

PASOTTIA, A NEW GENUS OF TITHONIAN OPPELIID AMMONITES (LATE JURASSIC, AMMONOIDEA: HAPLOCERATOIDEA)

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Boletín
del Instituto de
Fisiografía y Geología

Parent H., Schweigert G., Scherzinger A. & Enay R., 2008. *Pasottia*, a new genus of Tithonian oppeliid ammonites (Late Jurassic, Ammonoidea: Haploceratoidea). *Boletín del Instituto de Fisiografía y Geología* 78(1-2): 23-30. Rosario, 02-12-2008. ISSN 1666-115X.

Abstract.- Extensive sampling in recent years of the Tithonian ammonite fauna of the Neuquén-Mendoza Basin has yielded samples of a new oppeliid genus which is herein described under the name *Pasottia* n. gen. with *Pasottia andina* n. sp. as the type-species. The holotype comes from the Middle Tithonian Zitteli Zone of La Amarga, southern Neuquén-Mendoza Basin. *P. andina* n. sp. is recorded from La Amarga and Cerro Lotena, confined to a single horizon of the Zitteli Zone. *Pasottia* n. gen. is classified in the Subfamily Taramelliceratinae based on (1) the characteristic microconch with a well marked sulcus with a row of linguiform structures on middle flank of last whorl of phragmocone and bodychamber, which is geniculate and (2) the unkeeled, narrow rounded venter of both sexual dimorphs. Based on the ammonite assemblage of the type horizon is dated in the Semiforme Zone of the Primary International Standard.

Key-words: Ammonoidea; Opeiliidae; *Pasottia andina* n.gen. et n. sp.; Middle Tithonian; Andes; Argentina.

Resumen.- *Pasottia*, un nuevo género de amonites tithonianos de la familia Opeiliidae (Jurásico Tardío, Ammonoidea: Haploceratoidea). Extensos muestreos de la fauna de amonites tithonianos de la Cuenca Neuquén-Mendoza realizados en los últimos años han puesto en evidencia la ocurrencia de un nuevo género descrito como *Pasottia* n. gen., con *Pasottia andina* n. sp. como su especie tipo. El holotipo proviene de la Zona Zitteli del Tithoniano Medio de La Amarga, localidad del extremo sur de la cuenca. *P. andina* n. sp. ha sido registrada en su localidad tipo y en Cerro Lotena, confinada en un horizonte de la parte media de la Zona Zitteli. *Pasottia* n. gen. es incluido en la subfamilia Taramelliceratinae sobre la base de: (1) la característica microconcha que posee un marcado surco con una fila de estructuras linguiformes en la mitad del flanco de la última vuelta del fragmócono y la cámara habitacional, la cual es geniculada, y (2) ambos dimorfos sexuales poseen un vientre estrecho y redondeado, sin quilla. Sobre la base del conjunto de amonites asociados en el horizonte tipo se concluye que éste es de edad Zona Semiforme del estándar primario interenacional.

Palabras clave: Ammonoidea; Opeiliidae; *Pasottia andina* n. gen. et n. sp.; Tithoniano Medio; Andes; Argentina.

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Received: 10/06/2008; accepted: 20/08/2008.

Editors: E. P. Peralta and A.F. Greco

INTRODUCTION

The Tithonian ammonoid fauna of the Neuquén-Mendoza Basin (NMB) has been studied for a long time (see Leanza 1981 and Parent 2003 for references). Nevertheless publication has been slow and does not clearly reflect the true diversity of the ammonoids that are present. The descriptions of the Haploceratoidea are particularly sparse. Among recent papers the most comprehensive description (Leanza 1980) includes five species: *Pseudolissoceras zitteli* (Burckhardt, 1903), *P. pseudoolithicum* (Haupt, 1907), *Parastreblites comahuensis* Leanza, 1980, *Glochiceras steueri* Leanza, 1980 and *Hildoglochiceras wiedmanni* Leanza, 1980. Extensive sampling in recent years of the Tithonian of the southern and central NMB has revealed a higher diversity. There are several new forms, some of which, if in small samples or poorly preserved adult specimens, are hard to distinguish from *P. zitteli*. In the Zitteli Zone of Cerro Lotena and La Amarga, two localities in the southern NMB (Fig. 1), an oppeiid genus occurs rather abundantly that has not been previously described.

The objective of this paper is to describe this new genus and the new species on which it is based.

STRATIGRAPHIC FRAMEWORK

All the material presented in this paper was collected at La Amarga and Cerro Lotena. The Tithonian of these two localities is represented by marine rocks of the Vaca Muerta Fm., conformably overlying the conspicuous conglomerates and coarse sandstones of the Tordillo Fm.

At the base of the Lower Tithonian the lowermost Mendozanus Zone is represented mostly by fine to coarse sandstones that contain abundant, sometimes moderately well-preserved ammonites of the earliest Andean Tithonian faunal horizon, provisionally named "Fauna A" (Parent et al. 2006). Upwards, to the base of the Zitteli Zone, the base of the Middle Tithonian, there follow several meters of marls with a still undescribed fauna of perisphinctids. The Zitteli Zone consists mainly of a succession of shales and marls, partially covered, which can be subdivided into three parts (the faunal lists below are not exhaustive, only the most representative taxa are mentioned):

(1) the lower part (6-10 m): gray to yellowish shaly marls with abundant nodules containing *Pseudolissoceras zitteli*, and representatives of *Choicensisphinctes* Leanza, 1980, "*Lithacoceras*" Hyatt, 1900, *Catutosphinctes* Leanza & Zeiss, 1992 and micro- and macroconch aspidoceratids.

