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The Antarctic Fossil Vertebrate Collection of the Museo de La Plata: Historical perspective of four decades of earth sciences investigations in Antarctica

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THE ANTARCTIC FOSSIL VERTEBRATE COLLECTION OF THE MUSEO DE LA PLATA: HISTORICAL PERSPECTIVE OF FOUR DECADES OF EARTH SCIENCES INVESTIGATIONS IN ANTARCTICA

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Abstract. The Museo de La Plata (MLP, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata) houses Antarctica's largest fossil vertebrate collection. This collection is a major international research resource and constitutes one of Antarctica's most important records of vertebrate history and evolution. The principal focus of this collection is on vertebrate fossils from the Antarctic Peninsula (Late Cretaceous and Paleogene of the James Ross Archipelago, NE Antarctic Peninsula and the Jurassic of the Antarctic Peninsula). The collection is estimated to consist of over 32,000 specimens, including fossils of fishes, anurans, marine reptiles (plesiosaurs and mosasaurs), avian and non-avian dinosaurs, turtles, and marine and terrestrial mammals. The collection comprises many complete and extraordinarily well-preserved skeletons and has 22 holotypes. It also contains several institutional icons, including the skeletons of the elasmosaurid plesiosaur *Vegasaurus* and several non-avian dinosaurs such as *Antarctopelta* and *Trinisaura*, as well as non-avian dinosaurs *Vegavis* and *Conflicto*. The MLP Antarctic fossil vertebrate collection dates from 1978; its importance lies not only in the fact that it is globally one of the main reference collections of Antarctic paleontological material but also in its high proportion of Mesozoic and Cenozoic faunas, which can be used to understand evolutionary dynamics, continental movements, and climatic changes over the past 80 Ma. The collection was made under the auspices and agreement between the Dirección Nacional del Antártico - Instituto Antártico Argentino and the Museo de La Plata in 1983.

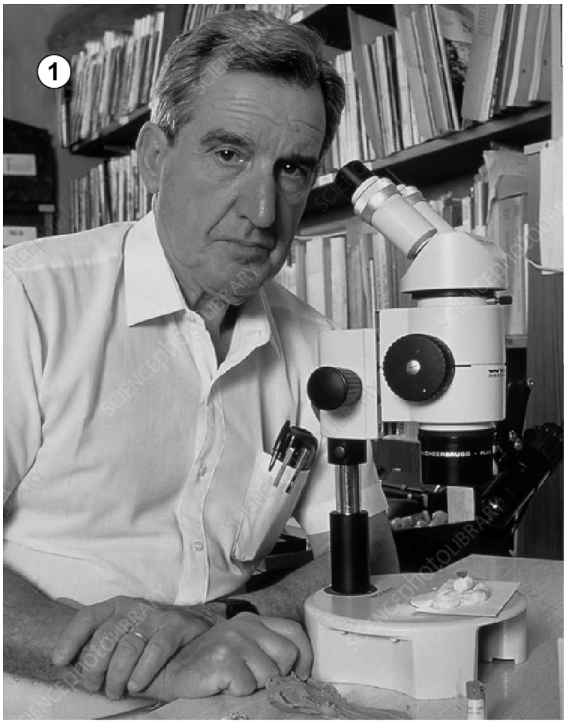
Key words. Antarctic repositories. Vertebrate paleontology. Campaigns. Researchers. Logistics.

