

Platypeltoides carmenae: A new Nileidae (Trilobita) from the Lower Ordovician (Tremadocian) of Guelmim area; Western Anti-Atlas, Morocco

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ABSTRACT – It is described a species of the genus *Platypeltoides*, *P. carmenae*, from the Fezouata shales, Lower Ordovician (Tremadocian) of the Guelmim province (Morocco). With this new species and another which is still pending to be described, the genus *Platypeltoides* includes four different species in Morocco, all them belonging to the Lower Ordovician (Tremadocian).

RESUMEN – Se describe una nueva especie del género *Platypeltoides*, *P. carmenae*, de los esquistos de Fezouata, Ordovícico Inferior (Tremadociense) de la provincia de Guelmim (Marruecos). Con esta nueva especie y otra más todavía por describir, el género *Platypeltoides* cuenta en Marruecos con cuatro especies diferentes, todas ellas pertenecientes al Ordovícico Inferior (Tremadociense).

KEY WORDS – Trilobita / Palaeozoic / *Platypeltoides* / Tremadocian / Morocco.

INTRODUCTION

In 2008 one of us (JC) had the opportunity to meet Hassain, cousin of Ossaid Ben Moula, a trilobite seeker who showed me some interesting giant trilobites recently found by his family in a new site of the Guelmim area, specifically in the northwest of Assa (Guelmim-Esmara), in the Moroccan Western Anti-Atlas. We could verify very soon that these trilobites were not yet been described, and after collecting some additional specimens as well as the data of the outcrop, we decided to realize this study, as a part of the project that we have been developing since 2005 on the Ordovician trilobites of Morocco.

HISTORICAL BACKGROUND

The first research on the geology of this area of Morocco was carried out by the French geologist Henri Coquand (1813-1881), who collected and

described the first fossils from this region (Coquand, 1847). The presence of Ordovician rocks in the Anti-Atlas was firstly mentioned by Neltner (1929) at the Tafilelt area, and similarly, the existence of the Ordovician system in the western (Jbel Tachilla, Tiznit area; Bigot & Dubois, 1931) and central Anti-Atlas (Foum Zguid area) was pointed out by Bondon (in Termier, 1936).

A long list of researchers have studied the trilobites from the Upper and Middle Ordovician of Morocco: Neltner (1929), Barthoux (1924), Termier (1927 and 1936), Roch (1930), Destombes (1963, 1966, 1967 and 1971), Destombes *et al.* (1985), and more recently Vela & Corbacho (2009), Corbacho (2011), Corbacho & Kier (2011), López-Soriano & Corbacho (2012), Corbacho & López-Soriano (2013), Corbacho & Calzada (2014), Corbacho *et al.* (2014) and Fortey & Edgecombe (2017). Concerning the trilobites from the Lower Ordovician of Morocco, the list of authors include Pruvost (in Roch, 1939), Termier & Termier (1950), Hupé (in

Choubert *et al.*, 1955), Destombes (1962, 1967, 1971, 1972, 2006a, 2006b, 2006c, 2006d, 2006e, 2006f and 2006g), Destombes *et al.* (1985), Rábano (1990), Vidal (1996, 1998a and 1998b), Vela & Corbacho (2007), Vela (2007), Corbacho (2008 and 2014), Fortey (2009, 2010 and 2011), Corbacho & Vela (2010, 2011 and 2013) and Corbacho & López-Soriano (2012 and 2016). See also Basse (2012) and Lemke (2017) for the described species.

The species included in the genus *Platypeltoides* from Morocco are: *Platypeltoides magrebiensis?* Rábano, 1990 and *Platypeltoides hammondi* Corbacho & López-Soriano, 2016.

GEOGRAPHICAL AND GEOLOGICAL SETTINGS

Type locality –The studied locality consists of grey-blue ferruginous sandstones which have been assigned to the Upper part of the Lower Fezouata Formation (Destombes, 1971), Lower Ordovician (Upper part of Tremadocian) (Figure 1). The studied site is located approximately 710 km of the SW of Rabat, in the administrative area of Agadir and 88 km of the NW de Assa in Guelmim area; Western Anti-Atlas, Morocco (Figure 2). The coordinates of the site are N 28° 43' 31" and W 009° 36' 31" - Altitude 689 m. In this site the following trilobites appear: *Lehua tahirii* Corbacho, 2008., *Lehua* sp. and *Megistaspis (E.) hammondi forteyi* Corbacho & Vela, 2010 and *Parabathychealus gallicus* Dean, 1965.