(2) the middle part (about 1 m): gray shaly marls with large nodules and an abundant ammonite fauna: *P. zitteli*, *Pasottia andina* n. gen. et n. sp., *G. steueri* (microconch of an undescribed genus widely represented through the Lower and Middle Tithonian of the basin), *Choicensisphinctes*, *Catutosphinctes*, and macro- and microconch aspidoceratids (including "*H. wiedmanni*", see below).

(3) the upper part (3-10 m, best exposed at La Amarga): brown, hard limestones and marls with large nodules and an abundant ammonite fauna: *P. zitteli*, *G. steueri*,

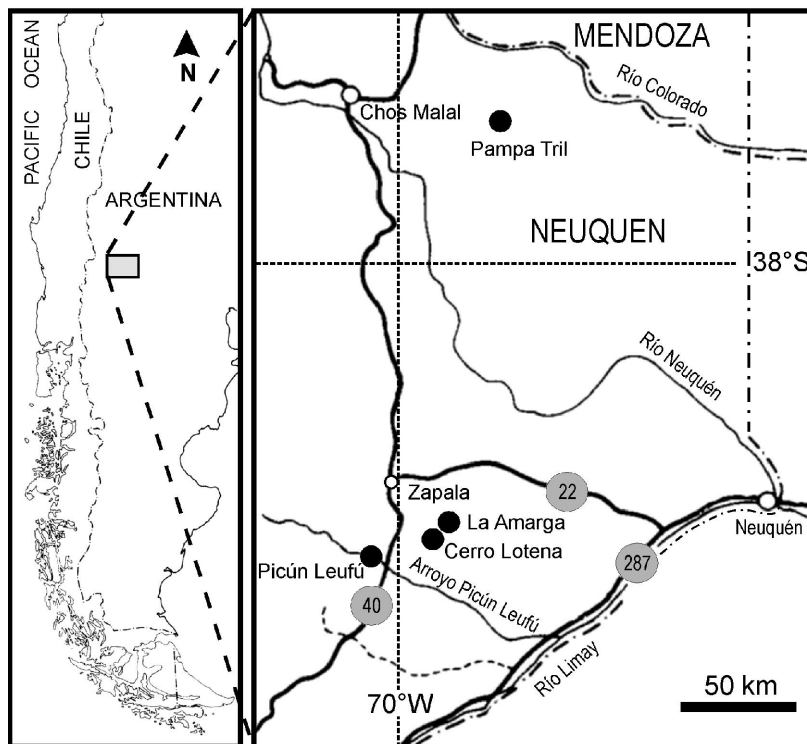


Figure 1. Map showing the localities cited in the text.