Resumen. LA COLECCIÓN ANTÁRTICA DE VERTEBRADOS FÓSILES DEL MUSEO DE LA PLATA: PERSPECTIVA HISTÓRICA DE CUATRO DÉCADAS DE INVESTIGACIONES DE CIENCIA DE LA TIERRA EN ANTÁRTIDA. La División Paleontología de Vertebrados del Museo de La Plata (MLP, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata) alberga la colección de vertebrados fósiles más numerosa de Antártida que se conoce en el mundo. Esta colección es un recurso internacional de investigación y constituye uno de los registros más importante de la historia evolutiva de los vertebrados en Antártida. El núcleo importante de los vertebrados fósiles de esa colección proviene de la península antártica (Cretácico Superior y Paleógeno del archipiélago Ross al NE de la península y del Jurásico marino de la misma). La estimación del número de ejemplares de esta colección es aproximadamente de 32.000 especímenes, incluyendo peces, anuros, reptiles marinos (plesiosaurios y mosasaurios), dinosaurios avianos y no avianos, tortugas y mamíferos marinos y terrestres. La colección contiene una variedad de esqueletos extraordinariamente bien preservados y contiene 22 holotipos. También contiene íconos institucionales como los esqueletos del plesiosaurio elasmosáurido *Vegasaurus* y de dinosaurios no avianos como *Antarctopelta* y *Trinisaura*, como así también de los dinosaurios avianos *Vegavis* y *Conflicto*. La colección antártica de vertebrados fósiles data del año 1978 y su importancia no solamente radica en que mundialmente es una de las colecciones de referencia en cuanto a material paleontológico, sino que también su gran acervo en faunas del Mesozoico y Cenozoico pueden ser usados para entender dinámicas evolutivas, movimientos continentales (tectónica) y cambios climáticos de los últimos 80 Ma. La colección de vertebrados fósiles fue realizada bajo los auspicios y convenios desde 1983 entre la Dirección Nacional del Antártico - Instituto Antártico Argentino y el Museo de La Plata.

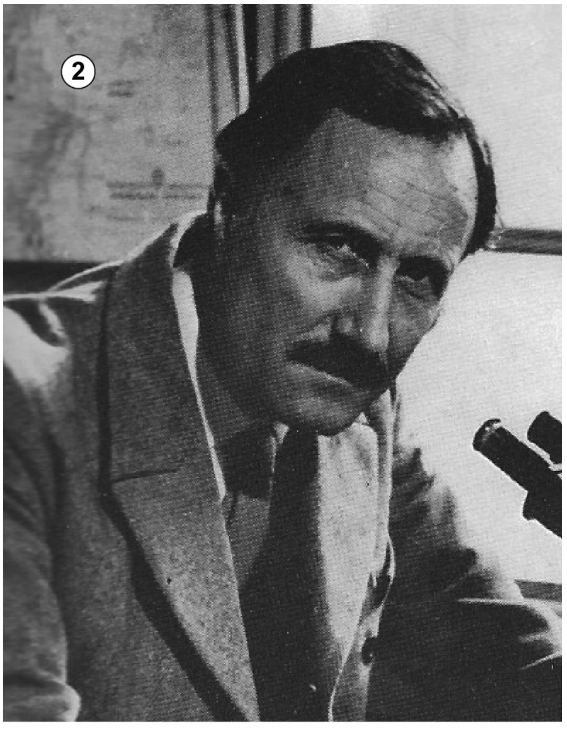
Palabras clave. Repositorios antárticos. Paleontología de vertebrados. Campañas. Investigadores. Logística.

THE ANTARCTIC VERTEBRATE PALEONTOLOGY collection of the Museo de La Plata (MLP-PV) provides the most complete database for studying Mesozoic and Cenozoic vertebrate life and evolution in the Antarctic Peninsula. This collection represents a major international research resource and constitutes one of the most important records of vertebrate history and evolution in the Antarctic continent.

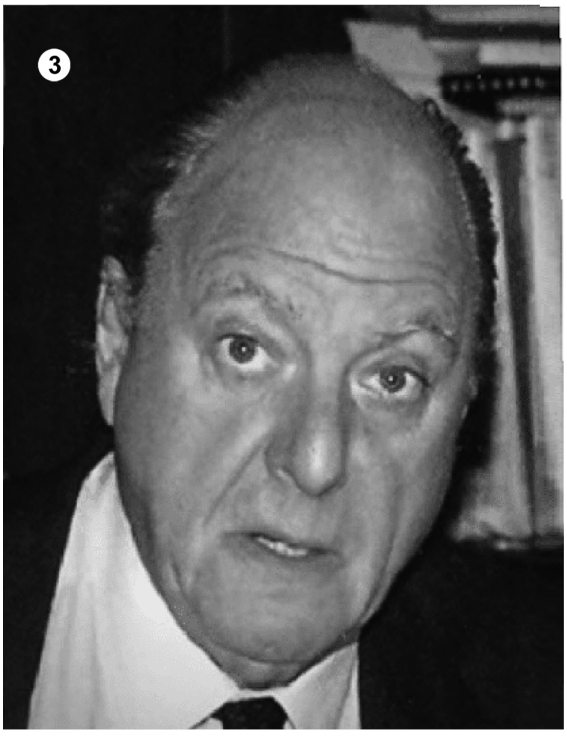
The first antarctic work carried out in the field by



