THE JURASSIC-EARLY CRETACEOUS ARC OF THE CHILEAN COASTAL CORDILLERA NEAR TALTAL: AN ASSEMBLAGE OF CRUSTAL SLIVERS

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INTRODUCTION

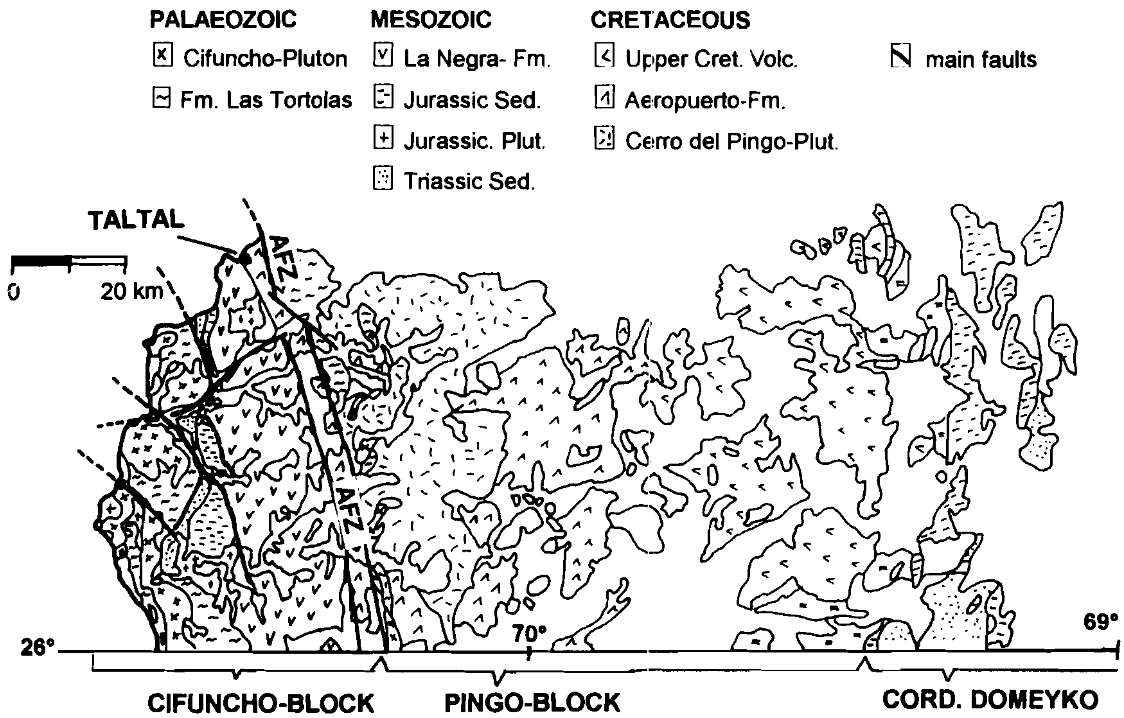
The north Chilean Coastal Cordillera represents the first magmatic arc (Jurassic to early Cretaceous) of the Andean cycle. This arc is composed of > 5 km of arc volcanics (mainly basaltic andesites) and gabbroic to granodioritic intrusives. The main structure of the Coastal Cordillera is the > 1000 km long arc-parallel Atacama Fault Zone (AFZ) which was activated in the early Cretaceous as a trench-linked strike-slip fault. South of Taltal (25°24.100 S / 70°29.100 W) the Atacama Fault Zone separates two blocks of strongly different geological and tectonical development, the Cifuncho-Block to the west and the Pingo-Block to the east.

The CIFUNCHO - BLOCK is made up of an assemblage of different crustal slivers represented by three fault-bounded sub-blocks. These are from W to E:

- a western block consisting entirely of Palaeozoic rocks, strongly folded phyllites and quartzites, outcropping mainly along the coast, which were intruded by granites of the Permian Cifuncho Pluton.
- a middle block consisting of ~ 1500 m of a coarse to medium grained continental sedimentary sequence, locally containing intermediate volcanic intercalations of late Triassic age, Lower Jurassic marine sediments overlain by a Lower Jurassic volcanosedimentary sequence
- an eastern block composed entirely of arc volcanics, ~ 5000 m of the Jurassic La-Negra Formation and ~ 800 m of the likewise volcanic Lower Cretaceous Aeropuerto Formation

The stratigraphic record of the PINGO - BLOCK bordering the Cifuncho-Block to the east is strongly reduced. Triassic and Jurassic formations are lacking: Palaeozoic sediments and plutonic rocks are overlain only by the magmatic arc volcanics of the Lower Cretaceous Aeropuerto Formation. The Pingo-Block was intruded by gabbros to granodiorites of the Cerro del Pingo plutonic group in early Cretaceous times.

