N. Jb. Geol. Paläont. Abh.
2007, vol. 245/2, p. 147–152, Stuttgart, August 2007, published online 2007

A new Early Miocene species of *Ophiocrossota* (Ophiuroidea) from Southern Patagonia, Argentina

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With 3 figures

Caviglia, S. E., Sergio Martínez, S. & del Río, C. J. (2007): A new Early Miocene species of *Ophiocrossota* (Ophiuroidea) from Southern Patagonia, Argentina. – N. Jb. Geol. Paläont. Abh., **245**: 147–152; Stuttgart.

Abstract: The first South American species of *Ophiocrossota* Clark, 1928, *O. kollembergorum* n. sp., is described, extending the known geographical range of the genus to Argentina. The new species is characterized by its large radial shields, proximally in contact within, but separated distally by the triangular plates, and by its large and elongate oral shields, that cover most of the interradial area.

Zusammenfassung: Die erste südamerikanische Art von *Ophiocrossota* Clark, 1928 wird beschrieben, und ihre bekannte geografische Verbreitung damit bis nach Argentinien ausgedehnt. Die neue Art zeichnet sich aus durch ihre grossen Radialschilde, welche proximal in Kontakt, aber distal durch die dreieckigen Platten abgetrennt liegen und durch ihre grossen und länglichen Mundschilde, welche die Interradialfläche beinahe ganz bedecken.

Key words: *Ophiocrossota kollembergorum*, Ophiuroidea, Miocene, Chenque Formation, Argentina.

1. Introduction

The genus *Ophiocrossota* Clark, 1928 was created in monotypy with the species *O. heteracantha* Clark, 1928 (living in St. Vincent and Spencer gulfs, southern Australia). Clark (1946) considered it a junior synonym of *Ophioglypha multispina* Ljungman, 1867 from off Sydney, but retained the generic name. Subsequently, authors (e.g. Fell 1960; Spencer & Wright 1966) accepted *Ophiocrossota* as a valid genus, but no other Recent species was reported. On the other hand, two fossil species were described: *O. baconi* Blake & Allison, 1970 from the Eocene of Oregon, and *O. oweni* Blake, 1975 from the Miocene of California. In this paper we describe the first South American species of *Ophiocrossota,* that extends notably the known geographic range of the genus to southern Argentina (Fig. 1). Therefore, the genus *Ophiocrossota,* although confined today to Australian waters, would have presented a much wider distribution in the past. Unfortunately, the scarcity of evidence still prevents any definite biogeographic hypothesis.

The new species has been previously named in an abstract by Caviglia (1978) as *O. kollembergeri*, without any figure or description; thus becoming until now a not available name. (ICZN 1999, articles 9.9, 13.1.1.).

DOI: 10.1127/0077-7749/2007/0245-0147

0077-7749/07/0245-0147 $ 1.50

Fig. 1. Geographic location (star) where the material of *Ophiocrossota kollembergorum* n. sp. was collected.

Ophiuroids are poorly known in the Tertiary fossiliferous record of Argentina. *Ophiura elegantoides* Furque & Camacho, 1949 has been described from the "Leticia beds" of the Isla Grande Tierra del Fuego, originally thought to be of Cretaceous age, but now formally recognized as Leticia Formation and placed in the late Middle Eocene (Olivero & Malumián 1999). Other references are very general (Bertels 1965; Martínez et al. 2005) or without any factual base (such as descriptions, illustrations or references to any specimen, De Sáez 1928). Only one another South American Tertiary ophiuroid species is described: *Amphioplus venezuelanus* Berry, 1941, from the Miocene of Venezuela. Kutscher et al. (2004) mentioned without description some ophiuroids from the Miocene of Chile, giving solely a photograph of their *Ophiomusium* sp.

2. Geological setting and Taphonomy

Fossiliferous horizons are situated two kilometers south of Punta Maqueda in the San Jorge Basin (northeastern Santa Cruz Province) (Fig. 1). The section exposed corresponds to Sequence I of the lower part of the Chenque Formation (Bellosi 1990) and consists of 12 m thick sandstones deposited in a shoreface environment. Basal horizons, where ophiuroids are found are only visible during low tides, and are composed of up to 4.5 m thick fine bioturbated grey to greenish sandstones deposited in a distal lower shoreface environment affected by weak storms. Overlying this bed are five meters thick fine-medium sandstones intercalated with shell-beds from the middle shoreface capped by three meters thick upper shoreface cross-stratified medium sandstones (Buatois et al. 2003).