System	Series	Stages	Groups	Formations
Ordovician	Middle	Darriwilian	Outer Feijas	Tachilla
	Lower	Floian		Zini
		Tremadocian		Upper Fezouata
				Lower Fezouata *

Figure 1. Stratigraphy of Lower Ordovician from the Anti-Atlas. Based on Van Roy (2006). * *Platypeltoides* Locality.

SYSTEMATIC PALAEONTOLOGY

Order ASAPHIDA Salter, 1864

Suborder ASAPHINA Salter, 1864 emend.

Fortey & Chatterton, 1988

Superfamily CYCLOPYGOIDEA Raymond, 1925

Family NILEIDAE Angelin, 1854

Genus *Platypeltoides* Pribyl, 1948

Type species - *Platypeltis croftii* Callaway, 1877 from the Tremadocian of Shropshire (England).

Geographical distribution - The genus *Platypeltoides* appears in the Tremadocian of Morocco, United Kingdom, Czech Republic, Sweden, Norway, Russia, Kazakhstan and China, and also in the Floian of Mauritania, France and Russia.

Platypeltoides carmenae sp. nov.

(Plates 1, 2, 3 and 4)

Diagnosis – *Platypeltoides* of large size, with a slightly triangular-shaped cephalon and medium-sized genal spines, big eyes located in the transverse median line of the cranidium, a thin anterior border and a slightly triangular pygidium with three axial rings and a terminal axial piece.

Material – In order to do this study, 25 cephalons, 29 pygidia and 12 complete specimens have been analyzed. Here we only present the data corresponding to five complete and well-preserved specimens. The holotype (length: 220 mm) is housed in the collections of the Natural History Museum of London, under the entry NHMUK It 29220 (Plate 1). Two paratypes of length 220 mm and 240 mm (both them in the same plate) are housed in the Museo Geológico del Seminario de Barcelona (Keith Hammond collection) under the entries MGSB-KH212 and MGSB-KH213 (Plate 2), whereas another paratype (265 mm in length) of the same collection is housed under the entry MGSB-KH214 (Plate 3). Finally, a last paratype (240 mm in length) is housed in the Museo Geológico del Seminario de Barcelona (Joan Corbacho collection) under the entry MGSB-JC602 (plate 4)

Name – This new species is named after Mrs. Carmen Sánchez for her invaluable help in our investigations.

Description – *Platypeltoides* of big size, with an elongated carapace. The cephalon shows a subtriangular shape; its length (sag.) is slightly lower than the maximum width (tr.) of the cranidium, and somewhat less than a third of the total length of the carapace. The glabella is smooth and wide (tr.), being moderately bulky; it represents almost a half of the total cranidium width (tr.) and it is laterally limited by marked and straight axial furrows. The frontal lobe abruptly expands outward at the level of the anterior part of the eye, and then it closes toward the inner part. The occipital furrow is absent, and the glabellar tubercle is not observed. The anterior part of the glabella drops sharply to the anterior margin with a narrow but clearly differentiated anterior border.