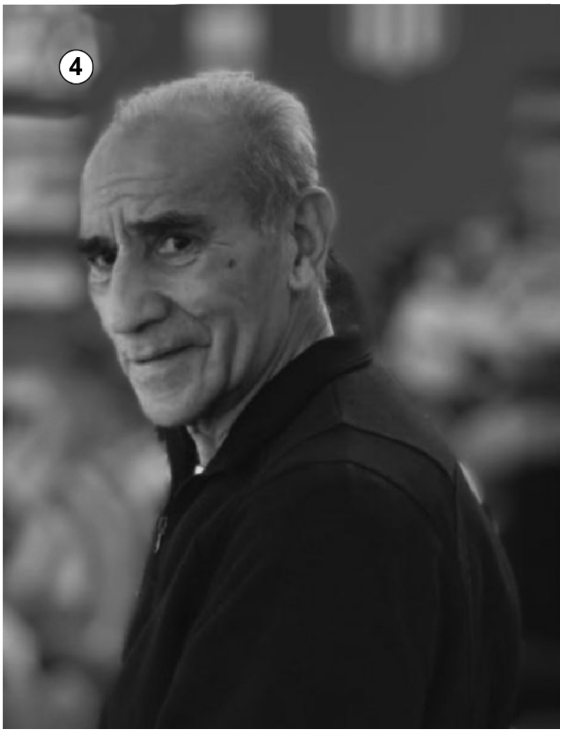
Dr. Rosendo Pascual
(1925 - 2012)



Dr. Néstor Fourcade
(1921 - 2023)



Dr. Carlos A. Rinaldi
(1930 - 2017)



Omar J. Molina
(1937 - 2022)

Figure 1. Relevant authorities and technician (from **MLP** and **IAA**) in the early stages of the formation of the Antarctic fossil vertebrate collection of the **MLP**.

personnel of the MLP began in 1974 under the auspices and invitation of the Dirección Nacional del Antártico (DNA) - Instituto Antártico Argentino (IAA). The DNA is the federal agency in charge of orientating, controlling, addressing, and performing scientific and technical investigations in Antarctica. It depends on the Ministerio de Relaciones Exteriores y Culto (MRECIC).

The first antarctic fossil vertebrate specimens were incorporated into the División Paleontología de Vertebrados (DPV) of the MLP in 1977; being head of this unit Dr. Rosendo Pascual (1923–2012) (Fig. 1.1) (Reguero & Gasparini, 2023).

In 1983, the DNA-IAA and the Universidad Nacional de La Plata (UNLP) signed the first official agreement. This historic agreement emphasized the importance of promoting and supporting antarctic scientific endeavors and stewardship of antarctic paleontological resources with logistics and geologists of the IAA together with vertebrate paleontologists of the MLP. Collaboration between the professional paleontological community of the MLP and the IAA was intended to better serve scientific research on fossils and the preservation of these non-renewable resources. This program of exchange and collaboration in antarctic areas of interest and benefit was established for the convenience of both institutions. The dean of the Facultad de Ciencias Naturales y Museo of the UNLP and the director of the IAA acted as conveners of the parties.

The first Antarctic vertebrate fossil specimens were officially incorporated to the MLP in 1978 (DPV Record Book of Fossil Vertebrates N° 4, p. 63–64, Fig. 2): MLP-PV 78-X-26-1 [410 specimens of Sphenisciformes birds, Chondrichthyes, and teleostean fishes. Marambio (Seymour) Island, collectors: Eduardo Pedro Tonni; Alberto Luis Cione];