THE CHILEAN COASTAL CORDILLERA SOUTH OF TALTAL



TECTONICS

In general the structures of the Cifuncho-Block were formed in an arc-parallel (N-S) sinistral transtensional regime in late Jurassic times. The following types of structures can be observed:

a) N-S trending **strike-slip faults** occur mainly at the boundaries of the sub-blocks. Fault rocks are fault gouge and breccia. Displaced marker horizons and microstructures indicate a mainly sinistral sense of displacement
b) **Folds and thrusts** occur only in the Triassic-Lower Jurassic sediments. Fold axes and thrust planes trend ~ ENE: vergencies are directed towards NNW and SSE.
c) **N - S to NNW - SSW striking normal faults**
d) **NE trending dextral strike-slip faults**. Along these faults the Cifuncho-Block has been fragmented into smaller parts

The age of deformation is constrained by predeformative dioritic sills and stocks (K-Ar in Hornblende: 155 $\pm$ 5 Ma) and by post-deformative andesitic dikes. N of Antofagasta similar dikes gave a cooling age of 147 $\pm$ 6 Ma (K-Ar in hornblende). This time-lag corresponds to the final stage of igneous activity in the Cifuncho Block which cooled below 100°C at 77 $\pm$ 7 Ma (fission track on apatite)
The different composition of the Pingo-Block poses the question whether this block, before it became part of the early Cretaceous magmatic arc, was covered by Jurassic marine backarc sediments in a similar way as the areas east of it (Cordillera Domeyko) or if it was an elevated area during that time. In

the first case exhumation of the Paleozoic rocks must have occurred during the late Jurassic or early Cretaceous, perhaps at the time of the intrusion of the Pingo-Pluton (~ 120 Ma). Deformation concentrated on the Atacama Fault Zone which separates the Pingo-Block from the Cifuncho-Block. Here a ~ 500 m wide mylonitic belt developed. Numerous kinematic indicators uniformly reveal a sinistral sense of shear. Two mylonitic zones could be distinguished: an older one, developed in a late Jurassic diorite yielded 141 $\pm$ 6 Ma (K-Ar in hornblende), a younger one developed in an early Cretaceous granodiorite yielded 123 $\pm$ 3 Ma (K-Ar in biotite). Thus, also in the Pingo block deformation was contemporaneous to magmatic activity. The Palaeozoic rocks fell short of the 100°C-isotherme at 134 $\pm$ 9 Ma and the Cretaceous granodiorite at 90 $\pm$ 9 Ma.

CONCLUSIONS

The Pingo-Block and the Cifuncho-Block as well as its subblocks are all bounded by major strike slip faults and show great differences in their respective geological evolution. Thus, these blocks could be interpretated as "terranes" which, according to Coney (1989) are "geologic entities of regional extent with a coherent stratigraphic sequence different from the cratone nearby and bounded by a major fault". It can be shown, however, that these blocks owe their origin to the special conditions of magmatic arc tectonics and the movement of the forearc with respect to the upper plate so that the term "terrane" may be not adequate for this phenomenon. The following facts have to be considered:

a) The blocks were originally part of the upper plate and were affected by arc magmatism.
b) The mobility of these blocks depends entirely on igneous activity in the arc which, by advective heat transfer, leads to a weakening of the crust of the arc. This weakening results in a decoupling of the forearc from the remaining upper plate. Decoupling in turn allows the forearc slivers to move parallel to the arc. When magmatism stops, the crust of the arc becomes rigid and the forearc slivers become locked.
c) The overall movements of the blocks are constrained essentially to directions parallel to the arc along trench linked strike slip faults.

The described lateral movements were a consequence of strongly oblique plate convergence towards SE (JAILLARD 1986). This oblique convergence caused the movement of the Cifuncho-Subblocks relative to the Pingo-Block. Although the amount of the lateral displacement cannot be determined at the moment, the described contrasting stratigraphic records of the two blocks are an indication of large-scale displacements.

REFERENCES

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