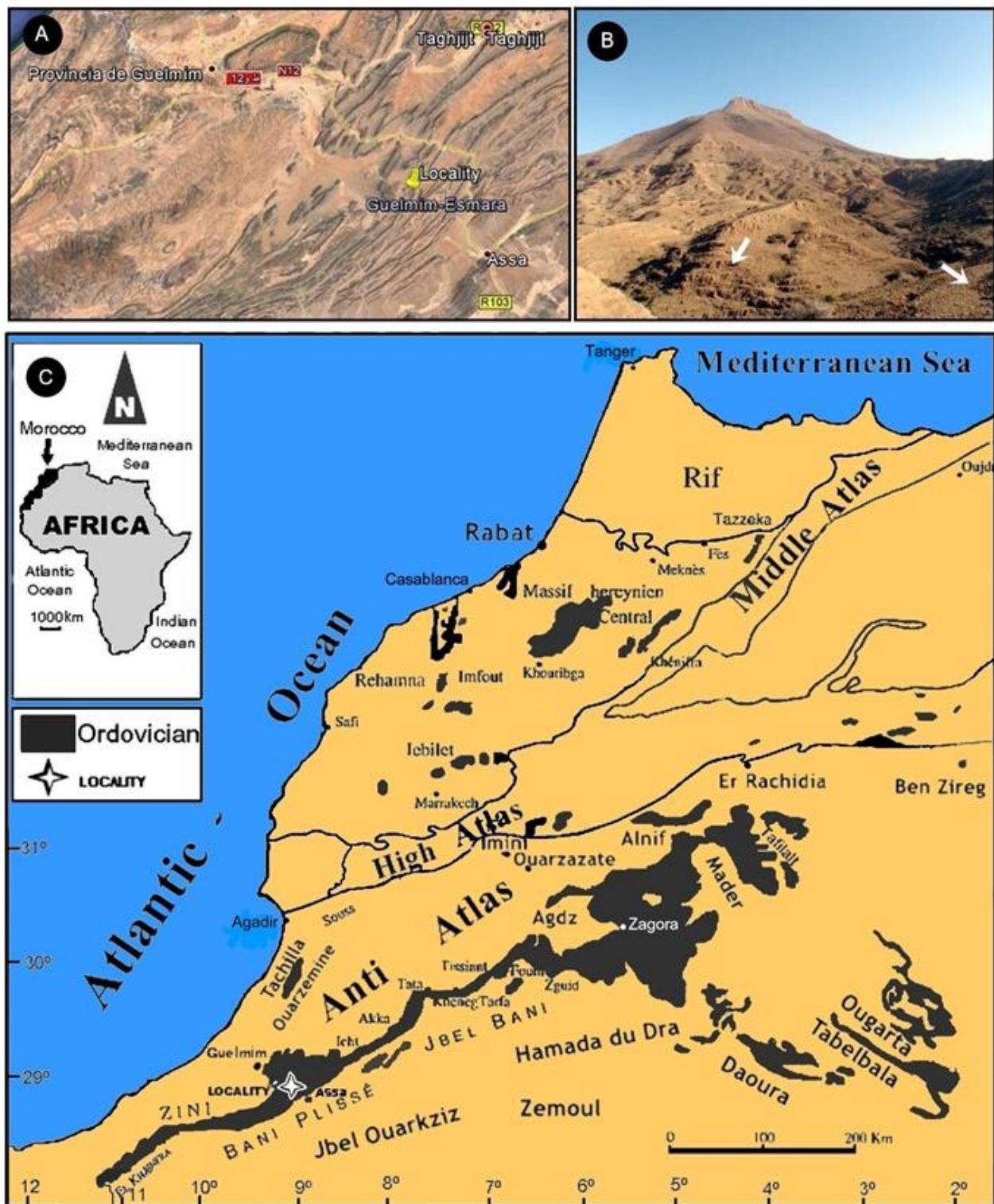


Figure 2. **A:** Satellite photo (Google Earth, 14-12-2015) of Guelmim area with the location of locality. **B:** The arrows indicate the stratigraphical level where the studied fossils were found. **C:** Ordovician from Morocco (after Destombes 1971, taken from Corbacho & López-Soriano, 2016; modified). * *Platypeltoides* Locality

The eyes are large, being located in the front of the midline of the cephalon; their length (exsag.) is approximately but something less than one-third of the cephalic length (sag.). The posterior branch of the facial sutures are directed outward as a sigmoidal curve, delimiting a rear area of the relatively wide fixigenas. The librigenas have subtriangular shape, without grooves; they finish in strong and long genal spines projected backwards in parallel to the thorax, reaching the third thoracic segment. There is no information about either the hypostome or the ventral doublure.

