

GEOCHEMICAL BEHAVIOUR OF RARE EARTH ELEMENTS
IN ALTERITES OF PHOSPHATE AND TITANIUM ORE DEPOSITS
IN TAPIRA (MINAS GERAIS, BRAZIL) :
THE IMPORTANCE OF THE PHOSPHATES

SOUBIES F.*, MELFI A. J.** and AUTEFAGE F.***

* ORSTOM, UR/1G/Laboratoire de Minéralogie, Université Paul Sabatier, 39 Allées Jules Guesde, 31400, Toulouse, France.

** Instituto Astronômico e Geofísico da Universidade de Sao Paulo, Av. Miguel Stefano, 4200, Caixa Postal 30627, 01051 Sao Paulo, Brazil and Géosciences de l'Environnement, URA CNRS 132, Université d'Aix-Marseille III, Case 431, 13397 Marseille, Cedex 13, France.

*** INSA, Departement de Génie Civil, Av. de Ranguel, 31077, Toulouse, Cedex, France.

INTRODUCTION

The geochemical behaviour of the rare earth elements (REE) during the supergenic evolution of the rocks is not yet well known (Bonnot-Courtois, 1981; Henderson, 1984). This paper deals with the REE behaviour in ferralitic weathering profiles of the residual phosphate and titanium deposits of Tapira (Cruz and Cheney, 1976), originated from pyroxenites and peridotites containing apatite and perovskite (Figures 1 and 2). This study was carried out on a rock constituted essentially of apatite, perovskite and titanomagnetite, with diopside and phlogopite as accessory minerals.

RARE EARTH ELEMENTS BEHAVIOUR

The analysis of a microfractured and silicified fresh rock has shown perovskite as the main bearing REE primary mineral (1.5 to 2.0 % RE₂O₃), while apatite takes a very subordinated place (0.1 to 0.4% RE₂O₃).

The alteration of this rock occurring on a first stage with preservation of the volume (isovolume) leads to: (1) total removal of silica (opal and quartz); (2) partial dissolution of primary apatite along the fracture and neof ormation of secondary apatite, enriched in fluor and depleted in REE, and (3) total transformation (pseudomorphose) of perovskite into microbotryoidal anatase in the voids from which appears a crystal association (geodes) of rare earth phosphate of rhabdophane family (calcium-rhabdophane - (Ca,REE) PO₃ (O,OH) x H₂O).

On a second alteration stage it is observed that (1) all apatites are dissolved leaving behind

important assembly of voids; (2) the calcium-rhabdophane is partially dissolved and replaced by calcium-florencite - (Ca,REE)(Al,Fe)³(PO₄)(PO₃(O,OH)(OH))₆; (3) a certain titanium mobilization occurs in the interior of the anatase (corrosion gulf and tinaceous cutans) followed by its partial epigenization by ferruginous products and an initial alteration of the titanomagnetites.

CONCLUSION

The study seems to indicate that in Tapira: (1) the phosphorous has a fundamental role on trapping the REE released by hydrolysis of the bearing primary minerals; (2) the REE remain in the alterites and are fixed in mineralogical phases of a sequence of REE phosphate richer and richer in aluminium; (3) the REE and the Ti remain closely associated in the studied weathering phases.

REFERENCE

- BONNOT-COURTOIS, C. (1981) - Géochimie des Terres Rares dans les Principaux Milieux de Formation et de Sédimentation des Argiles. Thèse Doct. Etat, Université Paris XI, Orsay, 217p.
C.B.M.M. (1984) - Complexos Carbonatíticos do Brasil: Geologia, Companhia Brasileira de Mineração e Metalurgia, Dept. Geol., 44p.
CRUZ, F.F. and CHENEY, T.M. (1976) - Recursos de Fosfato no Complexo Carbonatítico de Tapira, MG. An. 29^o Cong. Bras. Geol., vol 1, p 89-107.
HENDERSON, P. (1984) - Rare Earth Element Geochemistry. (Editor), Elsevier, 500p.