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Sedimentary facies and ammonites relations between Arequipa and Tacna during Lower to Middle Jurassic

De la Cruz AA , Acosta Pereira H

Instituto Geológico Minero y Metalúrgico INGEMMET, Dirección de Geología Regional. Av. Canadá N° 1470, San Borja, Lima, Per,u. aalvan@ingemmet.gob.pe

Arequipa basin has been studied by different authors, such as Jenks (1848), Wells (1953), Benavides (1962), Vargas (1970), Leon (1981) and Vicente (1981). These authors refer to the layers of the Chocolate Formation (Lower Jurassic) in Arequipa, as a succession of andesitic and sedimentary rocks, containing Sinemurian ammonites. There are geological investigations in localities of Tacna made by Wilson & Garcia (1962), Jaen & Ortiz (1963), Salinas (1987), among others; whose produce the first geological maps of the zone.

Currently, data showed in this report (stratigraphic columns, ammonites paleontology) (Fi. 2), corresponds to a set of information not yet published, obtained from INGEMMET field jobs. Data sets were taken from outcrops along coastal strip of southern Peru, in localities of Yura (Department of Arequipa) and cerros Palquilla and Pelado (Department of Tacna) (Fig. 1), within the Arequipa Mesozoic basin, southern Peru. Lower and Middle Jurassic sediments have been analyzed in Arequipa (Yura) and Tacna (cerros Palquilla and Pelado) in terms of stratigraphy, sedimentology and paleontology. A taphonomic study of ammonites and its paleoenvironmental and chronological implications and has been related one to another.

In Cerro Yanacoto, Yura, Arequipa, there is a stratigraphic section, containing to Chocolate Formation as a succession of sedimentary rocks (Acosta et al., 2008), which is correlated with Junerata and Pelado formations (Fig. 2). This succession involves conglomerates, sandstones, and calcareous siltstones, from marine incursion of few thicknesses; in its respective sedimentary facies variations.

Here, the Chocolate Formation contains ammonite fauna, and they are positioned in calcareous siltstone interstratified with very fine grained sandstone; showing us the presence of relatively shallow marine waters. Sedimentation in this fossiliferous levels, presents evidences of submarine turbulence in a prodelta sub-environment, contained in talud facies; being these fossils possibly re-transported post-mortem (Alván et al., 2008). These are the ammonites *Uptonia* sp., *Megarietites* sp. and *Eparieti-*

tes sp.; above these levels, there are *Megarietites meridionalis* (REYNES), *Eparietites* cf. *undaries* (QUENSTEDT) and *Arnioceras* sp., fossils arietitidos that indicate us Upper Sinemurian strata.

In those levels, the presence of ammonites from marine water not so deep, belongs to a deltaic system, in its distal part; referring to a sub-environment of pro-delta.

In the localities of Cerro Palquilla and Cerro Pelado, there are sedimentary rocks, that, in the same way, they are disturbed by one or more than one fault or diagenetic processes, produced by extensive tectonics. These sedimentary processes are related to relatively deep marine facies.

In Cerro Palquilla, sedimentary facies in Pelado Formation (Lower Jurassic to Under- Toarcian) and San Francisco Formation (Upper Toarcian to Upper Bathonian), consist of detritus and carbonated facies of turbidites, carbonated platforms and fluvial deposits; from different sedimentary environments within a delta in relatively deep marine water (prodeltas, slope base lobes and deltaic platform). Besides this, there is evidence of carbonatic sedimentation with turbidity currents, stirring all the ammonites in site.

Here, in Pelado Formation, this paper reports 5 fosiliferous levels, that contain the ammonites *Megarietites meridionalis* REYNES, *Megarietites* sp., *Uptonia* cf. *U. ignota* (SIMPSON), *Uptonia* cf. *U. obsoleta* (SIMPSON) and *Uptonia* sp. y *Arietoceras* sp. This clustering indicate us Sinemurian to Toarcian times. Most of these ammonites are positioned in turbidity zones. The “verticality” of the ammonites is lost at depths greater than 10 m. However, this sedimentation is fast and violent, and makes the ammonites be conserved and retained in “vertical” position, as evidenced by submarine turbidity processes.