The thorax has seven segments. Its width (tr.) represents almost a half of the total length of the total exoskeleton length (sag.). The rachys is wide, with a slight fusiform shape toward its posterior part. The width (tr.) of the first segment represents about 1.4-fold that of the pleura, whereas these two measurements are virtually the same in the last thoracic segment. The rachys is laterally delimited by well-defined furrows. The pleural furrows are deep and oblique. The pleurae show rounded ends, with wide articulate facets and short (tr.) posterior bands that do not reach the distal ends of the pleural furrows.

Pygidium with subtriangular shape. Its length (sag.) represents nearly a 50% of its width (tr.). The rachys is fusiform, well delimited both laterally and posteriorly. In its anterior margin, its width (tr.) represents about a third of the maximum pygidium width. Articular facet well differentiated. Wide pygidial border with wide pleural furrows, whose internal line runs in parallel to the pygidial border, joining with the rachys in its posterior end. Three axial rings and a terminal axial piece are observed.

Comparison with other species of the genus - *Platypeltoides carmenae* sp. nov. is very similar to *P. magrebiensis?* and *P. hammondi*. *P. carmenae* sp. nov. shows a narrower axial lobe than these two species. Compared with *P. magrebiensis?*, the main difference is the presence of genal spines and an anterior border. Compared with *P. hammondi*, it is different because the more pointed cephalon shape, the presence of an anterior border, much wider librigenas, shorter and wider genal spines parallel to the thorax, and the pygidium shows three well-differentiated axial rings as well as a terminal axial piece.

Another member of this genus but not yet described is *Platypeltoides* aff. *carmenae*, from the Zagora region. Compared with *P. carmenae* sp. nov., this undescribed species shows a more rounded shaped cephalon and pygidium as well as a narrower pygidial rachys; however, because we only have one specimen (not very well preserved), we cannot guarantee that it does not belong to the same species.

Compared with the other species of the same genus, *Platypeltoides carmenae* sp. nov. is different mainly because the genal spines.

Look at table 1 on next page

CONCLUSION

Platypeltoides carmenae sp. nov. is a new species from the Upper part of the Lower Fezouata Formation (Tremadocian) of Morocco. The presence of well developed genal spines in adult specimen is a very particular feature of this species because together with *Platypeltoides hammondi* are the only two species in which this characteristic has been observed in this genus.

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Table 1. Measurements (mm) of the specimens figured in this paper

Specimen number	TL	EL	CL	DEC	DGC	CW	CW1	GW	FGW	PW	RW	RL	PL
Holotype	220	25	94	22	87	180	112	50	76	124	33	50	66
KH212	220	26	84	21	80	----	110	49	73	123	33	53	74
KH213	240	26	90	23	85	180	114	51	77	128	36	54	75
KH214	265	29	96	28	90	200	122	53	84	144	37	68	90
JC602	240	28	92	26	89	295	113	52	75	128	36	60	81

TL = total exoskeleton length; **EL** = total eye lenght; **CL** = total cephalon length; **DEC** = distance between the posterior eye side and the posterior cephalon side; **DGC** = distance between the anterior part of the glabella and the posterior cephalon side; **CW** = total cephalon width; **CW1** = maximum cranidium width (in posterior margin); **GW** = basal glabella width; **FWG** = frontal glabella width in the widest part; **PW** = maximum pygidium width; **RW** = anterior width of the pygidial rachis; **RL** = total length of pygidial rachis; **PL** = total pygidium length.

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Plate 1. *Platypeltoides carmenae* sp. nov., Holotype NHMUK It 29220, Lower Fezouata Formation; Lower Ordovician (Tremadocian), Guelmim area (Morocco). The specimen was coated with ammonium chloride for a better display. **A** = Front view; **B** = Side view; **C** = Dorsal view. Measures are indicated in Table 1.