The exposed section belongs to the Early Miocene *Jorgechlamys juliana-Reticulochlamys borjasiensis* Assemblage (del Río 2004). This assemblage characterizes the San Julián Formation exposed in the southern coast of the San Jorge Gulf and to the basal horizons of the Chenque Formation that extends along the littoral of Patagonia from Playa Las Cuevas north to Comodoro Rivadavia city (Chubut Province).

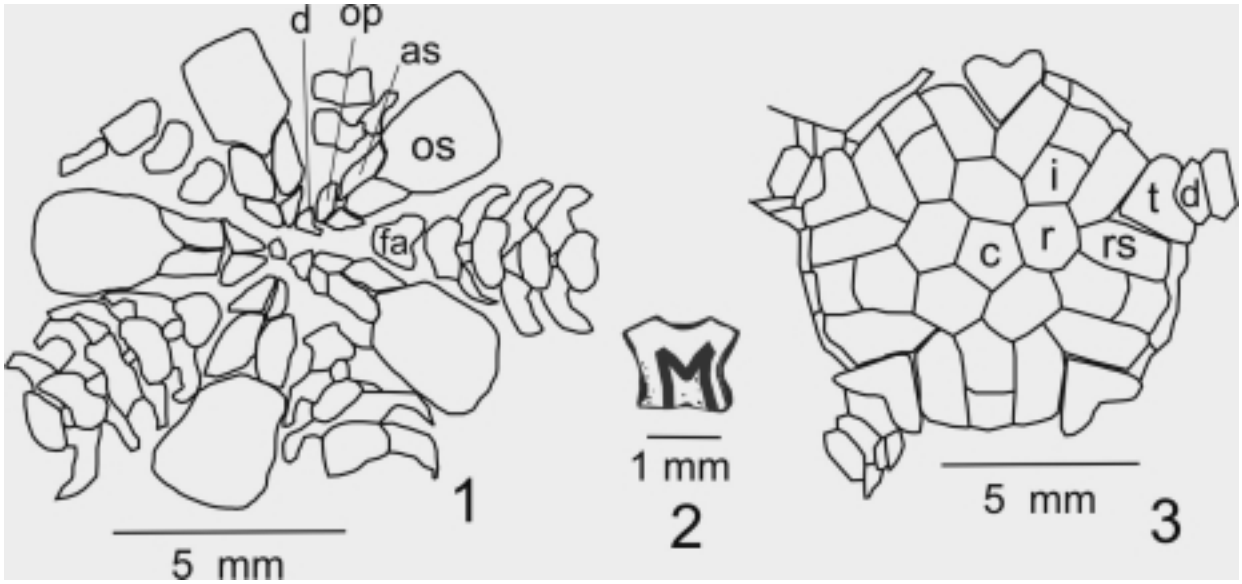

Fig. 2. *Ophiocrossota kollembergorum* n. sp.; **1** – holotype MLP 12465, plate architecture of oral surface; **2** – holotype MLP 12465 sketch of first ventral arm plate, showing the characteristic "M"-shaped distribution of ridges; **3** – paratype MLP 12466, plate architecture of aboral surface. C: central plate, R: radial plate, Rs: radial shield, T: triangular plate, i: interradial plate, d: dorsal arm plate, os: oral shield, as: adoral shield, op: oral plate; d: dental plate, fa: first ventral arm plate.

Most of the specimens were found in a patch of seven by five meters, with an average density of 45 individuals per m^2. Other individuals were found isolated or composing small groups of up to 20 exemplars. The fossils were recrystalized, details being therefore sometimes obscured.

Evidence points to the fact that ophiuroids were buried "in situ". The sediment does not present signs of disruption; most of the specimens lay parallel to the bedding plane, presenting at least parts of the arms (some of them showing complete arms). Around 60 % of them were inverted; this behaviour has been reported in Recent ophiuroids (e.g. Fell 1961; Hendler et al. 1995), and can be seen in published photographs (e.g. Vevers 1952), being present also in the co-generic Miocene species *O. oweni* (Blake, 1975).

Abbreviations: MLP: Museo de La Plata, Argentina.

3. Systematic Paleontology

Class Ophiuroidea Gray, 1840
Subclass Ophiuridea Gray, 1840
Order Ophiurida Müller & Troschel, 1840
Suborder Ophiurina Müller & Troschel, 1840
Infraorder Chilophiurina Matsumoto, 1915
Family Ophiuridae Lyman, 1865

Genus *Ophiocrossota* Clark, 1928

Type species: *Ophiocrossota heteracantha* Clark, 1928 (by original designation) (= *Ophioglypha multispina* Ljungman, 1867, according to Clark 1946). Recent, Southern Australia.