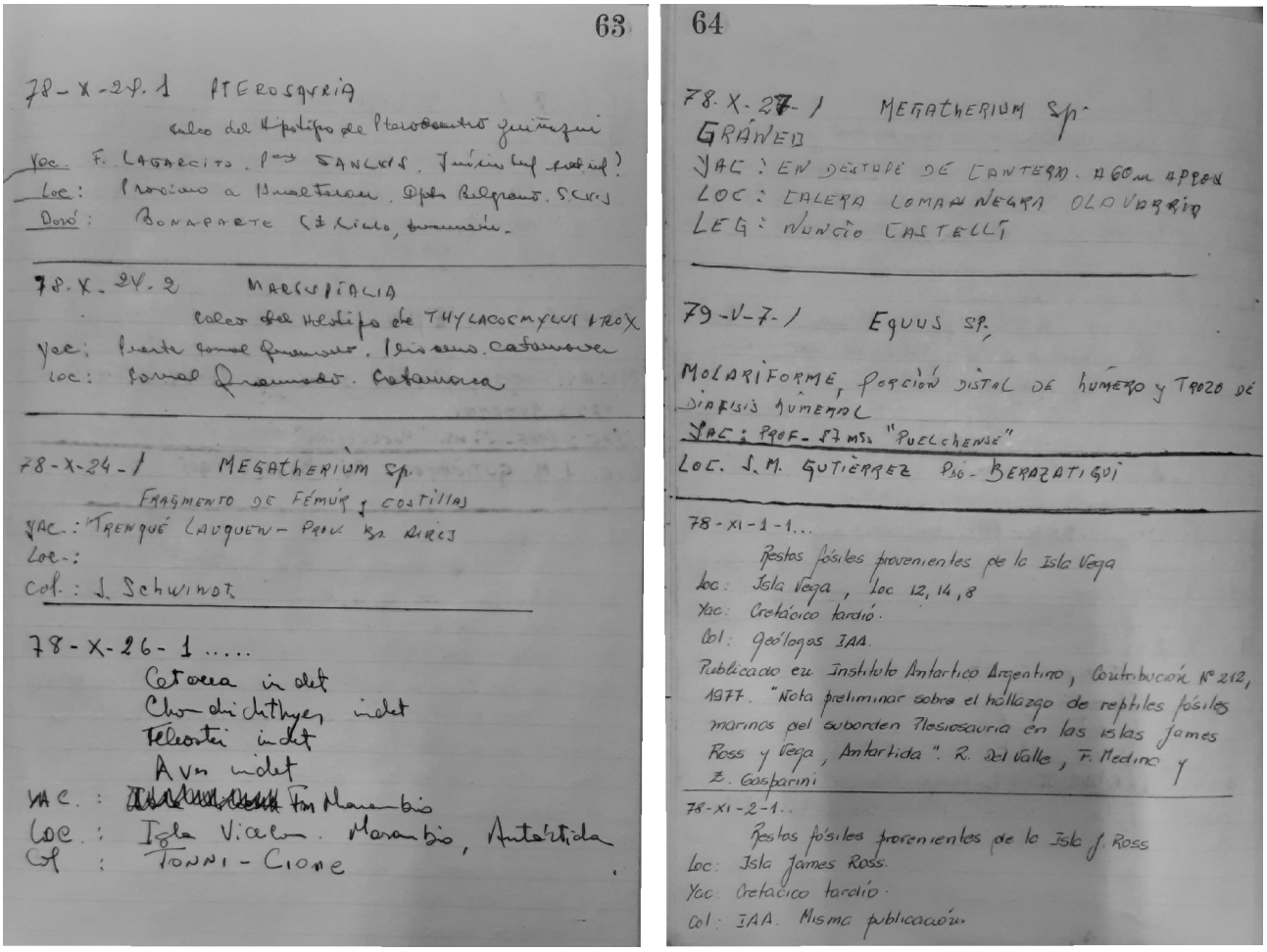


Figure 2. DPV Record Book of Fossil Vertebrates N° 4, copies of the pages 63–64 with the entrance and data of the first antarctic fossil vertebrate collections incorporated to the **MLP**.

MLP-PV 78-XI-1-1 (10 specimens of marine reptiles, Vega Island, collectors: IAA Rodolfo del Valle, Patricio Marshall, Francisco Medina), and MLP-PV 78-XI-2-1 (14 specimens of marine reptiles, James Ross Island, collectors: IAA R. del Valle and F. Medina) (Cione *et al.*, 1977; Del Valle *et al.*, 1977; Tonni & Cione, 1978).