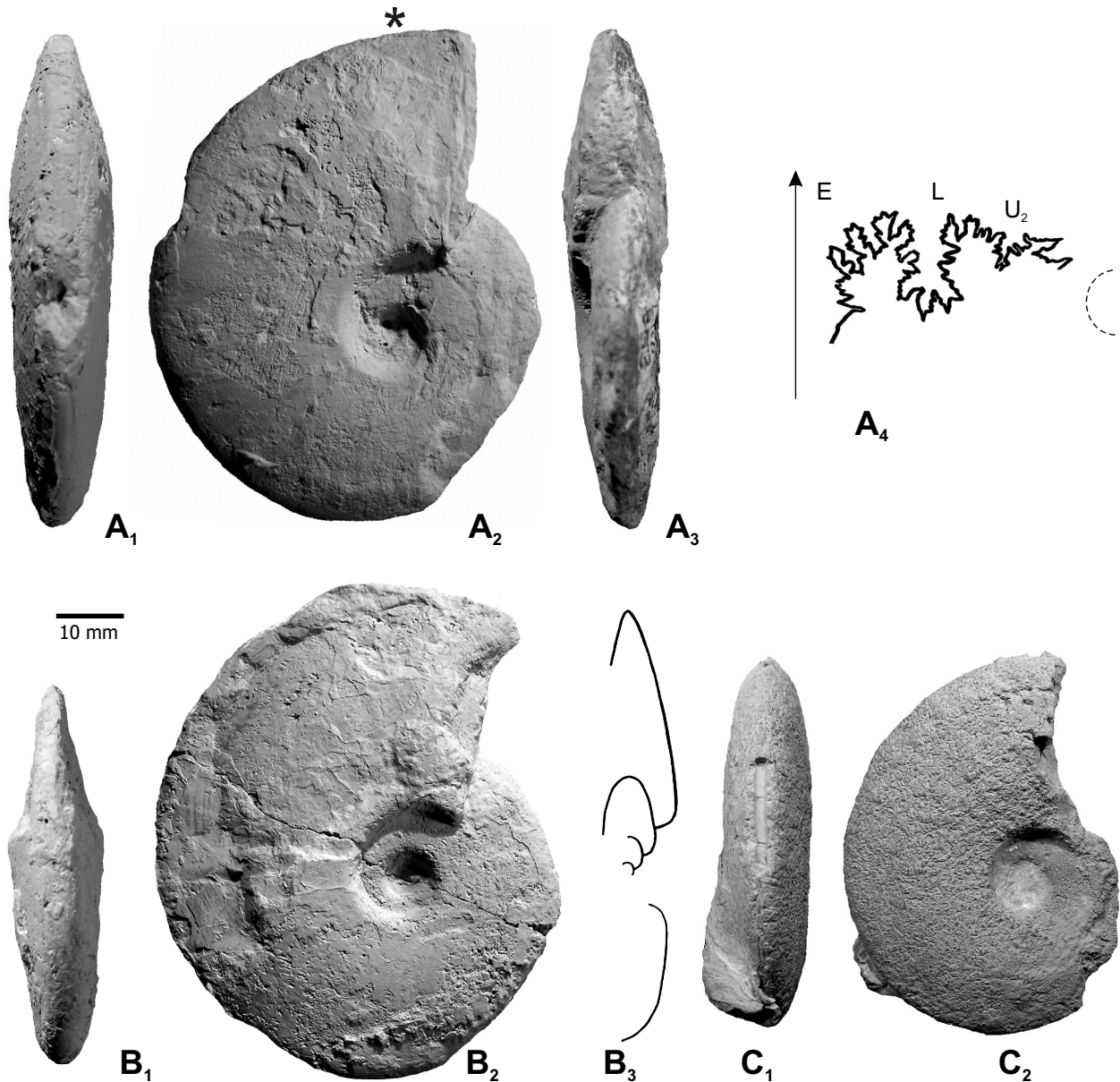


Figure 2. *Pasottia andina* n. gen. et n. sp. **A:** holotype (LPB 853), complete adult macroconch phragmocone with incipient bodychamber, ventral (**A₁**), lateral (**A₂**) and apertural (**A₃**) views and last septum suture line (**A₄**); La Amarga; Zitteli Zone. **B:** paratype (LPB 1090) complete adult macroconch phragmocone, ventral (**B₁**) and lateral views (**B₂**) and whorl section (**B₃**); Cerro Lotena; Zitteli Zone. **C:** paratype (LPB 1090/1), incomplete adult macroconch phragmocone, ventral (**C₁**) and lateral (**C₂**) views; La Amarga; Zitteli Zone. All natural size excepted suture (**A₄**) x3. - Asterisk at last septum.

Choicensiphinctes, *Catutosphinctes*, *Volanoceras krantzense* Cantú-Chapa, 1990, *Physodoceras* cf. *neoburgense* (Oppel, 1863) and other macro- and microconch aspidoceratids (including “*H. wiedmanni*”). Most likely this part of the section includes the horizon from which the holotype of *P. comahuensis* was collected (Bed 5 in Leanza 1980: 9).

This upper part is followed by a succession of poorly fossiliferous, bluish to greenish shales, gray siltstones and mudstones, which in Cerro Lotena pass into marls and limestones containing, mainly in their upper part, an abundant fauna of the Proximus Zone, including oppeliids, *Catutosphinctes*, and aspidoceratids.

SYSTEMATIC PALEONTOLOGY

The studied material is housed in the Museo Olsacher (MOZP), Zapala, Neuquén and in the Laboratorio de Paleontología (LPB), Universidad Nacional de Rosario. Macroconch (female): [M]; microconch (male): [m]. Dimensions are as follows: diameter (*D*), diameter at last septum (*D_{ls}*), diameter at adult peristome (*D_p*), umbilical width (*U*), width of whorl section (*W*), height of whorl section (*H₁*), and ventral or apertural height of whorl section (*H₂*), all given in millimeters (mm); approximated values denoted by (°). OD: original designation; SD: subsequent designation; TS: type species.

