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Sphenodiscus pleurisepta (Conrad, 1857) from the Maastrichtian La Tabla Formation in the Upper Magdalena Valley, Tolima, Colombia

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ABSTRACT

The La Tabla Formation is an important petroleum reservoir in the Upper Magdalena Valley of Colombia. It was deposited in regressive and lowstand systems tracts and comprises a succession of lower shoreface to coastal plain deposits. A section in the Talora Creek, near the village of Piedras, Department of Tolima, exposes 90 m of a progradational to aggradational succession composed of very fine sandstones to medium-grained pebble conglomerates, with abundant planktic and benthic foraminifers as well as bivalves and ammonites. A few well-preserved phragmocones of the ammonite *Sphenodiscus pleurisepta* (Conrad, 1857), collected from a level 63 m above the base of the formation, are here described and the chronostratigraphic position of the species discussed. In the Western Interior Basin of North America, *S. pleurisepta* ranges from the upper lower Maastrichtian *Baculites clinolobatus* Zone through the upper Maastrichtian *Jeletzkytes nebrascensis* Zone. The present findings support previous datings of the La Tabla Formation as Maastrichtian on the basis of foraminifers.

1. Introduction and geological setting

The predominantly ammonite genus *Sphenodiscus* has been reported from several formations in Colombia (Spath *in* Hedberg, 1937, p. 1998, footnote; Notestein et al., 1944; Petters, 1955; Hubach, 1957; Bürgl, 1958; Ujueta Lozano, 1961; Etayo-Serna, 1964, 1985, 1994). A recent study of the La Tabla Formation exposed in the Upper Magdalena Valley yielded a few well-preserved phragmocones from the type locality of the formation in the Talora Creek, near the village of Piedras, Tolima (Fig. 1). Previous study of the formation exposed east of Piedras, near the village of Jerusalén, Cundinamarca, has yielded only sparse fragments of *Sphenodiscus*.

In Colombia a sequence boundary occurs at the Campanian–Maastrichtian transition, reflecting the beginning of a relative sea-level fall after deposition of deeper-marine sediments in the late Campanian (Guerrero, 2002b). The facies interpretation is that of a shallowing-upwards succession of upper offshore to shoreface and coastal plain deposits (Guerrero et al., 2000).

The La Tabla Formation was deposited in regressive and lowstand systems tracts (Guerrero, 2002a,b). It is included in the Maastrichtian upper Guadalupe Alloformation (Guerrero, 2002a, fig. 3, 2002b, table 1, fig. 2), which comprises coeval progradational to aggradational formations of the back-arc Cretaceous Colombian Basin (*sensu* Guerrero et al., 2000), viz. the Buscavida and La Tabla formations in the Upper Magdalena Valley on the western flank of the basin and the Labor-Tierna and San Luís formations on the eastern flank of the basin. In the northern parts of the basin, towards Venezuela, a Maastrichtian unit containing *Sphenodiscus* sp. and *Coahuilites* sp. (Renz, 1981) is known as the Mito Juan Formation.

In the Talora Creek section near Piedras, the La Tabla Formation consists of 85–90 m of prograding, coarsening-upwards, very fine sandstones to medium-grained pebble conglomerates (Porta, 1965, 1966; Guerrero et al., 2000) containing bivalves (*Pecten* sp., *Ostrea* sp., *Cardium* sp., *Natica* sp.) (Porta, 1965, 1966), ammonites and large foraminifers (*Lepidorbitoides* sp.) (Porta, 1965, 1966). The formation has been dated as Maastrichtian on the basis of foraminifers (Guerrero et al., 2000; Tchegliakova and Mojica, 2001). The specimens of *Sphenodiscus pleurisepta* (Conrad, 1857) described here were collected from a level 63 m above the base of the formation (Fig. 2). The La Tabla Formation rests conformably and transitionally on the impure, muddy biomicrites and mudstones of the Buscavida Formation, whereas upwards there is a sharp boundary to the terrigenous mudstones and sandstones of the upper Maastrichtian Seca Formation (Guerrero et al., 2000), which straddles the Cretaceous–Palaeogene boundary.

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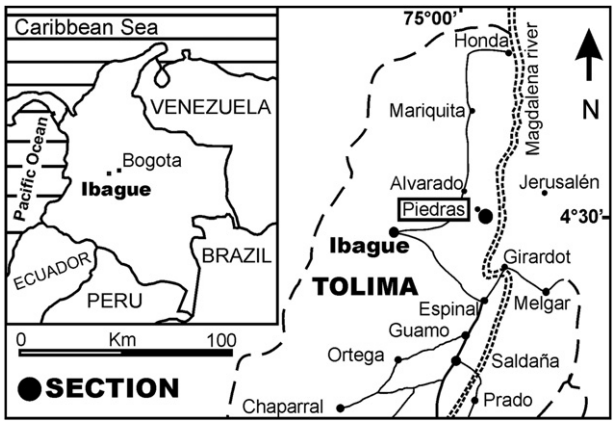

Fig. 1. Location of the type section of the La Tabla Formation at Talora Creek near Piedras, Tolima.

The fault affecting the La Tabla Formation (Fig. 2) caused only a minor displacement without biostratigraphic consequences.

The presence of *S. pleurisepta* in the sandstones of the La Tabla Formation is in agreement with previous observations indicating that the genus is a typical shallow-water form (Jacobs and Chamberlain, 1996; Ifrim et al., 2004).

2. Systematic Paleontology

The systematics follows mainly the *Treatise on Invertebrate Paleontology* (Wright, 1996).

