SEDIMENTOLOGICAL, TECTONIC & PALEOMAGNETIC IMPLICATIONS OF THE MIDDLE JURASSIC OF CALETA CAMARONES & QUEBRADA CHIZA, NORTHERN CHILE. AN OCEANIC BACK-ARC BASIN MARGIN.

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Resumen

Los sedimentos del Jurasico Medio de la Caleta Camarones (19.2°S), se interpretan como parte del relleno de una cuenca de tipo back-arc oceanico. Su diferenciacion se hace por medio de criterios estratigraficos, tectonicos y paleomagneticos, en las proximidades del Salar Grande (21°S).

Key Words: oceanic back-arc basin northernmost Chile

Geological setting

In the area of study (Fig. 1), from the Salar Grande (21° S) to Arica (18.5° S), the Coastal Cordillera is composed principally of Middle Jurrassic marine sediments of the Arica Group (Sala et al., 1966). To the south, however, it is dominated by Lower-Middle Jurassic volcanics of the La Negra Formation. The La Negra volcanics have been interpreted as having been deposited in an ensialic back-arc basin (Rogers, G. 1985). In contrast we propose that the Arica Group sediments to the north were deposited in an oceanic back-arc basin.

Stratigraphy

The Bajocian to Callovian Arica Group sediments are exposed along Quebradas Camarones and Chiza, and at Caleta Camarones. The sequence is cut by numerous faults so that the complete succession is uncertain (Fig. 2).

The base of the sequence is exposed at Caleta Camarones, where basaltic pillow lavas form an eroded 'headlands-type' topography, the headlands being controlled by growth faults. These lie stratigraphically above the La Negra volcanics, but

may in part be contemporaneous with the volcanics which have been dated at 186 M.a. (Rogers,1985).

In places the eroded volcanic headlands are unconformably overlain by massive intraformational conglomerates. A mixed sequence of marine carbonates, volcaniclastics and clastics then lie unconformably on the conglomerates, or directly on top of the headlands. Volcaniclastic sandstones and pebble beds are interbedded with the carbonates at the base of the sequence. Typically the carbonates are very fine-grained with planar fine laminae, and represent the background sedimentation. They are moderately siliceous suggesting deposition above but near the C.C.D. Mid-Bajocian ammonites occur at the base of the sequence. Slumps within the carbonate sequence suggest a sediment source from the west, the volcanic arc.

Faulted against the carbonates, and possibly contemporaneous with them, is a thick sequence of marine volcaniclastics. These consist of well bedded volcaniclastic sands, brecciated lava flows and glassy 'hot ash-flow' type deposits, derived from the volcanic arc. The sequence is cut by neptunian-dykes showing the continuing phase of extension.

Infilling the basin are proximal volcanoclastics, lying unconformably on top of the carbonates and volcaniclastics. These are auto-brecciated, submarine lava flows, showing very little transport, and may represent apron-fan deposits adjacent to the volcanic arc.

Eastwards in Quebrada Chiza, a large thickness of well-bedded calc-arenitic limestones occur. These may be of Bathonian age or possibly contemporaneous with the sequence at Caleta Camarones. They represent further back-arc basin sedimentation, more distal to the volcanic arc.

Overlying these calc-arenites is a sequence of Callovian or Bathonian marine, iron-rich sandstones, siltstones and shales representing a shallowing-upwards sequence. These, together with the calc-arenites below, are cut by approximately north-south trending basaltic dykes (the Cuya Dykes) which appear to act as feeders to overlying highly altered lavas. The Cuya dykes represent the final phase of basin extension.

Middle-Callovian marine sandstones, dated by ammonites, lie unconformably on top of the lavas, and are overlain by tuffs and a lava flow which represents the youngest Jurassic strata exposed in the area.

During the Upper Jurassic or early Cretaceous the basin was uplifted, faulted and strongly eroded before deposition of overlying Cretaceous continental sediments.

Tectonics

Despite ongoing subduction of the Nazca plate beneath the Andean margin since the late Triassic, the Coastal Cordillera of northern Chile is dominated by extensional tectonics.

In addition to a stratigraphic change, a change in tectonic style also occurs along the Coastal Cordillera. In the area of study, quebradas follow the paths of approximately north-east/south-west trending faults which cut the Arica Group sediments and have downfaulted them to the north.

These north-east/south-west trending faults have cut north-south trending basement faults which once controlled the oceanic and ensialic back-arc basin margins. These north-south faults have been reactivated by the Atacama Fault zone, which bounds the Coastal Cordillera to the south. However, the northern block, having displaced the basement faults, has controlled the trend of the Atacama and associated faults which swing out to the sea in the vicinity of the Salar Grande.