Institutional abbreviations. AT, Antarctic Treaty; **DNA,** Dirección Nacional del Antártico, Argentina; **DPV,** División Paleontología de Vertebrados, Argentina; **FAA,** Fuerza Aérea Argentina, Argentina; **IAA,** Instituto Antártico Argentino, Argentina; **MLP,** Museo de la Plata, Argentina; **MRECIC,** Ministerio de Relaciones Exteriores, Comercio Internacional y Culto, Argentina; **NRM,** Swedish Museum of Natural History, Sweden; **NSF,** National Science Foundation, USA; **SCAR,** Scientific Committee Antarctic Research; **UNLP**, Universidad Nacional de La Plata, Argentina.

Other abbreviations. CAV, *Campaña Antártica de Verano* (Summer Antarctic Fieldwork); **GEOANTAR,** *Programa geológico del Instituto Antártico Argentino* (Geological program of the Instituto Antártico Argentino); **ICG,** International Commission on Geoheritage; **IGY,** International Geophysical Year; **IUGS,** International Union of Geological Sciences; **K/Pg,** Cretaceous/Paleogene boundary; **PAA,** *Plan Anual Antártico*; **SANU,** South American Native Ungulate.

OPENING REMARKS

International context of the fossil vertebrates and collecting activities of Argentina in Antarctica

The AT applies to the entire region south of 60° South latitude. It was signed in Washington on December 1st, 1959 by the 12 countries (including Argentina) whose scientists had been active in and around Antarctica during the IGY, an international scientific project that lasted from July 1st, 1957 to December 31st, 1958. The IGY triggered an 18-month project of antarctic science. The International Council of Scientific Unions broadened the proposals from polar studies to geophysical research. More than 70 existing national scientific organizations then formed IGY committees and participated in the cooperative effort. The AT entered into force on June 23rd, 1961. Today, 54 nations have signed the Treaty—29 of which have voting rights (see http://www.scar.org/policy/antarctic-treaty-system/)—.

Among the signatories of the AT were seven countries—Argentina, Australia, Chile, France, New Zealand, Norway, and the United Kingdom—with territorial claims; other countries do not recognize any claims. The United States and Russia maintain a "basis of claim". It effectively stops nations from making territorial claims or from exploiting Antarctica. All positions are explicitly protected in Article IV, which preserves the *status quo*: "No acts or activities taking place while the present Treaty is in force shall constitute a basis for asserting, supporting, or denying a claim to territorial sovereignty in Antarctica or creating any rights of sovereignty in Antarctica. No new claim or enlargement of an existing claim to territorial sovereignty in Antarctica shall be asserted while the present Treaty is in force".

One key science priority of the Argentine Antarctic Program announced to the AT is: "The connections between Antarctica and Argentine South American territory to reveal the intimate biogeographical relationships between both regions, both current and those of the geological past" (https://www.ats.aq/devAS/Ats/KeyScPriorities?lang=e).

Historical background of the first antarctic fossil vertebrate collections and the Paleontological Heritage legacy of the fossil vertebrates from Antarctica. The Antarctic Peninsula (West Antarctica) is the region that has provided and will likely continue to provide the most informative fossil vertebrate remains from the Mesozoic–Paleogene of this continent. During the past three decades, geological and paleontological explorations of the James Ross Basin (Del Valle *et al.*, 1992), Weddell Sea, have revealed that this basin, located off the northeast tip of the Antarctic Peninsula, contains one of the most important records of Late Cretaceous and early Paleogene life in the Southern Hemisphere. Knowledge of the existence of fossils in Antarctica goes back to the early 19th century, when James Eights (1798–1882) described fossilized wood from the South Shetland Islands *in situ* (Eights, 1833). The first documented collection of marine invertebrate fossils from Antarctica was made by the Norwegian whaling Carl Anton Larsen (1860–1924) (Fig. 3.1), captain of the "Jason" ship (Fig. 3.2) on Marambio (Seymour) Island during the austral summer of 1892–1893 (Larsen, 1894). These fossils were studied and published by Sharman & Newton (1894) (Fig. 3.3).

Since the beginning of the 20th century, the geological and paleontological explorations on Marambio (Seymour)

Carl Anton Larsen
1860-1924

Jason

58 *Proceedings of Royal Society of Edinburgh.* [SESS

Proc. Roy. Soc. Edin. Vol. XXII.

