

Taphonomy and palaeoenvironments: a new Early Permian tetrapod fauna from Brazil

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The Lower Permian Pedra de Fogo Formation of northeastern Brazil accumulated in a large intra-continental sag-basin (Parnaíba Basin) located in subtropical Gondwana approximately 20°S (palaeo-latitude). With progressive climatic drying, palaeoenvironments changed from a large, shallow lake to expansive exposed mudflats surrounding a shrinking lacustrine wetland, culminating in isolated playas fed by ephemeral streams, which finally became an aeolian dune field. Our team has collected over 500 fossils from this formation including actinopterygians, dipnoans, chondrichthyans, two fully articulated coelacanths, at least four temnospondyl taxa (the archegosaurid *Prionosuchus*, trimerorhachid *Procuhy*, dvinosaur *Timonya*, and a rhinesuchid), small-to-medium-sized captorhinid reptiles (*cf. Captorhinus/Captorhinikos*), a small parareptile, and numerous fish-scale-bearing spiral coprolites. Three gradationally superimposed sedimentary facies associations are recognized in this formation: offshore lacustrine, shoreline/carbonate mudflats and finally an ephemeral stream/dune complex. The taphonomic style varies with depositional facies reflecting different modes of post mortem burial. Offshore facies comprise thick beds of massive siltstone and finely-laminated siltstone/mudstone couplets showing algal crenulations, but no infaunal burrowing, indicative of an anoxic lake bed. Scattered actinopterygian fish skeletons with scales are rare, but some fine sandstone turbidites contain more fully-articulated aquatic tetrapods, with rare soft tissue preservation, indicative of death and burial by storm-induced density underflows. The carbonate mudflats facies association contains silicified algal-laminated limestones displaying stromatolite mounds, tepee and desiccation structures typical of alkaline lake shorelines. Clusters of coprolites and fish-hash lenses comprising masses of isolated teeth and scales are suggestive of heavy predation within drying ponds and channels. The ephemeral stream/dune facies contains most of the plant material, mainly tree trunks and in places at the top of the Formation rare 3-D petrifications of leaves and fructifications. This previously unknown diversity of early Permian (~280 Ma) tetrapods in Gondwana shares faunal aspects (e.g. captorhinids, trimerorhachids) with the Permian redbeds (Clear Fork Group) of the southwestern United States, however, the presence of taxa such as rhinesuchids suggest that the Gondwanan tropics were an important cradle of later Permo-Triassic biodiversity.

A new cynodont from *Cynognathus* Subzone C and its implications on body size recovery in tetrapods following the Permo-Triassic mass extinction

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In tetrapods, body mass is an important proxy for many ecological variables. Mass extinction events have been hypothesized to have a 'Lilliput Effect' on vertebrate taxa, i.e. a dramatic, but short-lived decrease in average body mass in survivor species. Work in the Triassic *Cynognathus* Subzone C of South Africa during 2014 and 2017 recovered a partial cranium of a cynodont of enormous size with an estimated basal skull length exceeding that of any non-mammaliaform cynodont specimen yet described.