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EDITOR'S DESK

We are pleased to place before you the second issue (March–June) of the year 2015 entitled "*Aspects on Crustal Evolution and Geochronology*" meticulously guest edited by my colleague Professor Sajeev Krishnan, Center for Earth Sciences. Our Earth is about 4500 Million Years old based on studies related to the chronological studies on the starting material, meteorites. In all, we find seven articles in this issue addressing the crustal formation and the methodologies designed to study the various aspects. Geological evolution has always been fascinating particularly with respect to the slow but definitive changes which occur after the formation of the crust. The rich mineral information content makes the study quite complex yet intriguing. On behalf of the editorial board I express my sincere thanks to all the authors who have put in an enormous effort to bring this issue, which would serve as a store of knowledge on crustal evolution. Special thanks to Sajeev to have guest edited this issue and for getting the articles reviewed in time for publication. The editorial staff has worked round the clock to bring the issue on time as always and I thank their dedicated efforts in this context.

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GUEST EDITOR'S DESK

Aspects on Crustal Evolution and Geochronology

"*Everything changes but changes itself. Everything flows and nothing remains the same… You cannot step twice into the same river, for other waters and yet others go flowing ever on*" said the Greek philosopher Heraclitus referring to the changes. Our abode in the universe- the Earth is no different. It has evolved from a red ball of magma to a blue ball of lofty mountains and green valleys with streams of water flowing to the ocean. The history of the Earth dates back to 4500 Million Years ago, as revealed by the chronological studies on the meteorites, which is thought to be the starting material to the Earth's formation. The oldest rock is found in the Slave Craton region of Canada which dates back to 4200 Million years, implying the early crust was formed at least by then. Since there are no oceanic crustal remnants older than 200 Million years available to us, (except for the 2500 Million year old eclogites and ophiolites formed 1900 Million years ago) continental crust would hence be the narrator. This aspect corresponds to the Earth's moving plates known as plate tectonics, by which plates goes back to the mantle beneath causing earthquakes and the eruption of volcanoes. Since its formation, both the continental and oceanic crust was subjected to various internal and external processes, which is the challenge. Therefore, it needs a different vocabulary to read the rocks so as to unravel the processes and their chronology. More complex is the issue of over-printing of latter processes (as shown in the cover page) on the former, due to 'crustal reworking'. Hence the success would be to delineate older over the younger processes. With the advent of new technologies, it is now possible to investigate and find reasons for many of those. But it requires right discernment on the material and methods of study. For instance, the robust mineral zircon is considered to be the best available material to probe the processes, as old as the Earth's age, through U-Pb radiometric dating. One should be cautious before jumping to interpretations as even zircons are susceptible to alterations made by external agencies like the migrating crustal fluids.

This issue entitled '*Aspects on crustal evolution and geochronology*' compiles events of crustal evolution from Archean to recent and the technicalities of various methods of study by discussing cases from both India and abroad. Out of the seven contributions included in this issue, four deals with crustal evolution while the rest deals on specific methodologies.

The review by **Harlov** presents REE enriched minerals like monazite, zircon, xenotime, allanite, garnet etc., their interaction with each other and role as geochronometers. These minerals can be used as geochronological tracers for interpreting geochemical processes. However, it is important to understand that crustal fluids especially alkali bearing brines can alter these minerals, as mentioned above.

Another review included in this issue is on 'chemostratigaphy' by **Satish Kumar**. It discusses the possibilities of the chemostratigraphy as a tool to determine the depositional history of carbonates found in the orogenic belts, using Sr and C isotopes. Although post collisional processes like metamorphism or tectonic displacements affect the carbonates, chemostrtiaphy is effectively used to understand the processes related to their deposition. A worked example from the highly metamorphosed Sør Rondane Mountians in the Dronning Maud Land, East Antarctica is also discussed.

The article by **Chaudhary** discusses the Optically Stimulated Luminescence (OSL) dating method on sediments from Himalayas, where the surface processes by almost all agencies except wind are active. The method provides chronology for a variety of events, such as past glaciation events, age formation age of river terraces, paleo–lacustrine deposits, landslides, floods, seismic events with substantive new insights into timing and style of geological processes.

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The last among the methodologies presented, is a brief review on the Lu-Hf isotope method in zircon by **Bhattacharya** and **Shazia**. This method is a powerful tool in understanding the crustal-mantle differentiation processes and is now widely used to understand the generation as well as the reworking of crust. The Lu-Hf method is also used as chronometer and is potentially put to use to date metamorphic events from minerals like garnet.

Malaviarachchi and **Dharmapriya** present a compilation of the reaction texture studies on the Ultrahigh-Temperature (UHT) rocks from the Highland complex of Sri Lanka. Major UHT assemblages present in the gneisses of the Highland complex include saphirine + quartz, orthopyroxene + sillimanite + quartz, spinel + quartz and garnet + orthopyroxene + cordierite, formed in a P-T space at 8–12 Kbar and temperature exceeding 1000°C. The studies of UHT rocks provide a window to the lower crustal processes and evolution during the Proterozoic era.

The migrating crustal fluids not only play its part in evolving the crust, but also accounts for the major gold deposits around the globe. However, the source of these fluids is highly debated. **Bhattacharya** *et al.*, makes an assay on the source of the fluids resulted in the lode gold deposits from the eastern part of Archean Dharwar Craton. The authors are of the view that late magmatic fluids are the most potential source of gold bearing fluids. These fluids can carry considerable amount of gold in solution to a long distance through shear zones and fractures.

George and **Sajeev** give an appraisal on the crustal evolution of the eastern part of Palghat-Cauvery Shear Zone, a major shear zone in Southern Granulite Terrain of India. The authors suggest two-stage crustal evolution in the region from the available geological and geochronological evidences of the region. The first evolutionary event is marked by the granulite grade metamorphism that happened in the Paleoproterozoic era, immediately after the formation of Neoarchean Kolli-massif. This was followed by the reworking of Archean crust by Neoproterzoic era, which resulted in the formation of Cauvery Shear Zone.

To summarize, the Earth we see today has been shaped by myriads of internal and external processes, which are unique to the planet as described above. Such evolutionary processes has made the planet habitable for the existence of life, liquid water, oxic atmosphere and moving plates. It reminds us of the fact that things evolve like a shadow from dusk to dawn and we are here to marvel at the changes that never ends.

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