RESEARCH NOTE

ON THE ORIGIN OF BOLE BEDS IN DECCAN TRAPS

Abstract: The origin of red boles occurring between lava flows has been a subject of controversy though widely believed that it is a product of weathering of basalts and the term 'bole' meaning fossil laterite. A red to brown clay section of 7.25 m thickness, sampled at every meter interval inclusive of the lower part of the overlying flow and the upper part of the underlying flow showed such marked physical and chemical changes which do not confirm to a weathered zone. This section forms a sample of the innumerable sections at flow contacts observed in parts of Akola, Nanded, Parbhani, Nagpur and Amaravati Districts in Deccan Traps during systematic geological mapping.

Keywords: Bole, Deccan Trap, Maharashtra.

Introduction: The purpose here is to study the chemical variation from basalt to bole and bole to basalt in a section of two flows. This would enable classification of bole as to whether it is a product of weathering showing a gradational contact with variation in the major elements from basalt to bole or it can be a separate entity formed by normal processes of deposition unrelated to the basalt giving rise to a sharp break in the contents of major elements at the contacts. The bole beds in Deccan Traps are so prominent that they indeed form excellent marker horizons aiding and guiding the systematic geologist in his task of establishing the flow stratigraphy and thereby to locate the sources of the flows and sets of flows from different sources. Flow contacts in Deccan basalts are always marked by prominent red to chocolate brown, earthy brown, green, purple, grey beds which are an admixture of clay, silt and sand sized grains forming what is popularly known as bole beds. These vary in thickness from less than 0.5 m to 2 m though sections of 3 m and above are not uncommon. Pascoe (1973) summarized the bole beds as partly due to deposition from water with plant and vegetable matter and also as relics of intertrappean lateritisation, the red colour in the latter case having been assumed much before the superjacent lava covered it. Green earth has been described by Fermor & Fox (1916) and Fermor (1927) as partly intertrappean. Deshpande (1964) rejected the idea of baking as irregular veins, lenses, stringers of bole in the interior of the flow are as common as boles enclosing residual grains, pebbles and even boulders of trap rock. Agashe & Gupta (1968) also applied the term intertrappean but believe that boles were formed due to normal weathering of purple varieties of basalt and baking is not essential. Sahasrabudhe (1978) attributes the enrichment of iron oxides from basalt to bole as a factor for its origin. Boles have been reported from other countries. Lyell (1958) gave a baking effect for the Etnean lavas of Italy and Tyrell (1949) observed that normal weathering processes are responsible for boles of Scotland and as such these are ancient soils. Blatt et al. (1972, 233p.) described the ferruginous laterite horizon containing 50-60% Fe₂O₃ and 15-25% TiO₂ as a product of weathering of olivine basalts in Hawaii.

Method of Study: A red to brown clay section of 7.25 m thickness at the contact of two flows in Akola District (Fig.1) has been sampled at every meter interval including the basal part of the overlying flow and the upper part of the underlying flow. The nine samples were
analysed for major oxides with the ICP emission spectrometer and the instrument calibration was done with the aid of two standard samples of Japanese basalts (JB-1a and JB-2; Govindarajulu, 1989). The results presented in Fig.2 display some marked changes at the contacts of the two basaltic flows. Fig.3 shows marked breaks in the curves of the major oxides at both the ends. While clay samples, be it red or brown, maintain uniformity in general, the basalts are uniform in their class. The basal or upper part of most of the flows in Deccan Traps is usually rubbly, amygdular, scoriaceous, filled with zeolites, secondary silica and to some extent calcite, making it a representative section for the study of all red beds.
Discussion and Conclusions: A weathered horizon of any rock should necessarily have a
gradational contact whereas in the present section as also several other sections the contact
is markedly sharp. The basalt core with red clayey rim in a spheroid is no doubt a strong
argument in favour of weathering (Deshpande 1964) but such features have not been
observed in any of the areas studied. The most important evidence against weathering is not
only the sharp contact with the underlying flow but also it continues on to an underlying
limestone along the same level as observed in Nanded District. This quite obviously means
that it is an entity by itself and has nothing to do either with the basalt or limestone. Similarly

Fig.2. Analytical results of the sampled section of the red and brown bed.

Fig.3. Variation of some major oxides.
baking being the reason for the red colour is untenable since red clay occurs below the limestone at places in the zone of intertrappeans. The view that red clay is formed due to decomposition of volcanic ejecta is abandoned owing to failure to find progressive changes below the surface in clay cores such as would be expected by weathering (Shepard, 1963, 403p.). Short (1961) observes gain of SiO$_2$, Al$_2$O$_3$, Fe$_2$O$_3$, TiO$_2$ and loss of MgO, CaO, K$_2$O, Na$_2$O, MnO in the soil from a parent basalt. Whereas in this section, SiO$_2$, FeO, CaO, MgO, Na$_2$O is lost and Fe$_2$O$_3$, K$_2$O gained from the basalt, as such the underlying basalt is genetically unrelated to the red bed. The low Al$_2$O$_3$ and TiO$_2$ values point towards a sedimentary origin (Pettijohn 1975, 280p.). These are not ash beds since the glass content is negligible. Instead in thin section numerous pisoliths of gibbsite and goethite are seen loosely packed with intervening spaces filled with zeolites. The latter coat the walls of columns in a columnar structure. The red beds in association with intertrappean beds of limestones, cherts and marls can be representative of a typical evaporite facies since red beds have acquired a meaning synonymous with arid continental sediments which include evaporites. This should be the reason for the occurrence of gypsum deposits in some intertrappean beds such as in Gulbarga District of Karnataka and red beds in Shadol district of Madhya Pradesh (Srivastava, 1970). Red beds are unlikely to be lahars or mudflows as these do not contain any unconsolidated unstable ash. The only other possibility is red beds can be submarine pelagic deposits enriched in montmorillonite and zeolites (Shepard 1963, 444p.).

References


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