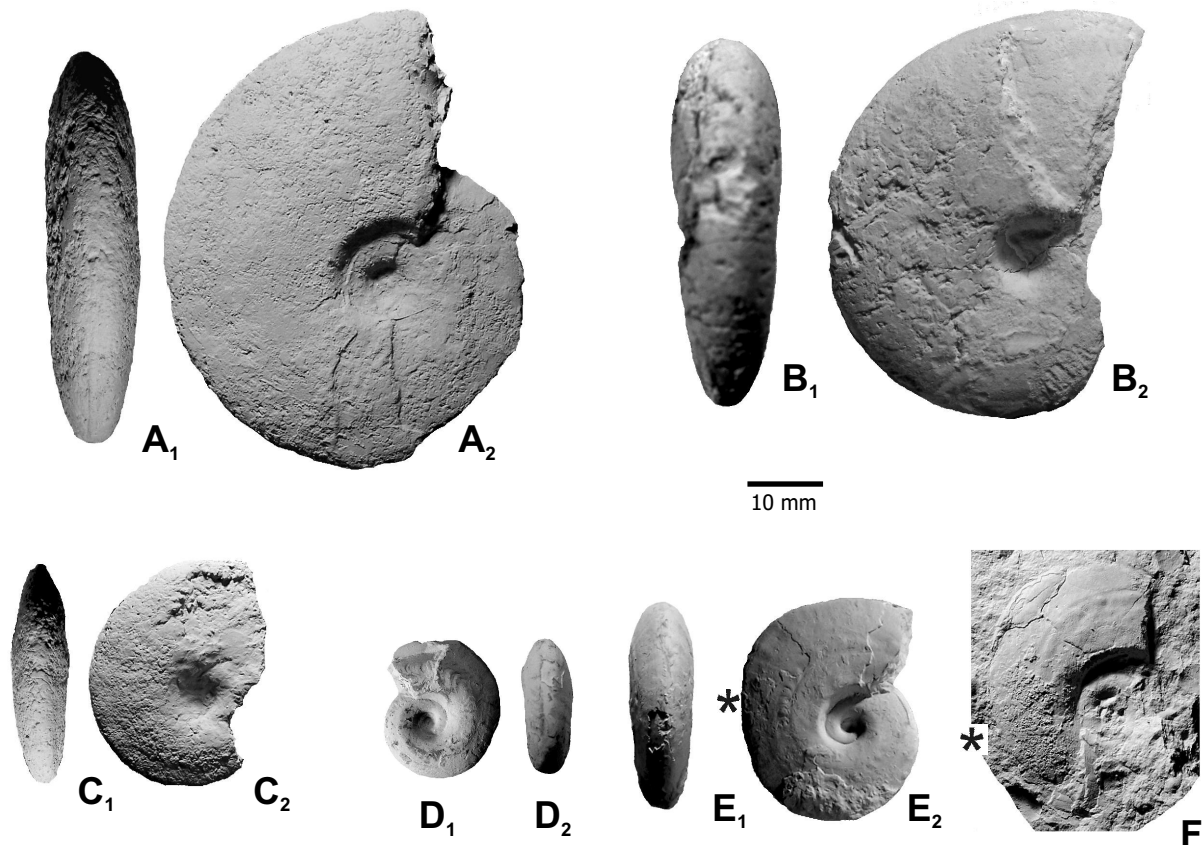


Figure 3. *Pasottia andina* n. gen. et n. sp. **A:** paratype (LPB 1090/2), adult macroconch phragmocone, ventral (**A₁**) and lateral (**A₂**) views; La Amarga; Zitteli Zone. **B:** paratype (MOZP 6870/2) adult macroconch phragmocone, ventral (**B₁**) and lateral views (**B₂**); La Amarga; Zitteli Zone. **C:** paratype (LPB 936), inner whorls of a macroconch, ventral (**C₁**) and lateral (**C₂**) views; La Amarga; Zitteli Zone. **D:** paratype (MOZP 7535/2), adult microconch phragmocone, lateral (**D₁**) and ventral (**D₂**) views; Cerro Lotena; Zitteli Zone. **E:** paratype (MOZP 7535/1), almost complete adult microconch, ventral (**E₁**) and (**E₂**) lateral views; Cerro Lotena, Zitteli Zone. **F:** paratype (MOZP 6853), almost complete adult microconch, lateral view; La Amarga; Zitteli Zone. - All natural size. Asterisk at last septum.

Superfamily Haploceratoidea Zittel, 1884
Family Oppeliidae H. Douvillé, 1890
Subfamily Taramelliceratinae Spath, 1928
Genus *Pasottia* n. gen.

Type species. - *Pasottia andina* n. sp. (description below).

Derivatio nominis. - In honour of the late Pierina E. Pasotti who made important contributions in Geology and Paleontology, and encouraged and supported ammonite research when directing the Instituto de Fisiografía y Geología (FCEIA–UNR).

Diagnosis. - Macroconch smooth, compressed suboxycone with high ovate to subtriangular whorl section; phragmocone moderately involute with rounded umbilical shoulder passing to uncoiled with sharp umbilical shoulder and flat, sloping wall. Bodychamber becoming strongly contracted, the umbilical seam uncoiled. Microconch inner whorls like in the macroconch; bodychamber also strongly contracted, geniculate from a point at which the rounded umbilical shoulder of the phragmocone becomes sharp and the umbilical wall flat and sloping. Last whorl of phragmocone and bodychamber with a sulcus and a dense row of linguiform structures.

Remarks and comparisons. - Inclusion in the subfamily Taramelliceratinae rather than in Streblitinae Spath, 1925 is indicated by (1) the microconch which has a lateral sulcus with a well marked row of linguiform structures, and (2) the venter which although narrow and smooth, lacks any kind of keel. It is worth remarking that some Streblitinae have a hollow floored keel which can be observed only in well preserved specimens. This is the case in *Uhligites* Kilian, 1913 (TS: *Streblites kraffii* Uhlig, 1903; SD by Roman 1938) as noted by Uhlig (1903: 34, 45) and confirmed with recently collected material from Southern Tibet (cf. Yin & Enay 2004).

Microconchs of the Haploceratinae Zittel, 1884 have smooth flanks and rounded umbilical shoulders, and those of *Haploceras* Zittel, 1870 (TS: *Ammonites elimatus* Oppel, 1865; SD by Spath 1923) have ventral crenulation (see Enay & Cecca 1986 and Wright et al. 1996).