Similar sedimentary processes, are present in stratigraphic column in cerro Pelado, in Pelado and San Francisco formations, there is evidence of turbidity flows, although the presence of ammonites in carbonated nodules are abundant. Here we have the presence of *Arietoceras* sp., *Megarietites* sp., *Belemnites* sp., *Belemnites paxillosus* LAMARCK. Association of fossils that indicate Sinemurian and Pliensbachian times.

It's considered as a baseline to carbonated deposits, formed since Sinemurian to Toarcian (in Chocolate-Junerata-Pelado and Socosani-San Francisco correlations) (Fig. 2), showing themselves progressive discordances. Thickness of these deposits varies according to their respective paleorelief. The similarity of these deposits between Arequipa and Tacna is extensive. It is considered as correct the comments made to the relationship between Chocolate Formation and Junerata-Pelado formations; as well as the relationship between Socosani Formation and San Francisco Formation, both in lithology and chronology.

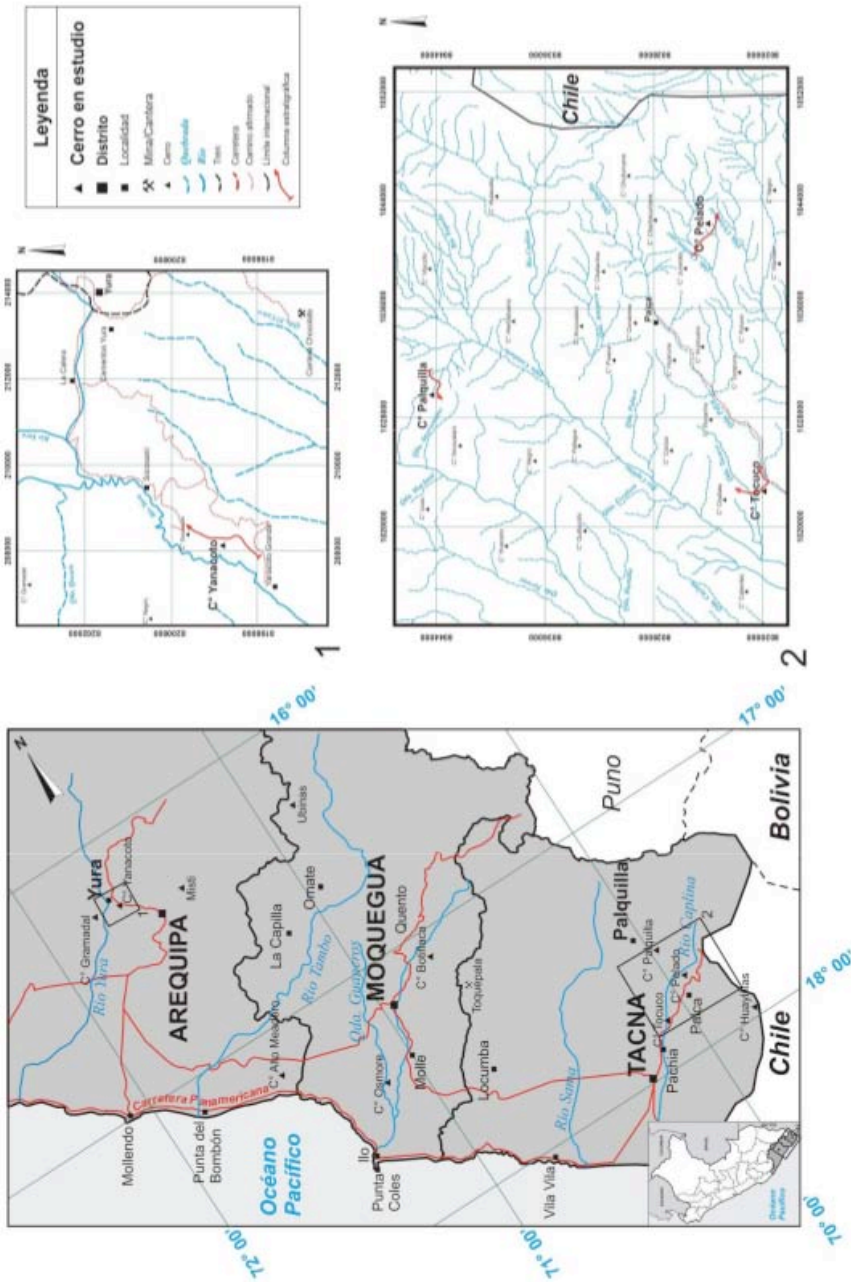


Fig. 1.- Location map and accessibility to localities in study; 1: cerro Yanaqocha in Yura, and (2): cerro Palquilla in Tacna. Red arrows indicate us direction of stratigraphic sections.

