NOTES

HAS DECCAN VOLCANISM ACCELERATED THE PACE OF BAUXITISATION?

INTRODUCTION

Conditions favourable for the formation of lateritic bauxite are known to prevail in tropical areas where temperatures are over 25°C for most of the time of the year and the incidence of rains is to the level necessary to leach rocks rich in aluminium. Most of the world’s commercial bauxite deposits are considered to have formed between Middle Cretaceous and Eocene times when optimum conditions for bauxite formation were understandably defined though earlier (Bardossy, 1981, p. 293) he had indicated that peak intensities of bauxite formation had existed at different geological periods. Bardossy’s analysis (1983) shows a conspicuous increase in bauxite formation in Upper Cretaceous when compared to Lower Cretaceous times and he opines that the marked increase may not be attributed to the parent rocks which weathered to give rise to bauxite. McFarlan (1983) considers microbiological activity as the probable factor that influenced bauxite formation.

DISCUSSION

An alternative to microbiological activity is possible if the palaeoclimatic pattern of Cretaceous-Early Tertiary times is considered. Durham (1970), on the basis of faunal and floral evidences, has suggested that between Cretaceous and Pliocene the tropical belt around the equator was wider than at present and at certain intervals of time during that period, the boundaries of the tropical belt extended to 50°–60° on either side of the equator; and that the retreat of the isotherms towards the equator occurred in later Tertiary times. The presence of Cretaceous and Palaeocene bauxites in Siberia between 50° and 60° latitude (Bardossy, 1973) also lends support to the extension of the tropical belt. The deterioration of climate during late Tertiary times has been suggested on the basis of studies on deep sea sediments by Donneley (1982). Climatic variations have been attributed to a variety of causes including changes in topographic relief, radiant heat from the Sun, internal radioactivity in the Earth, cosmical and astronomical variations and addition of volcanic dust. In this context, it is necessary to consider the possible role of widespread volcanic activity in the continents of the southern hemisphere, coinciding with the fragmentation of the Gondwanaland.

Extensive and thick stretches of basalt flows are known in South America, South Africa, Malagasy, India and Antarctica. While the basalts of South Africa and Antarctica are of Jurassic age (Windley, 1984) the others including Deccan basalts in India are thought to be of Uppermost Cretaceous age (Radhakrishna 1991). Drilling in the off-shore area of the west coast of India has brought out thin basalt flows interspersed with Late Cretaceous, Palaeocene and Lower Eocene sediments (Sastri, 1981). These thin flows probably denote the tapering of volcanic activity in post-Cretaceous times. So, from the global point of view, Deccan volcanism may perhaps be considered as an intense pulse in volcanic activity stretching from Jurassic to Lower Eocene. During this stretch of time, stupendous amounts of hot
mantle material had been spread over the skin of the continental crust in the southern continents. Such extensive and thick addition would have resulted in the setting up of thermal stresses, since basalts are known to have a temperature of about 1100°C (Bullard 1962). Naturally, the creation of thermal stresses would have led to the extension of the tropical belt on either side of the equator. The retreat of the tropical belt towards the equator in later Tertiary times was obviously due to the cessation of volcanic activity.

Of the natural sources of acid forming gases, volcanic activity is the largest source. Samples of gas collected from the Kilauea volcano in Hawaii, known for basaltic volcanism, have shown steam, carbon dioxide, nitrogen and sulphur gases with minor amounts of carbon monoxide, hydrogen and chlorine (Bullard, 1962). Reasonably similar gases would have been released into the atmosphere as a result of volcanic activity in the geological past. Atmospheric pollution by gases released in large amounts naturally leads to the precipitation of acid rains. The acidic nature of the precipitation in the wide tropical belt of Jurassic-Eocene times perhaps played a crucial role in the breaking up of silicate structures in granulitic rocks like charnockites and khondalites, ultimately leading to the formation of bauxite deposits. The quality of the bauxites as known now is presumably the compounded result of the residual weathering and leaching in Cretaceous-Eocene times.

The anomalous incidence of iridium in the formations at the Cretaceous-Tertiary boundary in some areas in the world has been attributed to an extra-terrestrial source resulting from the impact of an asteroid with the Earth towards the close of the Mesozoic Era. Opinion is divided on such an impact, but if the impact had occurred it would have reasonably induced thermal stresses on the Earth. The increase in atmospheric temperatures resulting from the asteroid impact would have fortified the thermal stresses induced by the spread of basaltic magma. While we have unequivocal evidence for stupendous volcanic activity, the asteroid impact with the Earth continues to be a contentious issue of enduring fascination.

References