Other species included: *O. baconi* Blake & Allison, 1970, *O. oweni* Blake, 1975.

Stratigraphic range and geographical distribution: Eocene (Oregon, USA), Miocene (California, USA; Santa Cruz, Argentina), Recent (Southern Australia).

Diagnosis: Radial shields large, proximally in contact within, but separated distally by a triangular plate. Margins of the triangular plate and distal inner margins of the radial shields with minute papillae. Oral shields large and elongate, covering most of the interradial area (modified from Fell 1960).

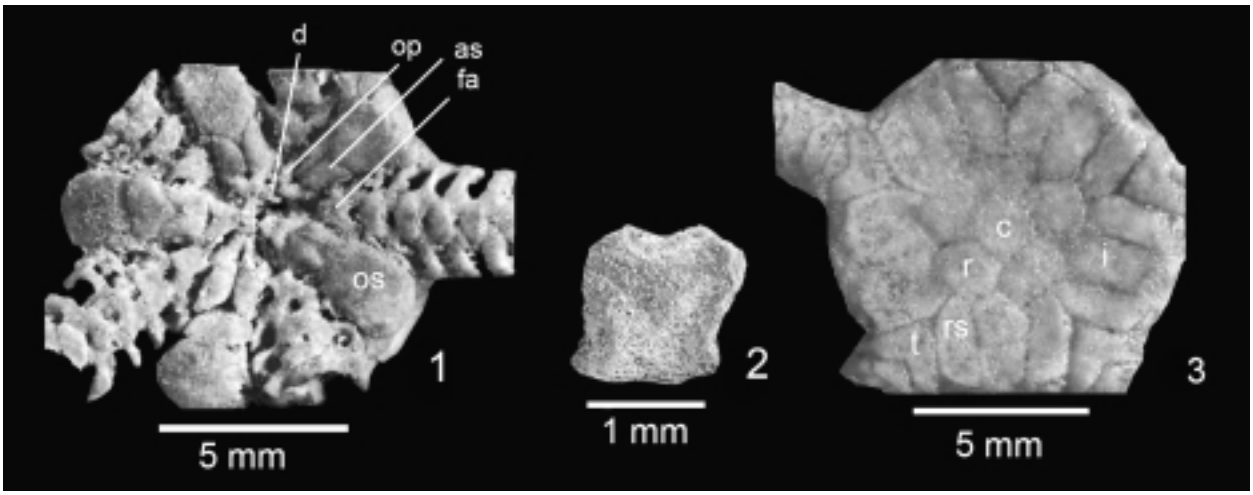

Fig. 3. *Ophiocrossota kollembergorum* n. sp.; **1** – holotype MLP 12465, oral surface; **2** – magnification of holotype MLP 12465 first ventral arm plate, showing the characteristic "M"-shaped distribution of ridges; **3** – paratype MLP 12466, aboral surface. Abbreviations as in Fig. 2.

Ophiocrossota kollembergorum n. sp.
Figs. 2-3

Etymology: Dedicated to CARLOS and MABEL KOLLEMBERG, who reported the finding to the senior author.

Holotype: MLP 12465, two km south from Punta Maqueda, Santa Cruz Province, Argentina. Chenque Formation, Early Miocene.

Paratype: MLP 12466, same provenance as holotype.

Diagnosis: First ventral arm plate almost quadrangular (with the proximal part narrower than the distal one), with a median and two lateral ridges, resembling a "M". Large triangular plates, with a deep sinus in its distal margin, and straight lateral margins. Polygonal and slightly elongated interradial proximal plate.

