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An integrate analysis of an Hauterivian coral biostrome from the Agrio Formation, Neuquén Basin, west-central Argentina

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ABSTRACT

A coral biostrome from the lower Hauterivian of the Neuquén Basin, west-central Argentina, was examined in detail. Taxonomic analysis established it as a monospecific assemblage of the scleractinian colonial coral *Stereocaenia triboleti* (Koby). Palaeoecological analysis of the species allows us to infer that it was an opportunistic species, capable of thriving in mixed carbonate-siliciclatic environments, on a soft substrate under a moderate to low sedimentation rate showing great regenerative capacity. Taphonomic analysis, together with lithofacies and microfacies analysis, allowed us to establish that the coral biostrome was deposited in a middle ramp setting under open marine and well-oxygenated conditions. Corals colonized a soft substrate during a transgressive phase and reaching its climax in the maximum flooding zone under lowest clastic input. They managed to form a low coral meadow of ramose forms of up to 30 cm in height. Coral remains were exposed on the interface after death and thus were subject to severe encrustation and bioerosion. The coral biostrome is interpreted as a mixed biogenic-sedimentologic skeletal concentration deposited by an interplay of an initial biogenic concentration through later episodes of physical reworking, probably storms, which yielded a largely parautochthonous fossil assemblage with minimum lateral transport. As sedimentation rate increased during a highstand interval, the coral-dominated community could not cope with it and was finally buried. The described coral biostrome recorded at the base of a shallowing-upwards cycle closely resembles coral biostromes described from the Hauterivian of Peru and Turkmenistan, and differs significantly from framework reef facies recorded in the Hauterivian of the Tethys region from the Paris Basin to Crimea.

1. Introduction

Scleractinian corals were significant elements of the Cretaceous shallow marine settings, along with mollusks, all over the world. In particular, they were especially important in the Tethys region where they form extended framework reef facies (Beauvais, 1992; Veron, 1995). At present there is an unbalanced level of taxonomic and palaeoecological knowledge between the Northern and Southern Hemispheres, the northern forms having been quite intensively studied while the southern faunas are generally poorly known.

On the other hand, the taxonomy of scleractinian corals has been constantly changing since the middle twentieth century (e.g. Wells, 1956; Alloiteau, 1957; Veron, 1995; Löser et al., 2002; Cairns et al., 2011), and new classification schemes and revisions of several taxa have been published. Cretaceous corals, in particular, have been recently matter of intense revision (Löser et al., 2002; Cairns et al., 2011).

In South America, especially in Argentina, Cretaceous corals are far from being adequately known. Previous taxonomic works include those of Gerth (1928) and Weaver (1931) who described corals from the Lower Cretaceous Agrio Formation of the Neuquén Basin, west-central Argentina. These contributions were undoubtedly important, however, the taxonomic status is certainly outdated. Therefore, in our opinion a thorough revision of Early Cretaceous corals from the Neuquén Basin is needed based on newly collected specimens on solid biostratigraphic grounds and facies framework.

Scleractinian corals have always been regarded as useful palaeoenvironmental tools but reliable taxonomic studies should be available to make palaeoecological interpretations more precise. In fact, zooxanthellate colonies are precise palaeoecological markers as they depend on a set of specific requirements including light availability, sea water temperature, depth, salinity, and sedimentation rate, among others (e.g. Kiessling, 2001; Spalding et al.,

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2001). Most of the occurrences of Argentine Jurassic and Cretaceous corals seem to correspond to lenticular and lentiform coral-dominated beds while framework reefs are not well-represented in contrast to Tethys occurrences. Nevertheless, recent studies in the Upper Jurassic La Manga Formation in the Neuquén Basin have demonstrated the presence of framework reef facies which resulted from interactions of sedimentation rate, coral palaeoecology and palaeoenvironment (Palma et al., 2009). Some other works have attempted to use Early Cretaceous corals as palaeoenvironmental and palaeoecological tools in the same basin which have demonstrated how useful these faunas can be when based on solid taxonomic grounds (see Lazo, 2004, 2005, 2007; Garberoglio and Lazo, 2011).

In this work an integrate analysis of a coral biostrome recorded from the Lower Cretaceous Agrio Formation of the Neuquén Basin is presented. It includes taxonomic, taphonomic, and palaeoecological aspects of the coral association and a detailed facies analysis. Therefore the aims of the present contribution are as follows: 1) study the taxonomy of the scleractinian corals recorded in a coral biostrome of the Agrio Formation at Loma Rayoso Area, Neuquén Basin, west-central Argentina; 2) describe the sedimentary facies and interpret the associated palaeoenvironment; 3) taphonomic analysis of the coral biostrome and interpretation of its genetic mechanism; and 4) palaeoecological analysis of the coral-dominated community.