Notes on some Additional Fossils collected at Seymour Island, Graham's Land, by Dr Donald and Captain Larsen. By George Sharman, Esq., and E. T. Newton F.R.S. (*Communicated by* Sir Archibald Geikie, F.R.S. (With a Plate.)

(Read February 7, 1898.)

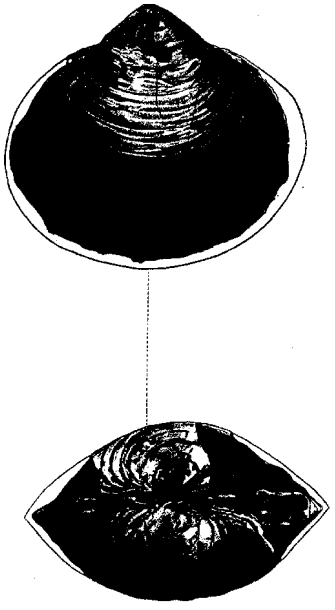
Dr Donald, who sailed on board the "Active" in the voyage of 1892–3, has given a short account of the discovery of a number of fossils by Captain Larsen on Seymour Island, to the north of Snow Hill, in January 1893 (*Geographical Journal*, vol. ii. p. 438, 1893). Some of these fossils were sent to Professor James Geikie, and at his request we gave an account of them to the Royal Society of Edinburgh, June 4, 1894 (*Trans. Roy. Soc. Edin.*, vol. xxxvii. p. 707; see also Dr Murray, *Geog. Journ.*, vol. iii. p. 11, note, 1894). The fossils do not appear to have been found *in situ*. Captain Larsen reports of the locality "that he found no traces of vegetation there, the surface being formed of volcanic débris and numbers of these fossils" (Dr Donald's notice, p. 438, *loc. cit.*).

The condition of the fossils, however, would seem to indicate that the mother rock from which they were derived could not be at any great distance from the spot where they were picked up.

As the few species of Mollusca represented by these fossils seemed to us to find their nearest allies among Lower Tertiary forms, and to be near to certain species known from Patagonia (Darwin, *Geol. Obs. Sth. Am.*, 1846), we were led to conclude that these new discoveries indicated the occurrence of Lower Tertiary rocks in Seymour Island.

Two of the fossils examined by us were sufficiently distinct from known species to justify their receiving new specific names. One of these was a large *Cucullæa* resembling *Cucullæa alta*, Sow., from tertiary beds of Santa Cruz, and *C. decussata*, Sow., from the Lower Eocene of Britain, but, as it differed in certain points, it has been named *C. Donaldi*.

The second new form, called by us *Cytherea antarctica*, has some



HARMAN, DEL.

Cyprina Larseni, n.sp. from Graham Land.

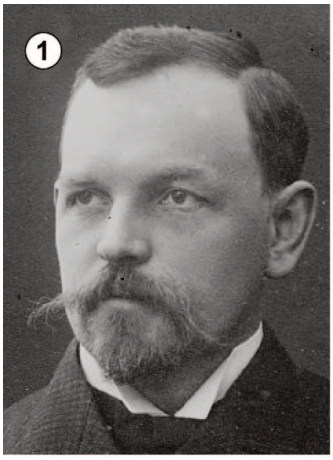
Sharman & Newton (1994)

Figure 3. 1, Carl Anton Larsen; **2,** "Jason" ship; **3,** Sharman & Newton (1894): "Note on some fossils from Seymour Island, in the Antarctic regions, obtained by Dr Donald".

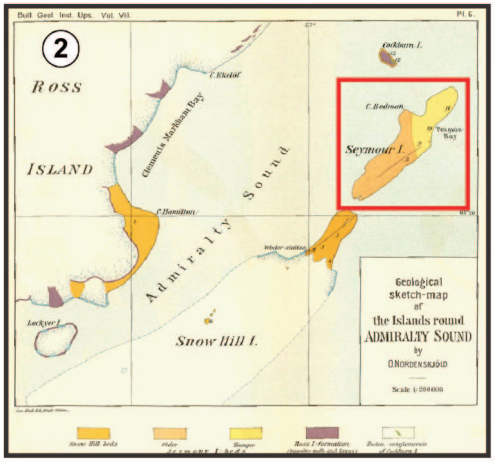
Island have demonstrated that this island contains one of the most important records of Late Cretaceous and Paleogene life in the Southern Hemisphere.