Fig. 1

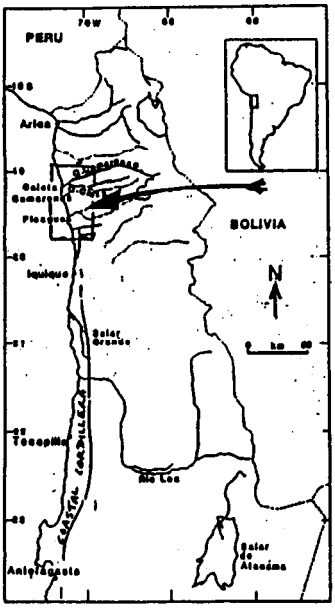
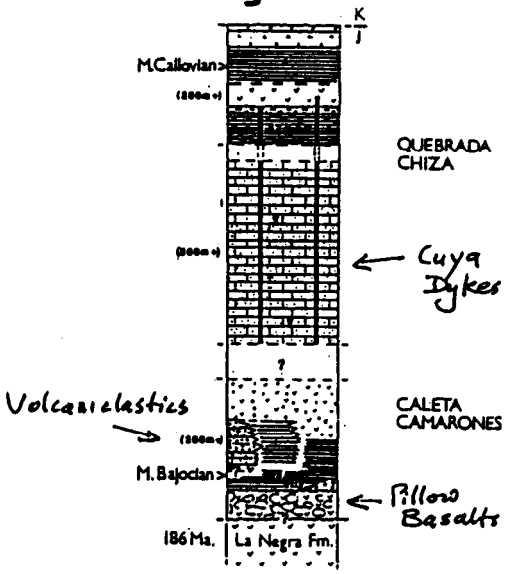


Fig. 2



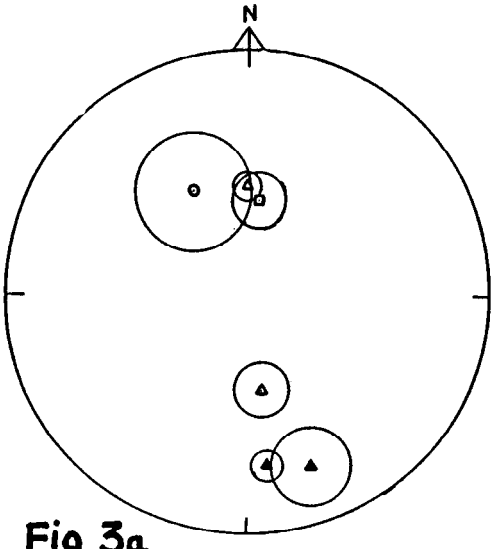


Fig. 3a

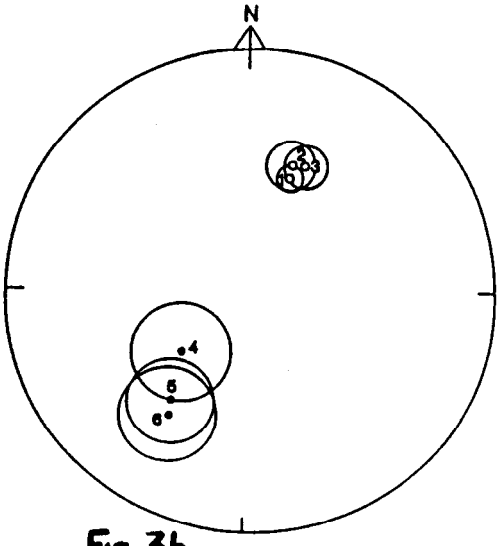


Fig. 3b

Palaeomagnetism

In the area of study, palaeomagnetic studies indicate a general anticlockwise rotation (Fig. 3a), which continues into southern Peru. In contrast, the Coastal Cordillera to the south is rotated clockwise (Fig. 3b), (Hartley et al, 1988). Also in Peru, clockwise rotations occur as far south as 4° S (Mourier et al, 1988).

The Coastal Cordillera is a whole series of fault-blocks, cut by north-south and north-east/south-west faults. The block rotation actually occurs in small scale blocks. One such block at Caleta Camarones, a fault-defined headland, actually shows a clockwise rotation in contrast to the general anticlockwise rotation of adjacent blocks , demonstating the scale of rotation.

Conclusion

Stratigraphic, tectonic and paleomagnetic studies in the Coastal Cordillera of northernmost Chile indicate that an oceanic back-arc basin existed in the Middle Jurassic. A continental-margin arc existed to the south, represented by the La Negra Formation. The transition between ensialic and oceanic back-arc basins probably occurs in the vicinity of the Salar Grande. The island arc to the north is absent perhaps due to underthrusting and subduction.

References

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