2. Geological setting and methods

The Neuquén Basin, located in west-central Argentina, extends through most of the Neuquén and Mendoza provinces along the Andean foothills, between 32° and 40° SL (Fig. 1A). It is a back-arc basin spanning from Late Triassic to Paleocene times, including marine and continental clastic, evaporitic and carbonatic deposits (Vergani et al., 1995; Howell et al., 2005). During the Early Cretaceous the Neuquén Basin had a mid-latitudinal location not far from its current position, approximately between 28° and 36° S, based on reliable palaeomagnetic data (Somoza, 2011). Several sedimentary cycles developed within the whole sedimentary megacycle of the basin. One of these, the Mendoza Group, corresponds to mostly marine sedimentary rocks that reach a thickness of thousands of metres, deposited from early Tithonian to earliest Barremian times (Aguirre-Urreta et al., 2007). These deposits are composed of low to high-frequency cycles which have resulted from the interplay between eustacy, clastic input, climatic oscillations and thermal subsidence (Legarreta and Uliana, 1991). In particular the Agrio Formation, defined by Weaver (1931) in the upper section of the Mendoza Group, has outcrops from the Diamante river in Mendoza to Piedra del Águila in the south of Neuquén. It was deposited from early Valanginian to earliest Barremian times, and comprises three members: the lower Pilmatué Member, the middle Avilé Member and the upper Agua de la Mula Member (Weaver, 1931; Leanza et al., 2001). Both, the Pilmatué and Agua de la Mula Members, are mainly composed of black to dark-grey shales and calcareous shales with intercalation of thin sandstones bodies and shell beds which were deposited in a shallow mixed clastic-carbonate ramp under an overall storm influence (Lazo et al., 2005; Spalletti et al., 2001b) (Fig. 2).

The studied section of the Agrio Formation is located in the Loma Rayoso Area, in the north of the Neuquén Province, west-central Argentina, on the right margin of the Neuquén River (Fig. 1B) and it would have been located at approximately 33° S during the Early Cretaceous. The Agrio Formation is well-exposed and its beds are easy to follow and correlate laterally along their strike. The studied section belongs to the upper half of the Pilmatué

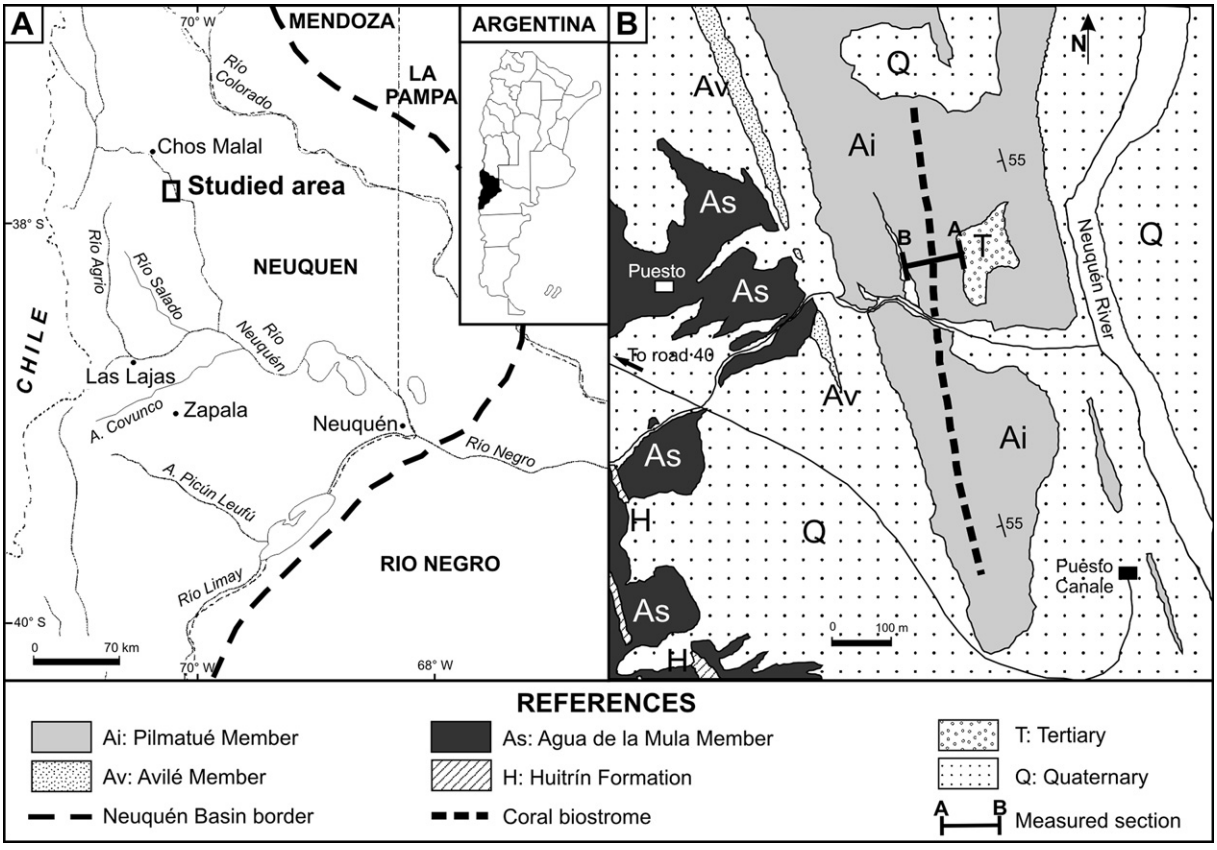

Fig. 1. A, Map showing location of the studied area in Neuquén Province, Argentina. B, Geological map of Loma Rayoso Area nearby Puesto Canale, modified from Rodríguez (2005).