DISCUSSION

'HEAVENLY BOUNTY' – SOME THOUGHTS ON IMPACT METALLOGENY

by B.P. Radhakrishna. Jour. Geol. Soc. India, v.72, 2008, pp.705-712

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As always Dr. Radhakrishna's editorial is of great interest and draws attention of Indian geologists to look at the possibility of mineral deposits in Archaean greenstone belts having been formed by impacts of heavenly bodies like meteorites, asteroids and/or comets....

While it is well taken that during the early part of the earth history, impacts could have been more common, it is still not very clear whether the impacting bodies directly contribute to mineral wealth.... In the Witwatersrand Basin of South Africa, the basin was receptor of placers from the preexisting greenstone belts of Barberton cycle and mineralization had little contribution directly from heavenly bodies. Impact may trigger development of express pathways for upward migration of metal-rich magmas/hydrothermal fluids. The mineral wealth of some of the impact structures/ basins hence may be attributed to similar impact-induced magmatic/hydrothermal activity, rather than to asteroids as the direct source of mineral bounty.

Radhakrishna opines that the komatiites, cherts and graphitic schists (of the >3000 Ma old Sargur Group supracrustal rocks of the WDC; he obviously implies) constitute secondary (?) crust, which in all likelihood represents material derived from outer space as remnants of the early phases of asteroid bombardment. The present writer instead considers that the komatiites of the Sargur Group are the offspring of the upper mantle. The delivery may be either normal (through mid-oceanic ridge or rift) or through caesarean cut (impact induced rift). If rifts in the continental crust were considered as channel ways for the upward movement of komatiitic magmas, then the development of rifts could be related either to terrain specific tectonic evolution or to asteroid bombardment. Up until this date there are no evidences for the latter in the Holenarasipur-Sargur region.

Peridotitic and basaltic komatiites of the >3000 Ma old supracrustal rocks of the Sargur Group, which share the characteristics of this clan of rocks as seen in different parts of the world.... were derived from melting of the upper mantle and are in part contemporaneous with the precursors (felsic magma?) of the surrounding, widespread Peninsular gneiss (TTG). Precursor rocks of the TTG were derived from subducting ocean slab. During ~3300-3000 Ma old gneissification events of the precursor rocks of the polyphase Peninsular gneiss, the terrain also witnessed k-metasomatism. It is not possible to visualize that asteroid can simultaneously supply (or constitute) ultramafic, mafic, polyphase felsic magmas and k-rich magmatogenic or metamorphogenic hydrothermal fluids. The ultramafic and mafic volcanic rocks and precursor rocks of the Peninsular gneiss, which, evolved under plume-arc tectonic regime, did not form in one shot.

The present comments are not to undermine the importance of impacts in Archaean aeon, but is a plea for proposals on the basis of concrete evidences – geofacts and balanced geological interpretation.

B.P. Radhakrishna, *Email: kkitts@gmail.com;* replies:

The critic has neither comprehended the central theme of my paper nor understood the concept of 'impact metallogeny'. He has totally missed the two significant points about metal concentrations in the crust – (1) the remarkable circumstance that all the major metal deposits so far identified are confined to the outer skin of the crust and (2) granting that they are derived from the mantle, we find no stages of enrichment of metal which is found in ppb level to yield a highly concentrated metal deposit in the outer layer of the crust. In the absence of sources for such heavy concentration of metal, an extraterrestrial source has been assumed. Impact origin is one such source which explains concentration of metal in the outer skin of the crust. The Big Bang origin of the planetary system, the plate tectonic theory are projection of new ideas. In fact Harry Hess, who first put forward the Theory, labeled it as 'geopoetry'. But today it has been able to explain the architecture of the earth. It has become an all embracing concept. If he had waited for the type of concrete evidence like the one which the commentator is thinking of, we would be still groping in the dark for a comprehensive mechanism to explain earthly processes in a satisfactory and convincing manner.

Lengthy comments made on the komatiites is not

connected with the subject at issue 'impact metallogeny'. The primary crust of the earth is largely destroyed and the present day crust is a secondary crust modified through impacts. Archaean komatiite volcanism is associated with meteorites and meteorite impacts. Spnifex texture komatiite volcanics were long ago suggested to be an impact matter from chondrite meteorites. Cosmic spherules contain spinifex olivine. The idea that Archaean greenstone belts can be very large impact features in not something new, but held by many workers on the Archaean.

The fact of early bombardment of the planetary bodies is evident by the trace of numerous craters. We, in India, seem to have failed to recognize them because we have failed to look for them. There may be different source of metal from the impact body. More work on this aspect is in fact necessary. Considering the transfer of metal was in vapour phase, structure at the site of impact had an important bearing. Further detailed geochemical work, especially on isotopic concentration, may help in distinguishing material of terrestrial and extraterrestrial origin.

The sun and the rest of the planets of the Solar System are a part of solar cloud in which nuclear synthesis was continuously operating, mixing and segregating the heavier elements. The segregated metals were in all probability introduced to the planet earth during the first 1000 m.y of its coming to existence. My plea is to explore all possibilities, 'Impact Metallogeny' being one such possibility which greatly enhances the scope of our study. Suggestions made in my speculative essay should be viewed in this light.