Among the haploceratids genera known in the NMB the most closely similar is *Pseudolissoceras* Spath, 1925 (TS: *Neumayria zitteli* Burckhardt, 1903; OD). The macroconchs of *Pasottia* n. gen. can be easily distinguished from those of *Pseudolissoceras* spp. by the consistently smaller adult size and more compressed, suboxyconic shell shape. Moreover, the septal suture line of *Pasottia* n. gen. is significantly more incized, especially in its first lateral lobe which is trifurcated. The

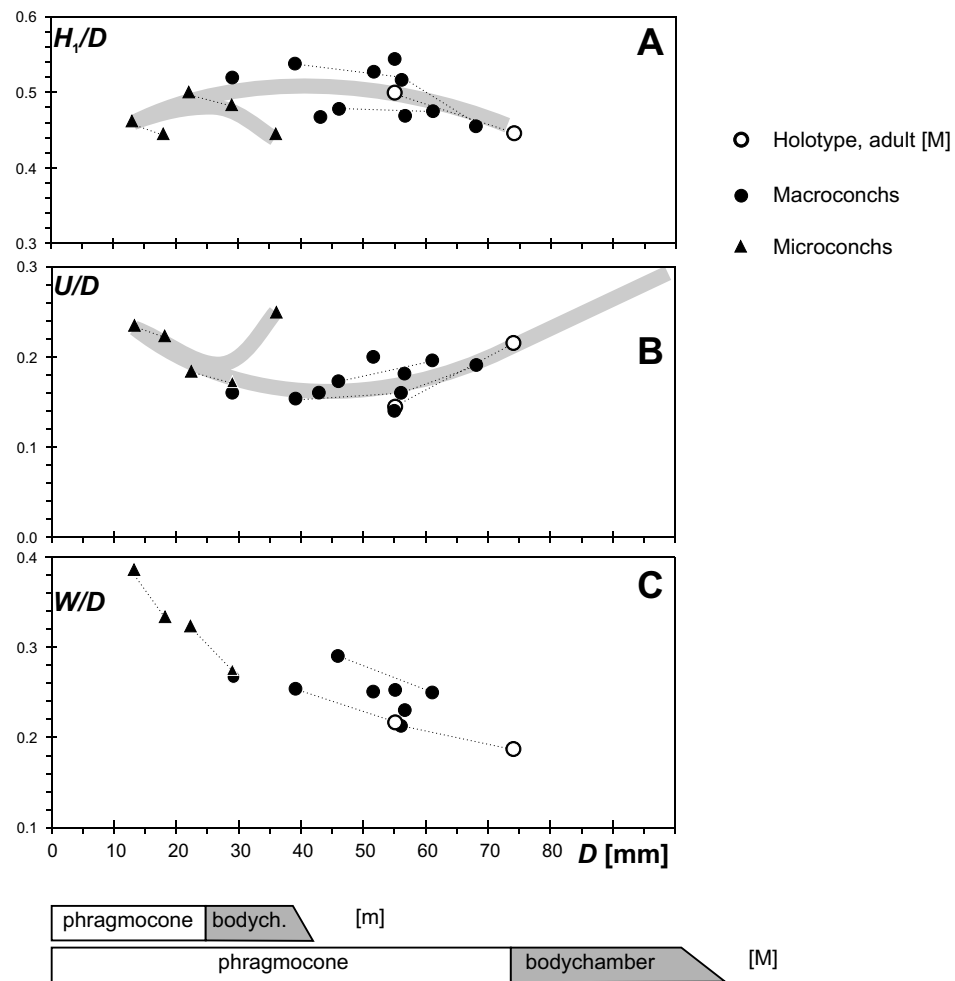


Figure 4. *Pasottia andina* n. gen. et n. sp. [M&m]. Relative dimensions versus diameter, ontogenetic trajectories and indication of phragmocone and bodychamber lengths for both sexual dimorphs. **A:** $H_1/D - D$. **B:** $U/D - D$. **C:** $W/D - D$. Thin broken lines linking multiple observations from a single specimen. Thick shaded curves illustrating the sexually dimorphic ontogenetic trajectories.

microconchs are also very different: in *Pasottia* n. gen. they are somewhat stouter and their bodychamber is geniculate from a point of ontogeny at which the well rounded, indistinct umbilical shoulder becomes suddenly sharp and almost rectangular. Another important difference between the microconchs is the completely smooth shell in *Pseudolissoceras* (see Parent 2001: fig. 7C-D), compared with a well-marked sulcus and a row of linguiform structures from the last whorl of the phragmocone in *Pasottia* n. gen.

***Pasottia andina* n. sp.**

Figs. 2-4; Table 1

Holotype.- The specimen LPB 853 (Fig. 2A), an adult macroconch phragmocone with beginning of the bodychamber preserved.

Paratypes.- Nine macroconchs (La Amarga: LPB 854-855, 936, 1090/1-4, MOZP 6870/2; C. Lotena: LPB 1090) and three microconchs (La Amarga: MOZP 6853; C. Lotena: MOZP 7535/1-2). All specimens of La Amarga come from the type horizon; those of Cerro Lotena come from biostratigraphically equivalent beds.

Type locality and horizon.- La Amarga, southern Neuquén Province (Fig. 1). Zitteli Zone, Andean Middle Tithonian; Vaca Muerta Fm.

Derivatio nominis.- Trivial name is derived from the Andean Chain.

Description.- Holotype (Fig. 2A): smooth suboxyconic adult macroconch phragmocone retaining small portion of the bodychamber; $D_{is} = 74$ mm. Inner whorls compressed suboval, higher than wide with rounded umbilical shoulder. Umbilicus on last whorl of phragmocone widely uncoiled, whorl section subtriangular, very narrow venter, weakly convex flanks and sharp umbilical shoulder passing to a flat sloping wall. Remains of the umbilical seam indicate a final diameter at the terminal adult peristome (D_p) of at least 100 mm, with a bodychamber of not less than a half whorl.

