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Early Turonian ammonites from Vallecillo, north-eastern Mexico: taxonomy, biostratigraphy and palaeobiogeographical significance

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Abstract

The 'Plattenkalk' of Vallecillo, approximately 100 km north of Monterrey in north-eastern Mexico, has yielded an ammonite assemblage of both North American (Western Interior) and Tethyan elements, comprising *Tragodesmoceras bassi* Morrow, *Quitmaniceras reaseri* Powell, *Watinoceras coloradoense* (Henderson), *Pseudaspidoceras pseudonodosoides* (Choffat), *P. flexuosum* Powell, *Mammites nodosoides* (Schlüter), *Vascoceras birchbyi* Cobban and Scott, *Fagesia catinus* (Mantell), *F. superstes* (Kossmat), and a few indeterminate forms. The excellent preservation of the shells, for instance of apertures, stomach contents or spines joined to the body chambers of *P. flexuosum*, as well as the occasional presence of aptychi, indicate rapid burial shortly after death. Correlation with the Cenomanian–Turonian boundary GSSP at Pueblo, Colorado, indicates continuous deposition from the latest Cenomanian to the early Turonian at Vallecillo. The index species *P. flexuosum* shows a diachronous first appearance datum between the two sections.

Keywords: Ammonites; Early Turonian; Late Cretaceous; Mexico; Biostratigraphy; Taphonomy

1. Introduction

In north-eastern Mexico, the Late Cretaceous is represented by moderately deep shelf-slope sediments, deposited in estimated water depths of a few tens to hundreds of metres. During the Cenomanian–Turonian, this shelf was generally low in relief, and there was no input of coarse terrigenous material, for instance from the Sabine Uplift in Texas or from the coast to the west (Fig. 1). In distal shelf areas, strata comprise monotonous, organic-rich black limestone, marly limestone and marl, rich in planktonic foraminifers and calcispheres. These are assigned to the Agua Nueva Formation (Fig. 1). This formation occasionally contains chert nodules, laminated carbonaceous black shale and bentonites. In outcrop, the black limestone weathers to bright white, grey and yellow colours, and this explains the banded appearance of the Agua Nueva Formation (Sohl et al.,1991).

The Agua Nueva Formation has generally been considered to be poor in macrofossils (Sohl et al., 1991). Recently, however, a fossil Lagerstätte was discovered near Vallecillo, a village approximately 100 km north of Monterrey, in the state of Nuevo León (Fig. 2) (Blanco et al., 2001; Blanco-Piñon et al., 2002; Ifrim et al., 2005, in press). Here, strata of the Agua Nueva Formation consist of finely laminated grey to pink (or yellow) platy marl, marly limestone, limestone and thin (up to 12 cm thick) mudstone rich in iron oxides (Fig. 3). The carbonate rocks form beds of up to 40 cm thick; these are mined as flagstones in small quarries. The platy marl and limestone sediments split parallel to lamination when dry and are here considered to be 'Plattenkalk', a very fine-grained and intensively laminated limestone forming slabs when opened. Plattenkalks are frequently formed under hostile bottom conditions, leading to excellent preservation of embedded fossils (Barthel et al., 1990). Vertebrate fossils from Vallecillo are

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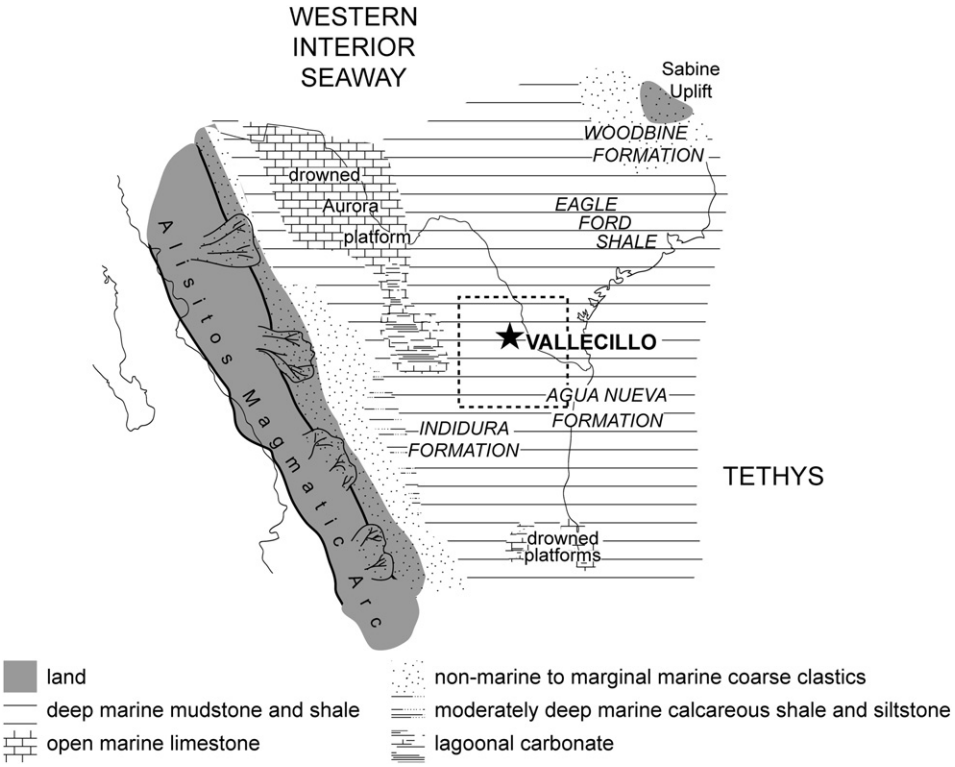

