STRATIGRAPHY OF THE WESTERN «CELICA BASIN» (SW ECUADOR).

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INTRODUCTION

The Celica basin is a turbiditic trough of Late Cretaceous age located in southwesternmost Ecuador and northwesternmost Peru, where it is named Lancones Basin. The sediments rest on the Paleozoic Amotape-Tahuin Massif (A-T Massif) to the West, and on the Celica volcanic arc to the East (fig.). Hence, the sediments of the basin are mainly siliciclastic toward the West and volcaniclastic toward the East.

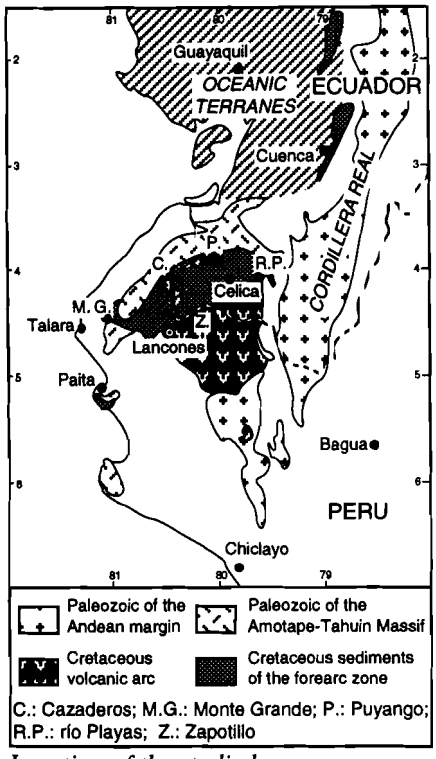
In Ecuador, the cover of the A-T Massif has been defined as a single formation of Cretaceous age (Puyango Gp or Cazaderos Fm, Kennerley 1973, Bristow & Hoffstetter 1977) that would grade laterally into the eastern series. In Peru, stratigraphic and sedimentological studies of the A-T Massif cover (Copa Sombrero Gp) resulted in the definition of several stratigraphic units (e.g. Iddings & Olsson 1928, Olsson 1934, Fisher 1956, Morris & Alemán 1975, Reyes & Caldas 1987).

Stratigraphic data on the Eastern series of the Celica Basin have been published previously (Jaillard et al. 1996). This paper presents new stratigraphic results obtained from the western part of the Celica Basin of southwestern Ecuador, i.e. the Cretaceous sedimentary cover of the A-T Massif.

STRATIGRAPHY

Basal Conglomerates. In Ecuador, greywackes and shales bearing silicified woods unconformably overly the A-T Massif basement. Then, conglomeratic quartzites with silicified tree-trunks are overlain by shales and fine-grained sandstones with thin intercalations of limestone and tuff. From poorly specified layers, Shoemaker (1982) determined Auracariaceae of Early Cretaceous age (fig.). Tuffs yielded reset K/Ar ages of 75±9 and 64±6 Ma (Shoemaker 1982). In Peru, similar quartzose conglomerates that unconformably rest on the Paleozoic A-T Massif are ascribed to the Albian (Gigantal conglomerate, Reyes & Vergara 1987).

Lower limestones. Overlying the siliciclastic rocks are grey to black, laminated bituminous marls and limestones. In Ecuador, unprecised beds yielded *?Hypacanthoplites* sp., *Parahoplites* sp., *Brancoceras aegoceratoides*, *Desmoceras latidorsatum*, *Hysteroceras orbignyi*, *Oxytropidoceras (?Laraiceras)* sp. and *Ox. (Venezoliceras) commune* of early to early late Albian age (Bristow & Hoffstetter 1977). In Puyango, we collected bivalves (*Ceratostreon* sp. *Cucullaea* sp., heterodonts), and the ammonite *Epicheloniceras s.l.* sp. of late Aptian to earliest Albian age (fig.). In Peru, comparable limestones are dated as Albian by foraminiferas, inoceramids and ammonites (Pananga and Muerto Fms, Iddings & Olsson 1928, Chalco 1955, Zuñiga & Cruzado 1979, Reyes & Caldas 1987). In both countries, the limestones are overlain by a thick clastic series made up of dark shales interbedded with sandstones and greywackes deposited by turbidity currents (Copa Sombrero Gp of Peru, Morris & Alemán 1975, Reyes & Caldas 1987).



Location of the studied area.

Copa Sombrero Group. In Ecuador, a calcareous nodule or a block from the base of the succession yielded the ammonite *Brancoceras* sp. of early middle Albian age (fig.). Higher in the succession, in shales and greywacke turbidites, we found post-Albian ammonites, which are currently studied. In Peru, the lower part of the succession consists of black shales and calcareous siltstones, with sandstone and pyroclastite intercalations, interpreted as basin plain to slope deposits (Huasimal Fm, Reyes & Caldas 1987, Reyes & Vergara 1987, Morris & Alemán 1975, Chávez & Nuñez del Prado 1991). It yielded ammonites of middle to late Albian (Fisher 1956), and early Cenomanian age (Olsson 1934).