Macroconchs (Figs. 2A-C, 3A-C): All available material consists of phragmocones; the bodychamber is known only partially from poorly preserved, crushed, unfigured remains. The specimen LPB 936 (Fig. 3C) shows the distinctive inner whorls, very compressed with a small umbilicus. There is little variation in adults and

Table 1. *Pasottia andina* n. gen. et n. sp. Dimensions of the holotype and paratypes. Bc: bodychamber; Ph: phragmocone; Ad: adult; Juv: juvenil.

		<i>D</i>	<i>U</i>	<i>U/D</i>	<i>W</i>	<i>W/D</i>	<i>H</i> ₁	<i>H</i> ₁ / <i>D</i>	<i>W/H</i> ₁	<i>H</i> ₂	<i>H</i> ₂ / <i>D</i>
<i>Macroconchs</i>											
LPB 853 holotype	Bc/Ad	74.00	16.00	0.22	14.00	0.19	33.00	0.45	0.42	24.00	0.44
	Ph/Ad	55.00	7.50	0.14	12.00	0.22	27.50	0.50	0.44	23.00	0.42
LPB 1090	Ph/Ad	68.00	13.00	0.19	–	–	31.00	0.46	–	20.00	0.29
		56.00	9.00	0.16	12.00	0.21	29.00	0.52	0.41	–	–
LPB 1090/2	Ph/Ad	61.00	12.00	0.20	15.30	0.25	29.00	0.48	0.41	20.00	0.33
		46.00	8.00	0.17	13.30	0.29	22.00	0.48	0.41	–	–
		39.00	6.00	0.15	10.00	0.26	21.00	0.54	0.48	–	–
MOZP 6870/2	Ph/Ad	55.00	7.50	0.14	14.00	0.25	30.00	0.55	0.47	–	–
LPB 1090/4	Ph/Ad	51.50	10.10	0.20	13.00	0.25	27.20	0.53	0.48	–	–
		43.00	7.00	0.16	–	–	20.10	0.47	–	–	–
LPB 936	Ph/Juv	29.00	4.50	0.16	7.80	0.27	15.10	0.52	0.52	–	–
LPB 1090/1	Ph/Ad	56.50	10.20	0.18	12.80	0.23	26.50	0.47	0.48	–	–
<i>Microconchs</i>											
MOZP 6853	Bc/Ad	36.00 ⁽⁶⁾	9.00 ⁽⁶⁾	0.25 ⁽⁶⁾	–	–	16.00	0.44	–	9.00	0.25
MOZP 7535/1	Bc/Ad	29.00	5.00	0.17	8.00	0.28	14.00	0.48	0.57	9.00	0.31
	Ph/Ad	22.00	4.00	0.18	7.00	0.32	11.00	0.50	0.64	–	–
MOZP 7535/2	Ph/Ad	18.00	4.00	0.22	6.00	0.33	8.00	0.44	0.75	–	–
		13.00	3.00	0.23	5.00	0.38	6.00	0.46	0.83	–	–

subadults in comparison with the holotype (Fig. 4). Some specimens are slightly more inflated with a somewhat wider venter, especially the specimen MOZP 6870/2 (Fig. 3B). The diameter of the siphuncle in the specimen LPB 1090/1 (Fig. 2C) is 1.3 mm at $D = 47$ mm.

Microconchs (Fig. 3D-F): Innermost whorls ($D < 5$ mm) depressed suboval and smooth. Subsequent whorls of phragmocone show a trend towards suboval higher than wide, with a rounded umbilical shoulder. The last whorl of the adult phragmocone, from about $D = 10$ -15 mm, carries a sulcus, with a row of linguiform structures that are somewhat reinforced all along the bodychamber. Close to the beginning of the bodychamber ($D = 25$ mm) there occurs a sudden change to a subtrapezoidal whorl section with rounded venter, subplanar flanks and a sharp umbilical shoulder passing down into a steeply sloping wall. Bodychamber uncoiled.

Remarks and comparisons.- Fig. 4 illustrates the described ontogenetic changes of relative dimensions of the juvenil and adult stages of both sexual dimorphs.

Some specimens of *P. zitteli* associated with *P. andina* n. sp., both in Cerro Lotena and La Amarga, are somewhat similar in their sharp umbilical shoulders and sloping walls but their larger adult size and other differences - sutural degree of incision and oxyconic shape - discussed above at the generic level, make possible a rather clear separation.

Pseudolissoceras concorsi Donze & Enay, 1961 [M] and *Pseudolissoceras bavarium* Barthel, 1962 [M] have flanks with a well marked periumbilical concavity or depression and very simple septal suture line, with ceratitic aspect (discussion in Parent 2001). These two traits strongly differentiate *P. andina* n. sp., which shows more complex septal suture and the maximum width of whorl section just on the umbilical shoulder.

P. comahuensis is known only by its holotype, a

phragmocone from Cerro Lotena which differs from *P. andina* n. sp. in its larger adult size and more inflated last whorl with a much narrower umbilicus. "*Neochetoceras*" sp. from the Lower Tithonian Mendozanus Zone of the NMB (Parent et al. 2006) differs from *Pasottia* n. gen. by the occurrence of falcoid ribs, a rounded umbilical shoulder and a different cross-section.