Fig. 1. Palaeogeographic map of the Cenomanian and Turonian of Mexico (after Seibertz, 1998; Goldhammer and Johnson, 2001). An asterisk marks the Vallecillo site. The area marked by dashed line corresponds to the detailed map in Fig. 2.

thus well preserved (e.g., fish with stomach contents, fins and soft tissues; see Blanco-Piñon et al., 2002; Blanco and Cavin, 2003; Blanco Piñon, 2003; Ifrim et al., 2005, in press; Ifrim, 2006). The age of these deposits is latest Cenomanian to early Turonian, as outlined below. The fine-grained texture of the limestones and mudstones at Vallecillo, the absence of sedimentary structures other than lamination, and the excellent fossil preservation suggest that deposition occurred in a quiet-water marine environment with restricted circulation. Similar conditions commonly occurred across the Cenomanian–Turonian boundary and were named Oceanic Anoxic Event (OAE 2) by Schlanger and Jenkyns (1976). Originally, the Vallecillo sediment was black and rich in organic matter, similar to other rocks of the Agua Nueva Formation. This is indicated by remnants of organic matter present in some beds/laminae that preserve dark grey to black colours; yet, on the whole the dark colour has weathered into pink, yellow or grey.

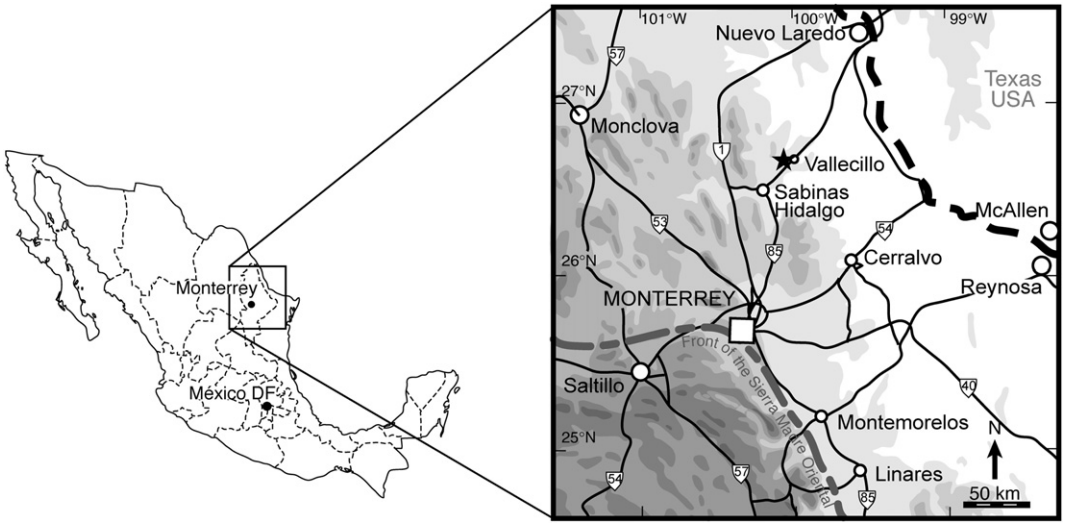

Fig. 2. Geographic location of Vallecillo, marked by asterisk, within Mexico and the state of Nuevo León.