Description (Holotype: oral surface; paratype: aboral surface): Disk of moderate size (Holotype diameter: 10 mm; paratype diameter: 10.5 mm), composed of large elements. Arms compact. Aboral surface of disk formed by at least 40 granulose elements. The central polygonal plate is surrounded by five polygonal radial plates, slightly larger than the central plate. Radial shields elongated, wider in the middle. All edges of the radial shields are straight, contacting each other along their proximal margins; the distal margins are separated by a large triangular plate. The interradial areas present two large polygonal plates; the proximal interradial plate is irregularly pentagonal to hexagonal; the distal interradial is longer than wide, nearly rectangular, and narrower distally. Along the distal interradial margin there are up to three wide small plates. Large triangular plates, with deeply recurved distal margins and straight lateral margins. First dorsal arm plate partially covered by the triangular plate. The next dorsal arm plates are short, wide, nearly hexagonal, slightly narrowing distally, but at least in the first five plates they are always in contact through the longitudinal margins. The oral shields largely cover the oral interradial areas. Oral shields are elongated, broadly rounded and curved aborally on their distal margin; their straight longitudinal margins converge gently to the mouth; the proximal margin is pointed, with two concave sides, in contact with the adoral shields. Adoral shields are elongated, contacting each other through their adradial margins. Oral plates are inflated and prominent. Dental plate polygonal. Large and almost quadrangular first ventral arm plates, with their proximal region somewhat narrower than the distal one, with a median and two lateral ridges, resembling a "M". Next ventral arm plates ovate, wider than longer, distally concave, becoming of nearly equal dimensions and without a concavity farther from the disk. Laterals are high and short, somewhat inflated adradially, apparently they are smooth and no spine bases are visible, but these can be artefacts of preservation. Genital plates and spines were not identified with certainty.

Discussion and comparisons: The new species is placed in *Ophiocrossota* because of the presence of large radial shields proximally in contact within but separated distally by a single triangular plate at arm base.

Ophiocrossota kollembergorum n. sp. is easily differentiated from the Recent *O. multispina* by the presence in the latter of more numerous and smaller interradial plates, smaller radial plates, triangular plate without distal sinus, more elongated and parallel-sided oral shields, and

triangular first ventral arm plate without the characteristic "M"-shaped ridges of *O. kollembergorum*.

O. oweni differs from *O. kollembergorum* n. sp. in having a saddle-shaped first ventral arm plate, lacking the characteristic "M" shaped ridges of *O. kollembergorum* n. sp., and presenting elongated aboral radial plates instead of hexagonal ones, triangular plates with concave proximal part of lateral margins (2/3 of their length) that are straight over their whole length in *O. kollembergorum* n. sp.. Also, the radial shield pair has lateral margins that are straight distally in *O. kollembergorum* n. sp., but curved in *O. oweni*; in *O. kollembergorum* n. sp. the interradial proximal plate is polygonal and slightly elongated, though in *O. oweni* it is wider than longer.

O. baconi differs from *O. kollembergorum* n. sp. in having a triangular first ventral arm plate, with a median ridge, and not a "M"-shaped one; smaller triangular plates, with a shallower distal re-entrant, and sometimes slightly concave lateral margins; interradial proximal plate longer than wide (polygonal and slightly elongated in *O. kollembergorum* n. sp.). The first dorsal arm plates are the larger of the series in *O. baconi* and subsequent plates are wider than longer, becoming narrow, triangular, and having no contact with each other. On the other hand, in *O. kollembergorum* n. sp. the first dorsal arm plates are reduced and partially covered by the triangular plate, and subsequent plates are hexagonal and wider than long, with the most distal ones becoming narrow but still retaining the basic form, being in contact at least along the first 15 plates. In addition, oral plates taper gently towards the mouth in *O. kollembergorum* n. sp., but are parallel-sided in *O. baconi*.

Acknowledgements

J. W. M. Jagt and the reviewers A. Kroh and S. Stöhr made very valuable suggestions. N. Sabattini, M. Manceñido, and H. H. Camacho contributed with facilities during the present work. A. Riccardi provided access to the MLP collections. G. Garbino made the SEM photographs. Anita Aisemberg gave linguistic assistance.

References

Bellosi, E. (1990): Formación Chenque: Registro de la transgresión patagoniana (Terciario medio) de la cuenca de San Jorge, Argentina. – Actas 11º Congreso Geológico Argentino, San Juan, **2**: 57-60.

Berry, C. T. (1941): Tertiary ophiurans from Venezuela. – Journal of Paleontology, **15**: 68-70.

Bertels, A. (1965): Noticias sobre el hallazgo de restos de Equinodermos en el Paleoceno de General Roca (Pcia. de Rio Negro). – Ameghiniana, **4** (3): 84-99.

Blake, D. B. (1975): A new West American Miocene species of the modern Australian ophiuroid *Ophiocrossota.* – Journal of Paleontology, **49**: 501-507.

Blake, D. B. & Allison, R. C. (1970): A new West American Eocene species of the modern Australian ophiuroid *Ophiocrossota.* – Journal of Paleontology, **44**: 925-927.