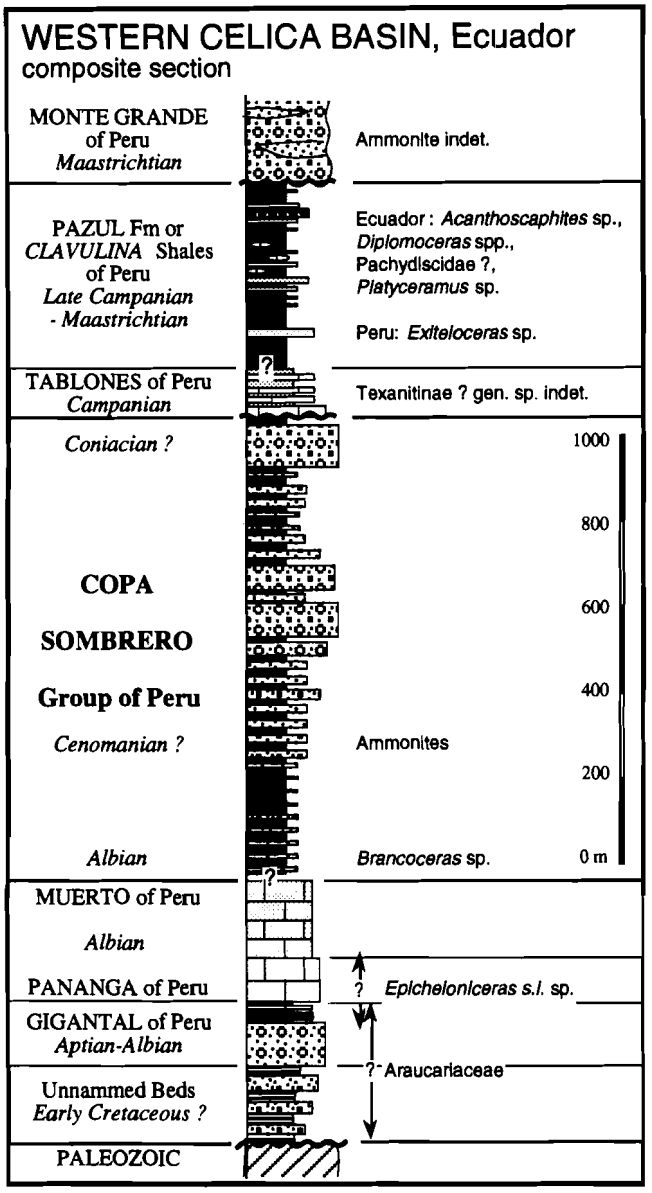
In Ecuador, the upper part of the turbidite succession includes two thick, unfossiliferous quartzose conglomerate layers correlated with the Jahuay Negro and Tablones formations of Peru, respectively. It contains numerous unidentifiable inoceramids. The upper part of the Copa Sombrero Group of Peru contains also two conglomeratic layers interpreted as upper to middle fan deposits (Chávez & Nuñez del Prado 1991). The lower one (Jahuay Negro Fm) contains scarce Cenomanian ammonites and Cenomanian-Turonian inoceramids (Reyes & Vergara 1987, Reyes & Caldas 1987). The upper conglomerate has been correlated either with the «middle Conglomerates» of Olsson (1934) (Chalco 1955), or with the Tablones Formation ascribed to the Campanian (Reyes & Caldas 1987). They are separated by a shaly unit with thin interbeds of arkosic sandstones bearing scarce inoceramids (Encuentros Fm, Morris & Alemán 1975, Reyes & Caldas 1987, Chávez & Nuñez del Prado 1991). From the Copa Sombrero Group, cf.*Barroisiceras haberfellneri* of early Coniacian age (Petersen 1949) and Senonian microfauna (Weiss 1955) were reported.

Unconformable limestones and marls. In Ecuador, in the northern part of the studied area (Puyango), thick-bedded, sandy coarse-grained limestones with large bivalves unconformably rest on the Albian black laminated limestones or on the overlying turbidites. A loose ammonite of unknown origin found on these outcrops is a *Vascoceras* ex gr. *cauvini* Chudeau, 1909 of latest Cenomanian age. These limestones grade upwards into yellow marls interbedded with light-coloured, skeletal and oolithic limestones. A whorl fragment of Texanitinae ? gen. sp. indet. found in these marls suggests a late Santonian to Campanian age (fig.). These carbonated units are only locally present. The Campanian foraminiferal assemblage mentioned by Sigal (1968, Bristow & Hoffstetter 1977) may proceed from these beds.