Placentoceras fallax Castillo & Aguilera, 1895 (holotype refigured by Verma & Westermann 1973: pl. 29: 2) from Mexico, resembles *P. andina* n. sp. in its sharp umbilical shoulder, involution and adult size, but differs in the somewhat more inflated last preserved whorl. The species was assigned to *Haploceras* by Verma & Westermann (1973) but most likely belongs to *Pasottia* n. gen.

Glochiceras somalicum Spath, 1925, a microconchiate oppeliid from the ?Kimmeridgian of Somalia, has a lateral sulcus with a row of linguiform structures and a sharply defined steep umbilical edge, but differs in its wider umbilicus and the bodychamber uniformly uncoiled, not geniculate as in *P. andina* n. sp.

The holotype of "*Hildoglochiceras*" *wiedmanni* Leanza has tuberculate inner whorls (see Leanza 1980: pl. 1: 4), and several complete specimens with lappets collected recently in Cerro Lotena and La Amarga indicate that this ammonite is in fact a microconch aspidoceratid, very close if not identical with "*Glochiceras*" *parabolistriatum* Krantz, 1926. "*Hildoglochiceras*" *nudum* Collignon, 1960, a microconchiate oppeliid from Madagascar known only by its holotype, said to come from the Kobelli Zone, is somewhat similar to microconch *P. andina* n. sp. in shell shape but differs in that the lateral sulcus is narrower and it shows some kind of weak ribs or growth lines in the outer half of the flanks.

Distribution.- Well represented in La Amarga and C. Lotena (southern NMB), with a few specimens collected in

Picún Leufú (southern NMB), Pampa Tril (Fig. 1) and Arroyo Cieneguita (central NMB).

Age.- Middle part of the Zitteli Zone, Andean lower Middle Tithonian. In La Amarga, *P. andina* n. sp. occurs just below a recently collected well-horizoned fauna that includes *P. zitteli*, *V. krantzense* and *P. cf. neoburgense*. This association may be correlated with the Semiforme Zone of the Primary International Standard (see Schweigert et al. 2002). Thus, it may be assumed that the type horizon of *P. andina* n. sp. is Semiforme Zone in age (early Middle Tithonian) or older. The underlying horizon in the studied sections yields the first *P. zitteli*. This species and its total range biozone are commonly accepted as restricted to the Semiforme Zone (see Parent 2001). In this context it is concluded that the type horizon of *P. andina* is Semiforme Zone in age.

CONCLUSION

In the Zitteli Zone of Cerro Lotena and La Amarga (southern Neuquén-Mendoza Basin) occurs rather abundantly *Pasottia andina* n. gen. et n. sp. The new oppeliid genus belongs to the Taramelliceratinae and is strongly sexually dimorphic. The new species is very similar to the co-occurrent, abundant *Pseudolissoceras zitteli*, from which can be clearly differentiated by the more incized septal suture line with the first lateral lobe trifurcated, the smaller adult size of the macroconchs and the different sexual dimorphism.

The consistent occurrence confined to a single horizon in C. Lotena and La Amarga, and some few records from biostratigraphically equivalent levels in Picún Leufú, Pampa Tril and Arroyo Cieneguita, suggests that *P. andina* n. sp. could be a good guide fossil.

Acknowledgements

Sergio E. Cocca, Rafael Cocca, Javier Chávez (Zapala), Oscar D. Capello, Sofia Parent and Julieta Parent (Rosario) gave valuable assistance in the field. Adrián Pellegrini and Mario Pellegrini (Rosario) gave valuable technical support in laboratory. Gerard Delanoy (Nice) kindly provided literature. J.H. Callomon (London), A.B. Villaseñor (México) and A. Zeiss (Erlangen) have made valuable suggestions to improve the manuscript as reviewers of the journal.

