OBDUCTION EVIDENCE ON THE BOLIVAR ULTRAMAFIC COMPLEX, SOUTH-WESTERN COLOMBIA

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RESUMEN: Asociado a un complejo de rocas ultramáficas y máficas, deformadas, anfibolitizadas y localmente migmatizadas ocurren tanto diques pegmatíticos que cortan a través de éste, como un depósito de magnesita criptocristalina. Estos rasgos se interpretan como producto del transporte de fluidos derivados de la base de un bloque de litósfera oceánica durante su obducción sobre la margen continental de Sur América.

KEY WORDS: ultramafic rocks, pegmatitic dykes, magnesite, obduction, plateau basalt province.

INTRODUCTION

Geological and geophysical studies show that the Northern Andes are made of two lithospheric Cretaceous provinces of different affinities: continental to the east and oceanic (the Oceanic Western Lithospheric Province - OWLP) to the west. The boundary is marked by the Cauca-Almaguer Fault (also called Romeral Fault and Dolores-Guayaquil Megashear) that parallels the western flank of the Central Cordillera from the Gulf of Guayaquil, through Ecuador and Colombia, to the Caribbean sea. To the east of the fault, calculated values of both gravimetric anomalies and seismic velocities (Case *et al.* 1971, 1973; Meyer *et al.* 1977; Ocola *et al.* 1977) suggest a crust composed of sialic materials (M=40-50 Km; Case *et al.* 1984). To the west the Andes are made of high density, high velocity materials, commonly interpreted as oceanic crust (M=25-30 Km; Case *et al.* 1984). The Pre-Cenozoic rocks of the eastern province consist on Precambrian and Paleozoic igneous and metamorphic rocks intruded by Mesozoic granitoid plutons, whereas the OWLP is made of Mesozoic (not older than Lower Cretaceous) basic volcanic rocks, associated with ultramafic complexes and marine sedimentary strata. Interpretations of the evolution of the lithosphere in Colombia (Barrero 1979; Bourgois *et al.* 1982; McCourt *et al.* 1984; Aspden &

Associated with the OWLP, within a belt situated some 20-30 Km to the

and c) exhibits local zones of strongpervasivede-farmation and

The Upper Cretaceous BUC outcrops on the eastern flank of the Western

It is covered by the recent deposits of the Cauca River. To the west the

isotropic gabbros from the BUC and tholeiites from the V... Formation

These suspected materials ... the WBLP

Replacement of pre-existing pyroxene by uralite, cummingtonite and

hornblende is conspicusus on the gabbro layers.

and local development of migmatitic textures with clear intrusive

plagioclase-hornblende dykes whereas in the upper parts the dykes are

The facts previously presented can be interpreted in terms of an obduction event during which the leading edge of the Caribbean plateau was overthrust on the continental margin of northern South America. The lack of the tectonic harzburguite on the BUC and on other ultramafic complexes placed in similar structural situation might indicate that the decoupling of this piece of oceanic lithosphere was produced at the level of the petrological Moho. During this processes the geotherm of the lithosphere that carried the obduction shifted to a region of higher temperature distilling the H_2O, CO_2 and boron contained in the terrigenous and calcareous sediments found in the continental lithosphere's upper part. The transportation of these fluids through the overthrusted block might then have cause both local fusion (by lowering of the solidus) leading to the formation of migmatites and amphibolitization of gabbros. Also, the products of the reaction between these fluids and the liquids produced by local fusion might have crystallized at fractures leading to the formation of the pegmatite dykes that cut the BUC. On the other hand, the mechanism of forming the magnesite deposits associated with ultrmafic rocks is commonly believed to involve altering serpentine by CO_2-rich waters, produced by steam distillation at depth. This mechanism agreed with the obduction model proposed and allowed to postulate a genetical model for the formation of the Bolivar magnesite deposit. In addition, the world's most important deposits of this type, located on a discontinuos belt through former Yugoslavia, Albania and Greece (particularly those of the Chalkidiki Peninsula in Greece; Dabitzias 1980) have similar characteristics to those of the Bolivar deposit. These characteristics suggest that these deposits formed as the result of obduction processes during the closure of Neo-Tethys.

CONCLUSIONS

The BUC was probably formed by crystallization in the magmatic chamber where the Volcanic Formation tholeiites (documented as formed on a oceanic plateau basalt province) evolved. During the collision of this plateau against the proto-South American continent its leading edge was obducted on top of the continental margin. During this process, connate waters contained on terrigenous and calcareous sediments that laid on top of the continetal platform were expelled as well as B and CO_2. The introduction of H_2O to the base of the obducted lithosphere (probably hot) and the heat generated by friction during thrusting of the oceanic plateau helped in the production of fluids that filled the open cracks where crystalized as pegmatitic dykes. The action of hydrothermal CO_2-rich waters on serpentinites formed by alteration of basal dunites of the CUB, produced Mg-enriched solutions that precipitated as veins close to the surface when the total pressure change from lithospheric to hydrospheric or whenever the craks caused by tectonism produced pressure drops.