In the Lancones Basin of Peru, Morris and Alemán (1975) consider the Campanian Tablones Formation to be an unconformable shallow-water deposit, that postdates the emergence and deformation of the Copa Sombrero Group. In the Talara Basin, transgressive sandstones and conglomerates of Campanian age rest unconformably on Paleozoic rocks or on the Albian limestones (Redondo Fm, Weiss 1955, González 1976). Farther south, in the Paita area, shales, calcareous sandstones, massive limestones and subordinate conglomerates of probable Campanian age, rest unconformably on Paleozoic rocks (La Mesa Fm, Olsson 1944). These units express a regional transgression in open shallow marine shelf to nearshore environments (Olsson 1934, 1944, Morris & Alemán 1975, and obs. pers.).

Overlying deposits. In Ecuador, the uppermost unit of the Celica Basin consists of black shales with calcareous nodules and thin-bedded sandstone turbidites. Toward the West (Cazaderos), we found the inoceramid *Platyceramus* sp. of Senonian age and poorly preserved ammonites among which *Acanthoscaphites* sp., Pachydiscidae indet. and two specimens of *Diplomoceras* sp. indicate a late Campanian to Maastrichtian age (fig.). Farther southeast (Zapotillo), thick black siliceous shales are characterized by numerous *Platyceramus* sp. and may be coeval with the late Campanian-Maastrichtian deposits.

In the Lancones Basin of Peru, the upper shaly unit (Pazul Fm) is considered as Coniacian (Fisher 1956), Campanian (Morris & Alemán 1975), or Maastrichtian to Paleocene in age (Reyes & Caldas 1987), according to the authors. It is regarded as a lower fan or basin plain deposit (Chávez & Nuñez del Prado 1991). On the A-T Massif of the Talara area, black shales (Clavulina shales, Olsson 1934) rest on the Copa Sombrero Group, and are overlain by coarse-grained quartzose conglomerates (Monte Grande Fm, Iddings &



Olsson 1928, Olsson 1934). In these black shales, we found *Exiteloceras* sp. of late Campanian to Maastrichtian age, whereas the overlying conglomerates only yielded an unidentifiable ammonite (fig.). In the Talara Basin, the Maastrichtian and Paleocene stages are represented by marine black shales (González 1976). Near Paita (NW Peru), the transgressive deposits are overlain by coarse-grained conglomerates of Maastrichtian age that mainly contain clasts of metamorphic rocks (La Tortuga Fm, Olsson 1944). In Río Playas (SW Ecuador), coeval conglomerates contain clasts of mainly volcanic origin (Casanga Fm, Jaillard et al. 1996). In Bagua (fig.) red beds of coastal and alluvial plain environment are dated as Maastrichtian (Mourier et al. 1988, Naeser et al. 1991).

EVOLUTION OF THE WESTERN CELICA BASIN.

During the early and middle Albian, the A-T Massif was a stable area of the Andean forearc zone.

The Celica Basin was created during the late middle to early late Albian. Its formation was associated with a strong synsedimentary tectonic instability expressed by slumps, olistolites, clastic dykes, and turbidite flows (Morris & Alemán 1975, Reyes & Caldas 1987, Chávez & Nuñez del Prado 1991). This event can be related to the Mochica tectonic phase of Peru, marked by an alternation of contractional and extensional deformations (Mégard 1984), probably due to a dextral shear regime (Soler 1991, Jaillard 1994).

The conglomerate intercalations (Cenomanian-Turonian?) indicate that the tectonic activity was going on, and that the A-T Massif was submitted to intense erosion. Some times after the Turonian or Coniacian, the Celica Basin was deformed and became emergent. This tectonic event is coeval with part of the Peruvian contractional phases of Coniacian to Campanian age (Steimann 1929, Jaillard 1994).

The unconformable limestones postdate the deformation and emergence of the Celica Basin. These deposits indicate an important shallow marine transgression, which we propose to correlate with the Campanian transgressive beds recognized on the eastern side of the Celica Basin of Ecuador (part of El Naranjo Fm of Río Playas, Jaillard et al. 1996), in the Talara Basin (Weiss 1955, González 1976) and the Paita area of northwestern Peru (Olsson 1944) and in the Bagua syncline of northern Peru (Mourier et al. 1988, Naeser et al. 1991). They express the creation of a wide forearc basin of late Campanian-Maastrichtian, possibly Paleocene age. Although field evidences are still lacking, it appears that this basin extended NNE-ward throughout Ecuador, where black shales and turbidites (Yunguilla Fm) yielded the ammonites *Sphenodiscus peruvianus*, *Solenoceras* sp. and microfaunas of Maastrichtian age (Faucher & Savoyat 1973, Bristow & Hoffstetter 1977). The Yunguilla «Flysch» is presently tectonically pinched between accreted terranes and the continental Andean margin (fig.).

In northwestern Peru and southwestern Ecuador, the coarse-grained conglomerates of Maastrich-

tian age express an important tectonic event of late Campanian-early Maastrichtian age (?) that rejuvenated volcanic (Ecuador) or metamorphic reliefs (Peru) and contributed to the emergence of the Bagua area.

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