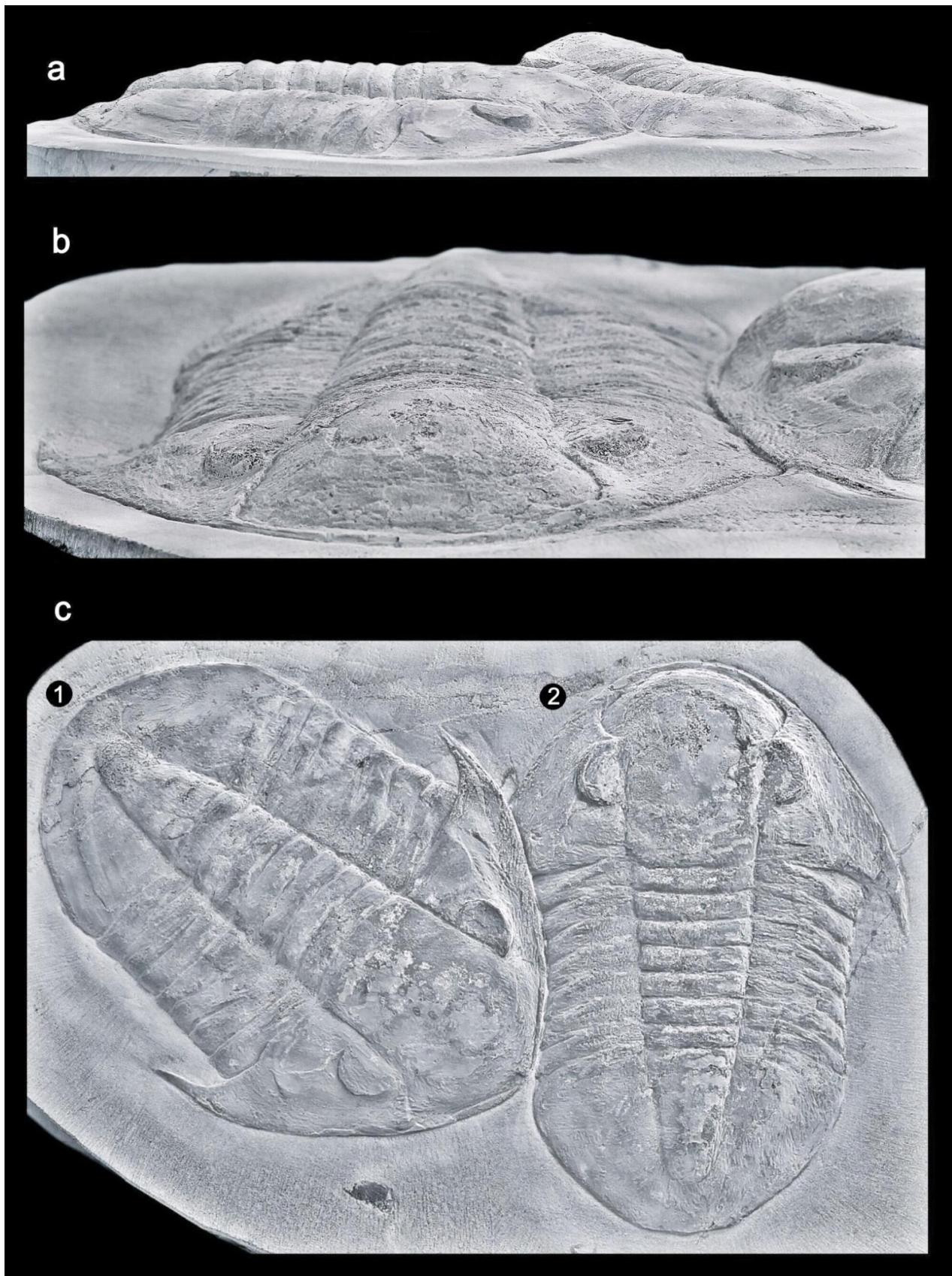


Plate 2. *Platypeltoides carmenae* sp. nov., Lower Fezouata Formation; Lower Ordovician (Tremadocian), Guelmim area (Morocco). These specimens were coated with ammonium chloride for a better display. **A** = Side view of the paratype MGSB-KH212 and rear view of the MGSB-KH213; **B** = Front view; **C1** = Dorsal view; **C2** = Dorsal view. Measures are indicated in Table 1.