Buatois, L. A., Bromley, G. G., Mángano, M. G., Bellosi, E. & Carmona, N. (2003): Ichnology of shallow marine deposits in the Miocene Chenque Formation of Patagonia: complex ecologic structure and niche partionioning in Neogene ecosystems. – 4º Reunión Argentina de Icnología y 2º Reunión de Icnología del Mercosur. – Asociación Paleontológica Argentina, Publicación Especial, **9**: 85-95.

Caviglia, S. E. (1978): Presencia del género *Ophiocrossota* (Echinodermata, Ophiurida, Ophiuridae) en el Terciario marino de Patagonia. – Ameghiniana, **13**: 331-332.

Clark, H. L. (1928): The sea-lilies, sea-stars, brittle-stars and sea-urchins of the South Australian Museum. – Records of the South Australian Museum, **3**: 361-482.

– (1946): The echinoderm fauna of Australia. Its composition and its origin. – Carnegie Institution of Washington Publication, **566**: 1-567.

De Sáez, M. D. (1928): Un nuevo equinodermo fósil argentino. – Revista del Museo de La Plata, **32**: 57-60.

del Río, C. J. (2004): Tertiary Marine Molluscan Assemblages of Eastern Patagonia (Argentina): A Biostratigraphic analysis. – Journal of Paleontology, **78**: 1097-1122.

Fell, H. B. (1960): Synoptic keys to the genera of Ophiuroidea. – Zoology Publications from the Victoria University of Wellington, **52**: 1-44.

– (1961): The fauna of the Ross Sea, 1: Ophiuroidea. – Memoirs of the New Zealand Oceanographic Institute: **18**: 1-124.

Furque, G. & Camacho, H. H. (1949): El Cretácico Superior de la costa atlántica de Tierra del Fuego. – Revista de la Asociación Geológica Argentina, **4**: 263-297.

Gray, J. E. (1840): A synopsis of the genera and species of the class Hypostoma (Asterias Linn.). – Annals and Magazine of Natural History, **6**: 275-290.

Hendler, G., Miller, J. E., Pawson, D. L. & Kier, P. M. (1995): Sea Stars, Sea Urchins, and Allies: Echinoderms of Florida and the Caribbean. – 390 pp.; Washington (Smithsonian Institution Press).

ICZN, International Commission on Zoological Nomenclature. (1999): International Code of Zoological Nomenclature (4th adopted by the International Union of Biological Sciences. Fourth Eedition). – xxxix + 136 pp.; London (International Trust for Zoological Nomenclature).

Kutscher, M., Neumann, C., Nielsen, S., Reich, M. & Villier, L. (2004): Echinoderms from the Miocene of Chile. – Proceedings of the 11th International Echinoderm Conference, Munich: 453-456.

Ljungman, A. V. (1867): Ophiuroidea viventia huc usque cognita enumerata. – Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar, Stockholm, **1866**: 303-336.

Lyman, T. (1865): Ophiuroidae and Astrophytidae. – Illustrated catalogue of the Museum of Comparative Zoology, **1**: 1-200.

Martínez, S., del Río, C. J. & Demichelli, M. (2005): Primer registro de ofiuroideos (Echinodermata: Ophiurida) en la Formación Puerto Madryn (Mioceno Tardío Temprano, Chubut, Argentina). – Actas VIII Jornadas de Zoología del Uruguay (Publicación Especial Sociedad Zoológica del Uruguay), Montevideo: 63.

Matsumoto, H. (1915): A new classification of the Ophiuroidea. – Proceedings of the Academy of Natural Sciences of Philadelphia, **67**: 43-92.

Müller, J. & Troschel, F. H. (1840): Ueber die Gattungen der Ophiuren. – Wiegmanns Archiv für Naturgeschichte, **6**: 327-330.

Olivero, E. B. & Malumián, N. (1999): Eocene stratigraphy of southern Tierra del Fuego, Argentina. – Bulletin of the American Association of Petroleum Geologists, **83**: 295-313.

Spencer, W. K. & Wright, C. (1966): Asterozoans. – In: R. C. Moore, R. C. (Ed.): Treatise on Invertebrate Paleontology. Pt. U. Echinodermata 3. p. U4-U107; Boulder and Lawrence (Geological Society of America and University of Kansas Press).

Vevers, H. G. (1952): A photographic survey of certain areas of sea floor near Plymouth. – Journal of the Marine Biological Association of the United Kingdom, **51**: 267-282.

Manuscript received: March 3rd, 2007.
Revised version accepted by the Stuttgart editor: March 29th, 2007.

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