

Stratigraphy of the Santiago Formation along the Patuca - Santiago road section; implications for the evolution of southeastern Ecuador during the Jurassic

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The Santiago Formation is a Jurassic sedimentary succession of eastern Ecuador, which is composed of organic-rich shales, sandstones, limestones, intraformational breccias and volcanic rocks. Previous authors defined three members within the Santiago Fm, from base to top: Santiago River, Yuquianza and Patuca members.

In this study we report lithology, sedimentary structures, stratigraphic patterns, and biostratigraphic data of these successions, in order to characterize the sedimentary evolution of the Santiago Fm. Outcrops are located in the Patuca-Tiwintza road, in the the Cutucú Cordillera of southeastern Ecuador.

In the Namangoza River, the Santiago Fm. unconformably overlies the undated Piuntza Unit, which comprises sedimentary and volcanoclastic rocks, deformed and affected by contact metamorphism. The Rio Santiago Member is a 350 meters thick series composed of fining-upward beds including fossiliferous mudstones and wackstones, shales and calcareous sandstones with ripples and planar lamination. Paleocurrents indicate a sediment transport to the south. This member is interpreted as deposited in a shallow marine platform.

The Yuquianza Member conformably overlies the Rio Santiago Member, and it consists of a coarsening-upward beds rich in mollusk fossils, calcareous shales, sandstones and siltstones with abundant volcanic fragments. The sandstones include planar cross-lamination and discontinuous wavy lamination. The thickness of the Yuquianza Mbr. is 100 m.

In the Patuca village, the Patuca Member conformably overlies to Yuquianza Member. The Patuca Member includes a fining upward bedding sequences of muddy sandstone with flattened volcanic clasts; lithoarenites with cross lamination and normal grading; greywackes; andesitic and basaltic-andesitic lava flows; peperites and volcanic breccias. Paleocurrents indicate a sediment transport to the South. The thickness of the Patuca Member is 80 m.

Based on outcrop descriptions in the Puchimi river, a new member is proposed, the Puchimi Member, which conformably overlies the Patuca Member. This member is 50 m thick, and include a coarsening upward sequence, which comprises fossiliferous and micaceous shales; sandy siltstone with parallel lamination and coal fragments; lithoarenites with volcanic clasts and inverse grading; sandy conglomerate matrix-supported, with abundant andesitic clasts. Paleocurrents indicate a sediment transport to the SE. In this Member, we collected the ammonoids *Arietites Glorubieceras* sp. and *Paltechioceras* sp., which indicates a Late Sinemurian to Pliensbachian age. This member is interpreted as deposited in a prodeltaic to distal delta front depositional environment. The new biostratigraphic data suggest that the age of Santiago Fm. ranges between Late Hettagian to Pliensbachian.

The overall stratigraphic succession of the Santiago Formation recorded the evolution of a sedimentary system from a shallow marine platform to deltaic sediments with a strong volcanic input from source located to the west. This interpretation is in line with organic matter analysis which shows an upward increase of terrestrial derived phytoclasts.