groups (Ramakrishnan and Vaidyanadhan, 2010). Our new field mapping and zircon U-Pb dating helped us to reconstruct a detailed lithostratigraphy. The lower unit (post-3.0 Ga) consists of basal conglomerate, stromatolitic carbonate, silici-clastics with diamictite, chert/BIF and pillowed basalt, in ascending order, all of which are older than 2676 Ma magmatic zircon ages from dacite dyke intruded into the topmost pillowed basalt (Hokada et al., 2013). The upper unit unconformably overlies the pillow lava, and consists of conglomerate/sandstone with ~ 2600 Ma detrital zircons, komatiite lava, BIF and silici-clastic sequence with mafic volcanics. Stromatolites have been reported by Srinivasan et al. (1989), where they described the occurrence of columnar,

pseudocolumnar and terete-shaped stromatolites from the Vanivilas formation of the Chitradurga Group. Columnar stromatolites were collected from the same localities.

Stromatolitic carbonate rocks show large variation in carbon, oxygen and strontium isotopic composition. The  $\delta^{13}\text{C}_{\text{PDB}}$ ,  $\delta^{18}\text{O}_{\text{SMOW}}$  and  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios vary from -2.3~0.1‰, 14.8~22.5‰ and 0.715~0.7031, respectively, whereas  $\delta^{13}\text{C}_{\text{PDB}}$  values of carbonaceous material vary between -22.1~-5.8‰. Multiple sulfur isotope studies of pyrite carbonate rocks from Bababudan Group show very large variation  $\delta^{34}\text{S}$  values up to +19.4‰ with negative  $\Delta^{33}\text{S}$ , whereas other sedimentary rocks show  $\delta^{34}\text{S}$  values near to 0‰. In general, the  $\delta^{13}\text{C}_{\text{PDB}}$  values of organic matter are high, but the massive dolomites have lower  $\delta^{13}\text{C}_{\text{PDB}}$  values. Combining isotopic results with microstructural observations, the possibility of rise in atmospheric oxygen contents before the GOE is discussed in this presentation. Furthermore, isotopic and microstructural proxies will enlighten us about the Archaean biological activity and surface environment and its evolution.

## References

- Hokada, T., Horie, K., Satish-Kumar, M., Ueno, Y., Nasheeth, A., Mishima, K., Shiraishi, K., 2013, An appraisal of Archaean supracrustal sequences in Chitradurga Schist Belt, Western Dharwar Craton, Southern India Original Research Article *Precambrian Research*, **227**, 99-119
- Ramkrishnan, M., Vaidyanadhan, R., 2010, Geology of India, Volume. 1 Geological Society of India, Bangalore p. 556
- Srinivasan, R. Shukla, M., Naqvi, S.M., Yadav, V.K., Venkatachala, B.S., Uday Raj, B., Subba Rao, D.V., 1989, Archaean stromatolites from the Chitradurga schist belt, Dharwar Craton, South India *Precambrian Research*, **43**, 239-250.