MAGMATISM AND TECTONICS IN THE ANDES OF CHILOÉ (42-44°S.), CHILE.

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Resume.

Une revue de l'évolution géologique de la Cordillère andine de Chiloé met en évidence un métamorphisme Permo-Carbonifère du complexe d'accrétion dévonien (?), un magmatisme calco-alcalin mésozoique à cénozoique, et enfin une tectonique et un volcanisme miocène à actuel.

Introduction.

The Andes of Chiloé comprise three N-S morphological units. From E to W these are: the Coast Ranges, which include Chiloé island, the Ancud-Corcovado basin, and the main Andean Cordillera. In this region, the low-grade Late Palaeozoic subduction-accretionary complex of the Coast Ranges is overlain by Miocene acid volcanic rocks and Pleistocene-Holocene fluvioglacial deposits. The inland marine basin which extends through the Gulfo de Ancud and the Golfo Corcovado is a southward continuation of the Central Valley of Chile, and is filled with at least 1km of fluvioglacial deposits.

The Andean Cordillera, which is the main subject of this work, comprises a backbone of Mesozoic-Cenozoic granitoids of the northern Patagonian batholith, intruded into a basement which contains relicts of Late Palaeozoic metamophic rocks. It is overlain by Tertiary marine sequences in the west and is associated with Jurassic-Cretaceous volcanogenic sedimentary rocks in the east. Active volcanoes are built on the north Patagonian batholith, along and to the west of the Liquiñe-Ofqui fault zone (LOFZ). The latter is a major crustal lineament which roughly parallels the continental margin from 38°S. to the Nazca-Antarctic-South American triple junction at 47°S., where the Chile Rise is currently being subducted beneath the continental crust.

Combined field and geochronological studies in this region gave the following results and synthesis of the local geological evolution:

Palaeozoic.

The low-to-medium grade metamorphic rocks which crop out along the western margin of the Cordillera, and in patches along the LOFZ, are composed of shale-sandstone sequences and greenstones which locally show relict pillow structures. In most outcrops a single NW-SE foliation isa observed, parallel to major lithological boundaries. At Buill, locally derived slate boulders contain well-preserved Devonian trilobites , indicating essential sychroneity of deposition with the Coast Ranges metamorphic complex, from which Devonian brachiopods have been described. The geochemistry of the pillowed basaltic lavas indicates a tholeiitic composition of ocean-floor type, which also suggests correlation with the accretionary complex to the west.

Rb-Sr whole-rock data from schistose rocks at Fiordo Comau suggest a Permo-Carboniferous age of ca. 290 Ma for their metamorphism, but with scatter reflecting varied provenance and incomplete homogenization. A comparable K-Ar muscovite age was obtained from schists of the Coast Ranges on Chiloé island, and similar ages have been reported from further south in the Aysén region.

The Palaeozoic metamorphic rocks of this part of the Cordillera are thus interpreted as an eastern extension of the subduction-accretion complex. Undated serpentinite and harzburgite bodies which occasonally occur along the western margion of the batholith may also be part of this complex.

Mesozoic.

The Mesozoic development of the Cordillera is dominated by the products of subduction-related magmatism, with indications of westward migration. On the present eastern flank of the Andes, a marine basin was infilled mainly by intermediate and acidic pyroclastic rocks which are interbedded with thin clastic horizons containing sparse Late Jurassic or Early Cretaceous fossils. This volcano-sedimentary sequence was affected by folding of unknown age and intruded by the batholithic rocks to the west.

The north Patagonian batholith constitutes the highest part of the Andes here. Its easternmost third is represented by relatively homogeneous leucocratic biotite granites, sections through which in the Palena-Futaleufú area have yielded good Rb-Sr whole-rock isochrons ages of 109±7, 112±3 and 121±4 Ma. Initial $^{87}Sr/^{86}Sr$ ratios are uniformly 0.7040-0.7045, as in the main Cretaceous phases of the Peruvian Coastal batholith, and indicate magma genesis by melting of a primitive source and emplacement with little upper crustal contamination. The central section of the batholith, around Lago Yelcho, consists largely of dioritic and granodioritic pltuonic rocks. These give far more scattered Rb-Sr data, suggesting late Cretaceous emplacement and a more complicated petrogenetic history. No remnants of Cretaceous fore-arc deposits have been identified.

Cenozoic.

The Cenozoic geology of this region is very different from that of the Central Chilean Andes. The westward development of the northern Patagonian batholith continued in the mainland coastal zone between Puerto Montt and Chaitén. The plutonic rocks here belong to a low-K calc-alkaline trondjhemitic series, typical of immmature island arcs. Their association with deep-rooted mylonitic shear zones, point to intrusion in a tectonically active environment, probably related to the LOFZ. At 42°S., Rb-Sr and K-Ar data

have yielded latest Miocene to Pliocene ages, including a Rb-Sr whole-rock isochron of 4.7±1.1 Ma. Their youth, and a relatively deep level of emplacement indicated by 3-4km wide thermal aureoles in the Palaeozoic host rocks, suggest mean uplift rates in excess of 1mm/year.

West of the batholith during late Eocene-early Miocene times, marine basins, probably formed as pull-apart basins associated with early movement on the LOFZ, were filling with turbidites largely composed of acid volcanic detritus. In the northern part of the area, these were deformed before being intruded by the latest phase of granitoids and, at a higher level, their subvolcanic equivalents.

After the late Miocene, movement on the LOFZ apparently had a significant vertical component, as shown by the deeper crustal levels exposed to the east. The (?)late Cenozoic-Quaternary volcanoes are spatially controlled by the LOFZ, since they lie along it or immediately to the west. Near Lago Yelcho, undeformed lacustrine sediments, capped by a 1.2 Ma-old basaltic lava, postdate the main trace, but continued tectonic instability in the region is evidenced by raised beaches and major earthquakes. The 1960 earthquake gave rise to uplift in coastal areas and subsidence in the western parts of the Cordillera.