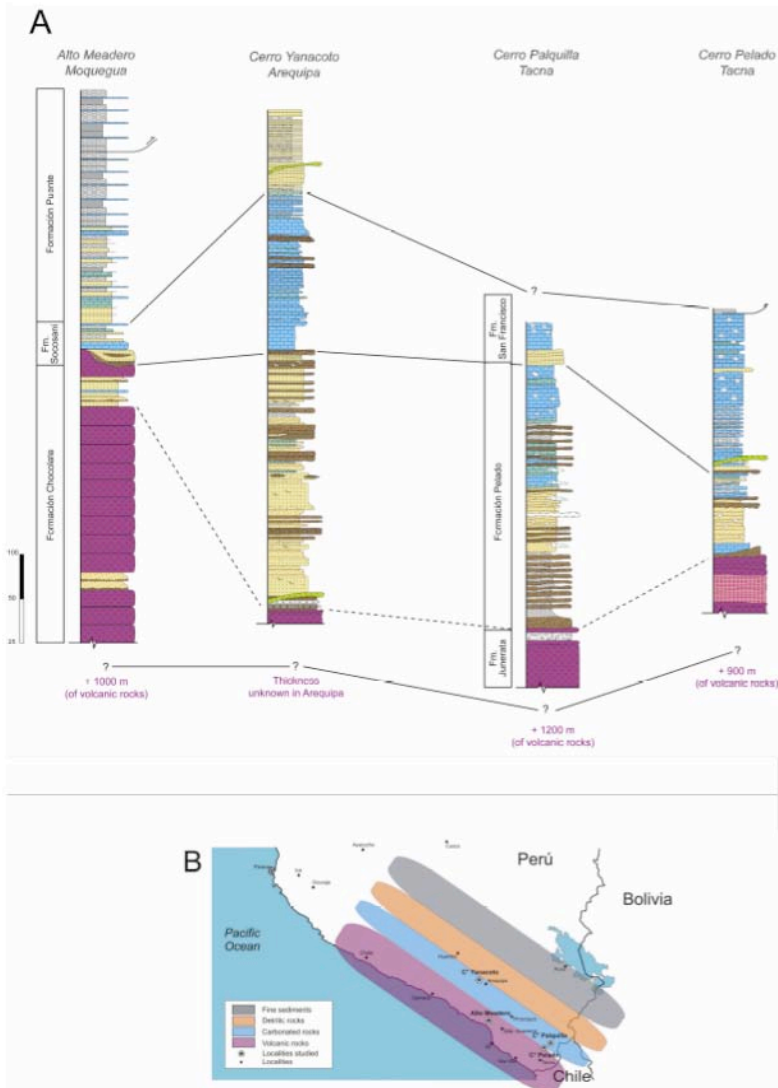


Fig. 2.- A: Representative stratigraphic columns of the Arequipa basin. B: Schematic graphic of the facies in Arequipa basin, southern Peru.

It is interpreted, for southern Peru that, in Sinemurian to Toarcian times, there has started a major marine transgression, where the deposition of carbonate rocks stretches with different thicknesses, described under different names depending on the area, stretching from Arequipa to northern Chile.

Referring to taphofacies, ammonites are deposited in mud layers, in slope environments and slope base, and, in some southern sectors, with fragments of pelec-

Pods. Ammonites are Arietitidos, typical relatively deep marine water fossils; their ornamentation consist of simple ribs, straight at sides and leaning toward to opening near the venter zone, without tubercules. In its ventro-lateral shoulders, inflections are observed, tending to the direction of shell growth; being these ammonites typical from calm water and seep seas in Sinemurian times. In the localities of Tacna, there are pavements made of mud, ammonites and bivalves, in evident sedimentary disturbance, from turbiditic environments. Taphonomic main features are verticality of buried ammonites in limestones levels, which are interspersed with conglomerated beds, interpreted as submarine channels. These characteristics of synsedimentary deformation, extensive tectonic environments, are along all southern Peru strip, showing post-volcanic extensive activity.

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