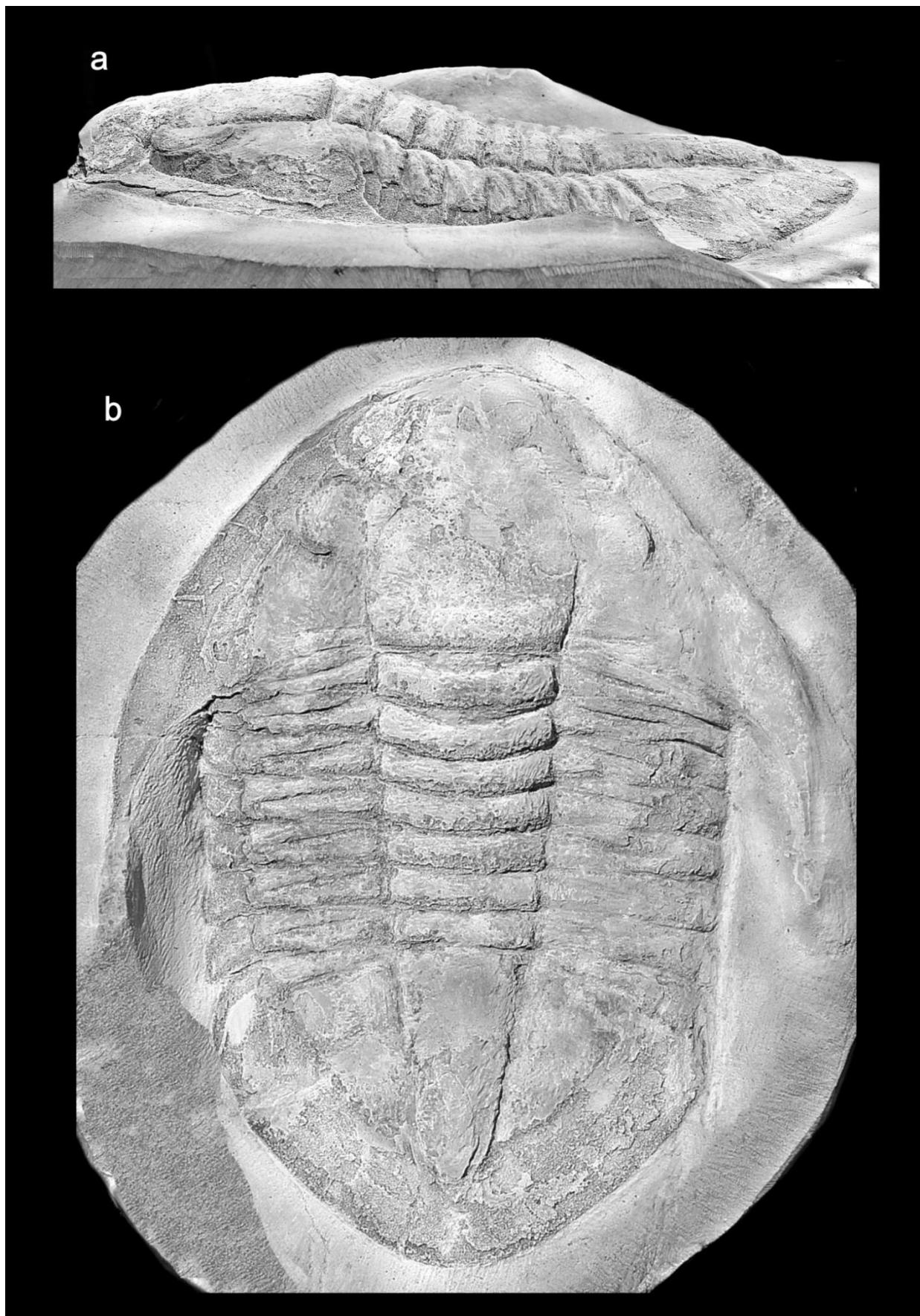


Plate 3. *Platypeltoides carmenae* sp. nov., Paratype MGSB-KH214, Lower Fezouata Formation; Lower Ordovician (Tremadocian), Guelmim area (Morocco). The specimen was coated with ammonium chloride for a better display. **A** = Side view; **B** = Dorsal view. Measures are indicated in Table 1.