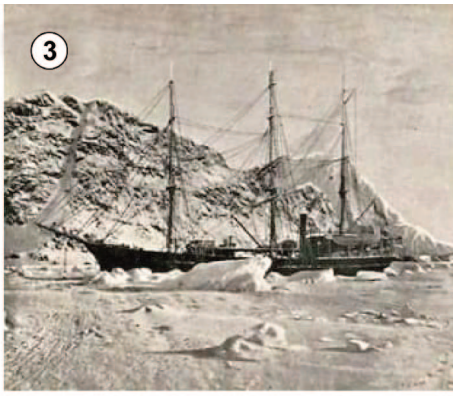
Otto Nordenskjöld (1869–1928) (Fig. 4.1), a Swedish geologist and geographer, led the 1901–1904 Swedish Antarctic Expedition to the Antarctic Peninsula. This expedition was one of the most scientifically successful expeditions in the history of antarctic exploration. Among other scientific results of this expedition is the first fossil vertebrate collection from Marambio (Seymour) Island, Antarctica (Fig. 4.2).

The expedition was under the Norwegian Carl Anton Larsen´s overall command, who served as captain of the "Antarctic" (Fig. 4.3) and had previously commanded a whaling reconnaissance mission in 1892–1893. In October 16th, 1901, the "Antarctic" left Gothenburg, Sweden, and sailed to Antarctica. On the way to Antarctica, the "Antarctic" visited Buenos Aires and the Malvinas Islands before leaving Nordenskjöld's party at Snow Hill Island (Fig. 4.4) off the Antarctic Peninsula to overwinter. Nordenskjöld had passed through Buenos Aires, where the Argentine government gave him supplies and other assistance on the



Otto Nordenskjöld
1869-1928





Antarctic

Snow Hill Island

José María Sobral
1880-1961

Figure 4. 1, Otto Nordenskjöld; **2,** José María Sobral; **3,** "Antarctic" ship; **4,** Snow Hill Island (Swedish hut); **5,** Geological map of Seymour (Marambio) Island, Antarctic Peninsula drawn by Otto Nordenskjöld (Wiman, 1905b) showing the locality 11 (**DPV 13/84**).

condition that he include in his wintering-over party a young Argentinean naval officer, Lieutenant José María Sobral (1880–1961) (Fig. 4.5).

Early in November 1902, Larsen sailed south to retrieve the party, but the "Antarctic" became trapped in ice and damaged so much that it eventually sank on February 12th, 1903, forcing the crew to winter in a shelter on Paulet Island. In 1903, the Argentine government organized a rescue with the corvette "ARA Uruguay", which successfully brought back all the surviving members of the Nordenskjöld party and the crew of the "Antarctic".

The Swedish South Polar Expedition was the first collector of antarctic vertebrate fossils on Marambio (Seymour) Island. The site was indicated as 'fossil locality no. 11' on Nordenskjöld's map (Fig. 4.2). It is about 50 m above sea level between the northeast coast and the 190 m high plateau, occupying a major part of the island's northeast. The area forms a smoothly undulating expanse covering 100 m in length and width (see Wiman, 1905a, p. 2; 1905b, p. 248). This locality (loc. 11 or currently known as DPV 13/84) has been revisited by earth scientists many times since the 1980s (Acosta Hospitaleche *et al.*, 2017)

Figure 5. 1, Carl Wiman; **2,** Wiman's publication (1905): "*Über die alttertiären Vertebraten der Seymourinsel. Wissenschaftliche Ergebnisse der Schwedischen Südpolar Expedition 1901-1903*". Original cover page of the contribution; Plate 1 (TAF. I.) showing two vertebrae of ***Zeuglodon*** sp. and Plate 2 (TAF. II.) showing tarsometatarsi of "***Eospheniscus gunnari***" (1, 1a), ***Delphinornis larsenii*** (2, 2a), ***Anthropornis nordenskjoeldi*** (3, 3a), ***Spheniscus*** sp. (4, 4a), and ***Ichtyopteryx gracilis*** (5, 5a); **3,** Florentino Ameghino; **4,** Ameghino (1905): "*Enumeración de los Impennes Fósiles de Patagonia y de la Isla Seymour*"; **5,** Marambio (Seymour) Island fossil penguins collected by the Swedish South Polar Expedition (1901–1903) and described by Wiman (1905a): **a.** ***Palaeuudyptes gunnari*****, NRM A.7**, holotype, incomplete tarsometatarsus; **b.** ***Delphinornis larseni*****, NRM A.21**, holotype, incomplete tarsometatarsus; **c.** ***Ichtyopteryx gracilis*****, NRM A.20**, incomplete tarsometatarsus; **d.** ***Anthropornis nordenskjoeldi*****, NRM A.45**, holotype, incomplete tarsometatarsus. Scale bar= 5 cm.

