

## TRIASSIC DEPOSITIONAL BASINS IN NORTHERN CHILE

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**Key words:** Andes, Triassic, sedimentary basins, depositional environments

Sedimentary basins with associated rhyolitic, andesitic and basaltic rocks developed during Triassic times as a result of extensional (possibly transtensional) tectonism in Chile (Charrier, 1979; Suárez and others, 1985) and Argentina (Stipanovic, 1983; Kokogian and Mancilla, in press; Uliana and Biddle, 1988). Most of the sediments were deposited in a continental environment but some marine strata have been recorded from Chile. A NW-SE orientation for the basins has been demonstrated in Argentina (Uliana and Biddle, 1988).

The Triassic marks a major change in the geological evolution of Chile and Argentina. Paleozoic terrane amalgamation and subduction-related magmatism and accretion was followed by widespread non-orogenic silicic magmatism of the Choiyoi Group during the late Carboniferous to early Triassic (Bell, 1984, 1987; Kay and others, 1989; Ramos and others, 1986). By Jurassic times a well-defined subduction-related island arc - back arc system, characterising the Andean orogeny, had developed parallel to the present day coastline.

The present study includes a summary of the conclusions of sedimentological, palaeogeographical and tectonic investigations of four major but geographically isolated occurrences of Triassic sediments between 26° and 29°S in northern Chile (Fig. 1). The San Felix Formation is Middle or possibly Lower Triassic in age and the Cifuncho, La Ternera and Dona Ines Chico Formations are attributed to the uppermost Triassic (Charrier, 1979).

The San Felix Formation overlies the Choiyoi magmatic rocks, in places with an angular unconformity, but elsewhere with a conformable contact. It is conformably overlain by marine limestones of uppermost Triassic age. The Cifuncho, La Ternera and Dona Ines Chico Formations lie unconformably on older successions and are conformably overlain by Liassic marine limestones (Suárez and others, 1985).

The Triassic sediments are predominantly clastic in origin and were deposited in a range of continental and marine environments. The great majority of the coarse clastic debris in the San Felix, La Ternera and Dona Ines Chico Formations comprises silicic magmatic material derived from the Choiyoi Formation. By contrast the Cifuncho Formation was derived from the unconformably underlying low-grade metasediments of the Las Tortolas Formation, a late Paleozoic accretionary complex (Bell, 1984).

The 1,000 m thick sedimentary sequence of the Cifuncho Formation consists predominantly of the deposits of a southwest flowing braided river system. Interbedded with the alluvial sediments are thin limestones formed in ephemeral playa lakes. These are associated with the deposits of inland siliciclastic sabkhas characterised by halite casts.

The Dona Ines Chico Formation is a 400 m thick succession of mudstones and minor sandstones deposited in a low-lying muddy alluvial plain. Conformably overlying shallow marine sediments suggest that this was probably a delta plain.

The La Ternera Formation is very variable in thickness, it reaches a maximum of some 1,800 m, but thins to zero over a distance of less than 10 km. The sequence of conglomerates and sandstones was deposited on an alluvial fan and braided river system, with sediments derived from the east.

The San Felix Formation reaches a thickness of possibly 4,000 m. It comprises a succession of shales with minor conglomerates and sandstones deposited predominantly as marine turbidites. The sedimentary characteristics indicate a proximal, prodelta setting. Palaeocurrents were possibly directed towards the northwest.

All four Triassic successions have interstratified volcanic strata. These, together with contemporaneous rhyolitic, andesitic and basaltic volcanic rocks to the west and east indicate an intra-arc setting (Suárez and others, 1985). The calc-alkaline nature of these volcanic rocks suggests subduction related magmatism.

The Cifuncho and La Ternera Formations contain thick successions of alluvial fan and ephemeral braided stream deposits. These, together with the halite casts and playa lake deposits of the Cifuncho Formation, suggest an arid to semi-arid climate. However, the Triassic formations are also characterised by an abundant fossil flora and thick mudstone successions which are indicative of a more humid climate.

The sedimentary succession of the San Felix Formation can best be explained by initially rapid subsidence, with subsequent turbiditic prodelta sedimentation, related to steep slopes in a near shore but deep water marine setting. The thick sequences of coarse-grained and poorly-sorted alluvial sediments of the Cifuncho and La Ternera Formations were deposited on alluvial fans and braid plains in fault-bounded and actively subsiding intermontane grabens or foredeep basins. By contrast the Dona Ines Chico Formation was deposited on a stable coastal plain or delta. Variations in thickness and sedimentary facies in the Triassic successions indicate a remarkable range of depositional environments and settings. The sedimentation probably occurred in a number of tectonically active and isolated basins between uplifted blocks.

The scattered and isolated nature of the Triassic exposures in northern Chile mean that the position and shape of the sedimentary basins, and the associated magmatic arc, are poorly constrained. This problem is compounded by the presence of major thrust and strike-slip fault systems which have probably produced significant lateral displacements between the exposures.

Calc-alkaline volcanic activity suggests that the Triassic sedimentary basins resulted from intra-arc extension (or transtension) associated with active subduction, during the earliest stages of the Andean orogeny related to the breakup of Gondwana.



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