Subclass Ammonoidea Zittel, 1884
Order Ammonitida Zittel, 1884
Suborder Ammonitina Hyatt, 1889
Superfamily Acanthoceratoidea de Grossouvre, 1894
Family Sphenodiscidae Hyatt, 1900
Subfamily Sphenodiscinae Hyatt, 1900

Genus *Sphenodiscus* Meek, 1871
Type species: Ammonites lenticularis Owen, 1852, p. 579, by original designation; =*A. lobatus* Tuomey, 1856, p. 168

Sphenodiscus pleurisepta (Conrad, 1857)
Figs. 3–6

1857 *Ammonites pleurisepta*. Conrad, p. 159, pl. 15:1 [erroneously (?) given as "*Ammonites pedernalis*, (Var.)"].

1861 *Ammonites pedernalis*, von Buch. Binkhorst van den Binkhorst, p. 21 (pars), pl. 5.a.1:1a, b only.

1898 *Sphenodiscus pleurisepta* Conrad sp. Böhm, pp. 193–197, pl. 7:1a–c.

1903 *Sphenodiscus pleurisepta* (Conrad). Hyatt, p. 59 (pars), pls 3:7–12, 3:14, 4:1–2, 5:1–2, 6:6.

1928 *Sphenodiscus pleurisepta* Conrad. Böse, p. 304, pl. 17:2–5.

1941 *Sphenodiscus pleurisepta* (Conrad, 1857). Stephenson, p. 436, pl. 95:1–4; 1944 Shimer and Shrock, p. 595, pl. 248:8–9; 1977 Wolleben, p. 392, pl. 3:24; 1993 Kennedy and Cobban, p. 58, figs 1a–c, 2, 3t (with additional synonymy); 1994 Emerson et al., p. 256; 1995 Cobban and Kennedy, p. 12, fig. 8:5 (with additional synonymy); 1996 Kennedy et al., p. 11, figs 4a, 5–12; 1997 Kennedy et al., p. 9, figs 9j, 11–14; 2000 Kennedy and Cobban, p. 178, pl. 1:12–15, Fig. 2; 2003 Landman and Cobban, p. 17, figs 12–15; 2004a Landman et al., p. 26, figs 10a–j, 11; 2004b Landman et al., p. 50, fig. 22; 2005 Ifrim et al., p. 56, figs 5e, 7a–c, 8a–d, h–i.

Material. Three internal moulds of phragmocones, nos. T-16-1, T-16-2, and T-16-3, from the upper part of the La Tabla Formation, Talora Creek, Piedras, Tolima, Colombia, kept in the palaeontological collections of the Departamento de Geociencias, Universidad Nacional de Colombia, Bogotá.

Measurements (in mm). Figures in brackets are percentages of whorl diameter.

Specimen no.	D	Wh	Wb	Wb:Wh	Ud
T-16-1	97	53,5 (0.55)	24.4 (0.25)	0.45	4.2 (0.04)
T-16-2	104	54.6 (0.52)	23.3 (0.22)	0.43	6.6 (0.06)
T-16-3	105	57 (0.54)	23 (0.22)	0.4	5 (0.04)

Description. Compressed, lanceolate oxycone, generally smooth with midlateral and ventrolateral tubercles. The greatest whorl breath is at around midflank; the flanks are feebly convex, and the venter is acute. Two rows of 13 midlateral and ventrolateral tubercles are joined by low ribs. The inner flank is feebly concave, the midflank broadly rounded, and the outer flank convergent. Parts of the phragmocone are broken and were filled with sand during deposition. The suture line (Fig. 6) shows indented external lobes (E), first lateral saddles (S) with two deep indented accessory lobes, deep first lateral lobes (L) and indented accessory lobes; between U2 and U11 the auxiliary saddles are entire.

Discussion. As indicated by Kennedy and Cobban (1993, p. 61), Cobban and Kennedy (1995, p. 12) and Kennedy et al. (1996, p. 13), the presence of two rows of tubercles on the flanks distinguishes *Sphenodiscus pleurisepta* from the smooth or feebly ribbed *Sphenodiscus lobatus* (Toumey, 1856). Our specimens compare closely with those illustrated by Böhm (1898), Hyatt (1903), Böse (1928), Stephenson (1941), Kennedy and Cobban (1993), Kennedy et al. (1997), and Ifrim et al. (2005).

Occurrence. Lower and upper Maastrichtian of the North American Western Interior, Gulf Coast and Atlantic Seaboard, and the Gulf of Mexico; Maastrichtian of the Liège-Limburg Basin, the Netherlands, and the Eastern Cordillera and Upper Magdalena Valley of Colombia.

3. Biostratigraphy

Ifrim et al. (2005) assigned an early Maastrichtian age to the basal middle member of the Cárdenas Formation at Arroyo de la Atarjea in northeastern Mexico, based on the co-occurrence of *S. pleurisepta* and the planktic foraminifers *Gansserina gansseri* Bolli, 1951 and *Globotruncana linneiana* (d'Orbigny, 1839).

Zaborski (1982, p. 316) stated that "*Sphenodiscus* has always been thought of as restricted to the Maastrichtian. The American forms are of this age" … "… in Europe it is predominantly an upper Maastrichtian indicator". He (Zaborski, 1982, fig. 36) showed the occurrence of ornamented forms of early and early late Maastrichtian age. In the Western Interior Basin of North America *S. pleurisepta* ranges from the upper lower Maastrichtian *Baculites clinolobatus* Zone through the upper Maastrichtian *Jeletzkytes nebrascensis* Zone (Kennedy et al., 1997, 1998; Landman and Cobban, 2003). But to Landman et al. (2004a,b), in the Atlantic Coast area *S. pleurisepta* ranges until the *Discoscaphites iris* Zone near the K–P boundary (Fig. 7).

In the Talora Creek section (Fig. 2) the foraminifers *Rugoglobigerina hexacamerata* Brönnimann, 1952 and *Globotruncana aegyptiaca*