REFERENCES

- Barthel K.W., 1962. Zur Ammonitenfauna und Stratigraphie der Neuburger Bankkalke. *Bayerische Akademie der Wissenschaften, Mathematisch-naturwissenschaftliche Klasse* **105**: 1-30.
- Burckhardt C., 1903. Beiträge zur Kenntnis der Jura- und Kreideformation der Cordillere. *Palaeontographica* **50**: 1-145.
- Cantu-Chapa A., 1990. *Volanoceras chignahuapense* sp. nov., amonita del Titoniano Inferior de Puebla, Centro de México. *Revista Sociedad Mexicana de Paleontología* **3(1)**: 41-45.
- Castillo A. del & Aguilera J.G., 1895. Fauna fósil de la Sierra de Catorce. *Boletín de la Comisión geológica de México* **1**: 1-55.
- Collignon M., 1960. Atlas des fossiles caracteristiques de Madagascar. Fascicule 6 (Tithonique). *Service Geologique de Madagascar, Tananarive*. Plates 134-175.
- Donze P. & Enay R., 1961. Les Céphalopodes du Tithonique Inferieur de la Croix-de-Saint-Concors pres Chambéry (Savoie). *Travaux Laboratoire Géologique de Lyon NS7*: 1-236.
- Douvillé H., 1890. Sur la classification des Cératites de la Craie. *Bulletin de la Société Géologique de France (serie 3)* **18**: 275-292.
- Enay R. & Cecca F., 1986. Structure et evolution des populations tithoniques du genre d'ammonites téthysien *Haploceras* Zittel, 1868. In G. Pallini, F. Cecca, S. Cresta, M. Santantonio (eds.): Atti del primo convegno internazionale Fossili, Evoluzione, Ambiente, Pergola 1984: 37-53.
- Haupt O., 1907. Beiträge zur Fauna des oberen Malm und der unteren Kreide in der argentinischen Cordillere. *Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, Beilage-Band 21*: 187-236.
- Hyatt A., 1900. Cephalopoda. In: Zittel K.A.: Textbook of Palaeontology, 1st English ed. (transl. by C.R. Eastman): 502-592. Mcmillan London & New York.
- Kilian C.C.W., 1907-1913. Erste Abteilung: Unterkreide (Palaeocretacicum). Lieferung 1-3: 1-398. In F. Frech: *Lethaea Geognostica. II. Das Mesozoicum, Band 3 (Kreide)*. Schweizerbart. Stuttgart.
- Krantz F., 1926. Die Ammoniten des Mittel- und Obertithons. In: Jaworski E., Krantz F. & Gerth H. (eds.): Beiträge zur Geologie und Stratigraphie des Lias, Doggers, Tithons und der Unterkreide im Süden der Provinz Mendoza (Argentinien). *Geologische Rundschau* **17a**: 427-462.
- Leanza H.A., 1980. The Lower and Middle Tithonian ammonite fauna fom Cerro Lotena, province of Neuquén, Argentina. *Zitteliana* **5**: 3-49.
- Leanza H.A., 1981. The Jurassic-Cretaceous boundary beds in West Central Argentina and their ammonite zones. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* **161(1)**: 62-92.
- Leanza H.A. & Zeiss A., 1992. On the ammonite fauna of the Lithographic Limestones from the Zapala region (Neuquén province, Argentina), with the description of a new genus. *Zentralblatt für Geologie und Paläontologie, Teil I, Heft 6, 1991*: 1841-1850.
- Oppel A., 1862-1863. III. Über jurassische Cephalopoden. *Paleontologische Mittheilungen aus dem Museum des koeniglich Bayerischen Staates* **1**: 127-262.
- Parent H., 2001. The Middle Tithonian (Upper Jurassic) ammonoid fauna of Cañadón de los Alazanes, southern Neuquén-Mendoza Basin, Argentina. *Boletín del Instituto de Fisiografía y Geología* **71(1-2)**: 19-38.
- Parent H., 2003. The ataxioceratid ammonite fauna of the Tithonian (Upper Jurassic) of Casa Pincheira, Mendoza (Argentina). In: H. Parent, G. Meléndez & F. Olóriz (eds.): Jurassic of South America. *Journal of South American Earth Sciences (Special Issue)* **16**: 143-165.
- Parent H., Scherzinger A. & Schweigert G., 2006. The earliest ammonite faunas from the Andean Tithonian of the Neuquén-Mendoza Basin, Argentina – Chile. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* **241**: 253-267.
- Roman F., 1938. Les ammonites jurassiques et crétaées. Essai de genera. Masson, Paris, 554 p.

- Schweigert G., Scherzinger A. & Parent H., 2002. The *Volanoceras* lineage (Ammonoidea, Simoceratidae) – a tool for long-distance correlations in the Lower Tithonian. *Stuttgarter Beiträge zur Naturkunde* **B326**: 1-43.
- Spath L.F., 1923-1943. A monograph of the Ammonoidea of the Gault. *Palaeontographical Society Monographs* **1-16**: 1-787.
- Spath L.F., 1925. The Collection of fossils and rocks from Somaliland made by Messrs. B. N. K. Wyllie and W. R. Smellie. Part 7: Ammonites and aptychi. – *Monographs of the Geological Department of the Hunterian Museum* **1**: 111-164.
- Spath L.F., 1927-1933. Revision of the Jurassic cephalopod faunas of Kachh (Cutch), India. *Geological Survey Memoirs, Palaeontographica Indica (new series)* **9(2)**: 1-945.
- Uhlig V., 1903. Himalayan Fossils. The Fauna of the Spiti Shales. *Memoirs of the Geological Survey of Indica. Palaeontologica Indica, ser. 15*, **4(1)**: 1-132.
- Verma H.M. & Westermann G.E.G., 1973. The Tithonian (Jurassic) Ammonite Fauna and Stratigraphy of Sierra Catorce, San Luis Potosi, Mexico. *Bulletin of American Paleontology* **63/277**: 107-320.
- Yin J. & Enay R., 2004. Tithonian ammonoid biostratigraphy in eastern Himalayan Tibet. *Geobios* **37**: 667-686.
- Wright C.W., Callomon J.H. & Howarth M.K., 1996. Volumen 4: Cretaceous Ammonoidea, Mollusca 4 (Revised), Part L. In: R.L. Kaesler (ed.): *Treatise on Invertebrate Paleontology. The Geological Society of America and The University of Kansas*: 1-362.
- Zittel K.A. v., 1870. Die Fauna der älteren Cephalopoden führenden Tithonbildungen. *Palaeontographica Supplement* **1**: I-VII + 1-192.
- Zittel K.A. v., 1884. Cephalopoda, p. 329-522. In: Zittel K.A. (ed.): *Handbuch der Palaentologie*, vol. 1, Abt. 2 (3); Munich & Leipzig (Oldenbourg).