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Origin of *in situ* Quartz Silt from quartzite weathering, Shillong Plateau (India)

R V S S [1], Sensarma S [1], Chakraborty T [2]
[1]CAS in Geology, University of Lucknow, India, shimyaphyrvs@gmail.com
[2]GSU, Indian Statistical Institute, Calcutta (India)

The Shillong Plateau (25°20'-26°30'N:90°-93°50'E) is a raised topographic feature between the Himalaya in the North and the Indo- Burman fold belt in the east. It is separated from Peninsular India by the north-trending Rajmahal-Garo Gap at which the Brahmaputra and Ganges Rivers meet. The plateau is one of the most tectonically and seismically active terrains in the present earth, with records of devastating earthquakes up to magnitudes 8.7 to 8.0 ± 0.1 in the Richter scale. Also, it is the rainiest place (annual average rainfall 2267 mm) in the present earth and a global bio-hotspot. Deformed Precambrian quartzite ± intercalated phyllite (Shillong Group) is abundantly exposed in the central part of the plateau, giving a unique opportunity to study the weathering of a lithology as resistant as quartzite in a tectono-climate setting conducive for active surface processes. The rock is made up of quartz (>95%) ± mica (4-5 %) and sparse lithics (<1%), and devoid of feldspar. Mica is of phengite composition.

The red/reddish brown weathering profiles (3.8-7.5 m thick) developed on quartzite comprise successively upward of least weathered rock/saprolith, saprolite, and soil. Evidence of *in situ* weathering of sand-sized quartz to quartz silt include: (1) quartz sand subjected to fracturing and chemical action in saprolite yielding numerous quartz silt while original quartz sand boundary is still preserved, (2) ubiquitous presence of thin (45-64 cm thick) but persistent Fe-rich nodular zone just top of saprolite; quartz sand suffered intense chemical weathering by percolating acidic fluid mediated by microbial activity, (3) reddish matrix in which nodules are impregnated maintain petrographic continuity with underlying saprolite and overlying soil, (4) overall angularity and poor sorting of quartz up the profiles, (5) consistent and regular Rare Earth Element (REE) patterns and (6), no report of eolian or glacial activity in the region in geologic past (Dasgupta and Biswas, 2000).

Quartz grain size analysis shows continuous reduction of size from dominantly medium sand (1-2ϕ) in the bedrock to fine sand (2-3ϕ) in the saprolite and nodular zone to medium silt (5-6ϕ) grain in soil. Mechanical manifestation on quartz grains is evidenced by fracture formation of different types and propagation. The density of fracturing is low in the bedrock and increases in the saprolite through the nodular zone. Fine hair line fracturing is also possible within the grain. The intergranular spaces formed by the fractures act as pathways for the chemically active fluid and enhance dissolution of quartz. Corrugation of grain boundary, notched/ embayed margins, hook/dumbbell shapes are petrographic evidences of chemical weathering. There is a general and progressive increase in bulk SiO_2 content from soil (49-55 wt %) through nodular zone (53-81 wt %), saprolite/saprock (85-95 wt %) to bedrock (≥ 95 wt %). Silica dissolution, however, do not results in silica precipitation in the form of cement at the saprolite-bedrock interface. The implication is Si may have been leached out of the system and/or taken up during aggressive biologic activity.

Reference:

[1] Dasgupta, A. B and Biswas, A.K (2000) Geol. Soc. India: 169 p.