LARGE METEORITE IMPACTS AND GENESIS OF PRECAMBRIAN GRANITES. M.S. Sisodia Department of Geology, J.N. Vyas University, Jodhpur, 342005, India. sisodia.ms@gmail.com

Earth's continental crust is largely granitic (86%) thus granitoids have been a subject of comprehensive study for the Earth Science community. Extensive variation in composition, texture and emplacement of granites generated many conflicting views regarding its genesis, which as a consequence still remains an enigma. Chappell and White [1] classified granites into I-type and S-type based on their chemical and mineralogical composition. Granites resulting from melting of infra-crustal protolith and constituted of biotite, hornblende, sphene, magnetite with high Na_2O/K_2O ratio are called as I-type while the product of anatexis of sediments and constituted of muscovite, biotite, garnet etc but devoid of hornblende are called as S-type granites. Other authors later added, some more alphabets such as M-type (mantle granites), A-type (alkaline), C-type (crustal), and H-type (hybrid) to this classification. Granites are also classified as WPG (within plate granites), COLG (collision), VAG (volcanic arc), ORG (ocean ridge), IAG (island arc), CAG (continental arc), CCG (continental collision), POG (post orogenic), RRG (rift related), CEUG (continental epeirogenic) and OP (oceanic plagiogranites) on the basis of their tectonic environment [2]. Granites are invariably intimately associated with chemically erratic xenoliths and microgranular enclaves. How such xenoliths evolve within granites has been a matter of concern. To resolve this disorder 'restite- unmixing' hypothesis was proposed [3] but that was not accepted and was left to "rest-in-peace". Granites are also classified as Late-orogenic, Post-orogenic and Anorogenic on the basis of chemical composition associated with mountain building activity [4,5]. A geochemical classification on a three-tier strategy based respectively on iron ratio, modified alkali-lime index (MALI) and aluminium saturation index has also been proposed [6]. Experimental petrology has helped in resolving many rock genesis controversies [7] thus on the basis of experimental results scientists supported classification of granites based on mixing/hybridization of anatectic melts with mantle-derived magma [8]. The term 'Suite' is therefore used to define a group of igneous rocks derived from a common source [9] but the genetic significance of suite has always remained questionable because of chemically distinct variables found in all types of granites [10]. Although there are many controversies and confusion regarding genesis of granites but there exists a consensus that crustal anatexis and recycling of pre-existing crustal material has played a significant role in the petrogenesis of granitoids. Notwithstanding this consensus the earth science community has still no answer to explain crustal melting process, regions of magma generation and granitic intrusion mechanism. In the present paper two cases of impact derived granites are discussed to understand and elucidate the origin of granites due to impact.

Impact cratering is a fundamental process responsible for planetary accretion to shaping the planets. Small and big extra terrestrial bodies have continuously hit the Earth since its formation, similar to Moon and other planetary bodies. The effects of theses impacts on the Earth undergo erosion, weathering or get buried under sediments; nevertheless there are characteristic shock metamorphic features that help in the recognition of impact craters [11].

The molten rocks of Neoproterozic age, dominantly granites and rhyolites, covering an area of about 51 thousand sq km in western India, named as Malani Beds have been inferred to have evolved due to anorogenic felsic magmatism [12]. No consensus however exists regarding their nomenclature, origin and duration of magmatism [13, 14]. Recent survey of Malani Beds revealed the whole area as a highly eroded complex crater with diagnostic impact related features that divulge Malani rhyolite and granite as solidified impact melts [14]. In another case the Palaeoproterozoic felsic rocks, dominantly sheared and brecciated granites, occupying an area of about 750 sq km, structurally placed in a 'caldera' at Mohar area of Shivpuri district in M.P., India are debatably interpreted to have originated due to Plinian type volcanic explosion [15]. The observation of shock-metamorphosed features at Dhala confirmed the origin of these granites due to impact [16]. A 4.53 Ga old granite clast in the Adzhi-Bogdo meteorite [17] and 3.88 to 4.32 Ga old lunar granites [18] also corroborate probable impact origin. It is important to note that impacts generate a large volume of crustal melt that behave and look similar to effusive and intrusive volcanic products. The impact melts in larger cases form deposits of considerable thickness with polygonal joints similar to that observed in large igneous provinces. The centrally uplifted structures in complex crater cases that result due to rebound of the rocks compressed due to energy of the impact appear similar to the plutonic igneous rocks. Incomplete melting of crustal material after impact produces breccia or megabreccia that explains occurrence of erratic xenoliths and chemically heterogeneous enclaves found in granites. It can therefore be concluded that silicic large provinces especially of Precambrian age needs a re-examination to unearth their relation with the impacts, if any, in order to resolve the granite genesis enigma.

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