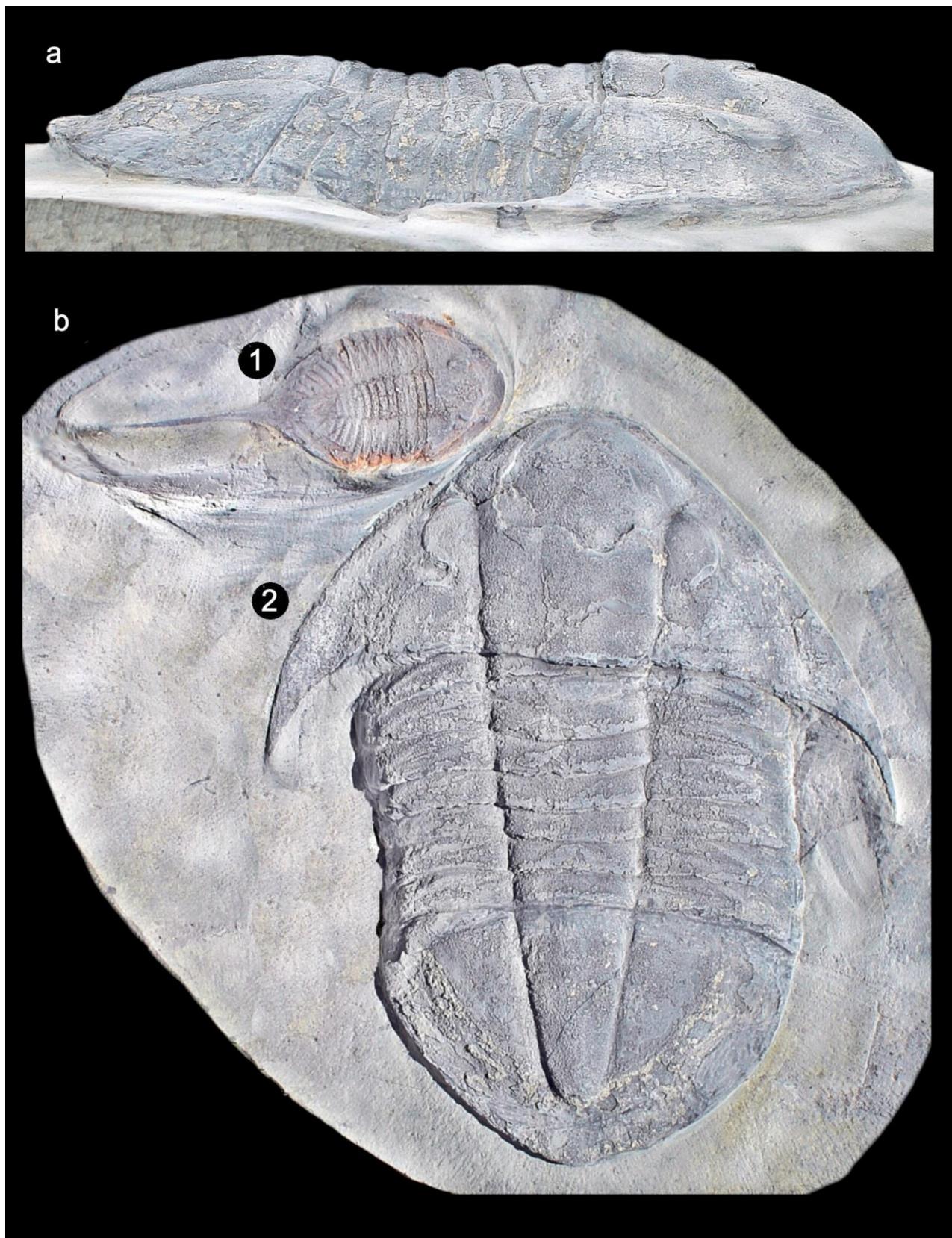


Plate 4. **B1** = *Megistaspis (E.) hamondi forteyi* Corbacho & Vela, 2010 (Holaspis); **A** (side view) and **B2** = *Platypeltoides carmenae* sp. nov., Paratype MGSB-JC602, Lower Fezouata Formation; Lower Ordovician (Tremadocian), Guelmim area (Morocco). The specimen was coated with ammonium chloride for a better display. Measures are indicated in Table 1.