and it is one of the most productive paleontological sites in Antarctica (Acosta Hospitaleche *et al.*, 2013, 2019a, 2019b; Reguero *et al.*, 2013a; Reguero, 2019). Carl Wiman (1867–1944) (Fig. 5.1) was the first scientist who described and figured the fossil vertebrates collected by the Swedish South Polar Expedition (Wiman, 1905a). The same year, Florentino Ameghino (1953–1911) (Fig. 5.3) published in his "*Enumeración de los Impennes Fósiles de Patagonia y de la Isla Seymour*" (Ameghino, 1905) (Fig. 5.4) a critic about the Antarctic Sphenisciformes described by Wiman (Fig. 5.5). The Swedish Antarctic collection included about 30 bones, all of which were found weathered out of the rock, thus with no apparent association.

After the Swedish South Polar Expedition (1901–1903), more than 40 years passed before the James Ross Basin was scientifically visited again, this time by members of the Falkland Islands Dependencies Survey (now British Antarctic Survey) in 1946. This was Antarctica's second fossil vertebrate collection (Marples, 1953). It consisted of some 45 specimens.

The establishment of the Marambio Station and its airstrip on Marambio (Seymour) Island in 1969 initiated the modern phase of geologic and palaeontologic investigations in the James Ross Basin (Fig. 6). As Elliot (1988, Preface, p. x) wrote: "Seymour Island is surely destined to be recognized as one of the more important localities for Cretaceous and Paleogene paleontological research in the Southern Hemisphere, if not the world at large".

Today, fossil vertebrates from Marambio (Seymour) Island (extensive to the James Ross Basin; Fig. 6) are housed in collections of national repositories (museums and universities) of several countries (Tab. 1).

The antarctic fossil vertebrate collection of the MLP is outstanding for two main reasons. The first one includes fishes, marine reptiles, and non-avian and avian dinosaurs from one of the best K/Pg recorded sections (the time interval when non-avian dinosaurs became extinct). Recent discoveries in Marambio (Seymour) Island challenge the view that the K/Pg extinctions were caused solely by a catastrophic asteroid impact. Furthermore, the fossil record in Marambio (Seymour) Island indicates a notable decline in diversity over an extended period preceding the impact event at the end of the Cretaceous (65 Ma). For this reason, this area (K/Pg) was selected as the first Antarctic geosite by the SCAR Geoheritage and Geoconservation (Hughes *et al.*, 2020) and it was included by the ICG of the IUGS as the most representative high latitude K/Pg location and one of the most significant and best exposed globally (https://iugs-geoheritage.org/geoheritage_sites/cretaceous-paleogene-k-pg-transition-at-seymour-marambio-island-

TABLE 1 – National repositories (museums, universities, institutes, *etc.*) housing scientific collections of fossil vertebrates from James Ross Basin, NE Antarctic Peninsula

Nation	Acronym	Repositories
Argentina	MLP IAA-PV	Museo de La Plata, La Plata Repositorio Antártico de Colecciones Paleontológicas y Geológicas, Instituto Antártico Argentino (IAA), Ciudad Autónoma de Buenos Aires
Chile	SGO	Museo Nacional de Historia Natural, Santiago
Brazil	MN	Museu Nacional (MN)-Universidade Federal do Rio de Janeiro (UFRJ), Rio de Janeiro
Sweden	NRM-PZ	Swedish Museum of Natural History, Stockholm
Poland	IB/P/B	Professor Andrzej Myrcha University Nature Centre, University of Bialystok, Bialystok
United Kingdom	BAS	British Antarctic Survey, Cambridge
USA	USNM TTU	Smithsonian National Museum of Natural History, Washington Museum of Texas Tech University, Lubbock

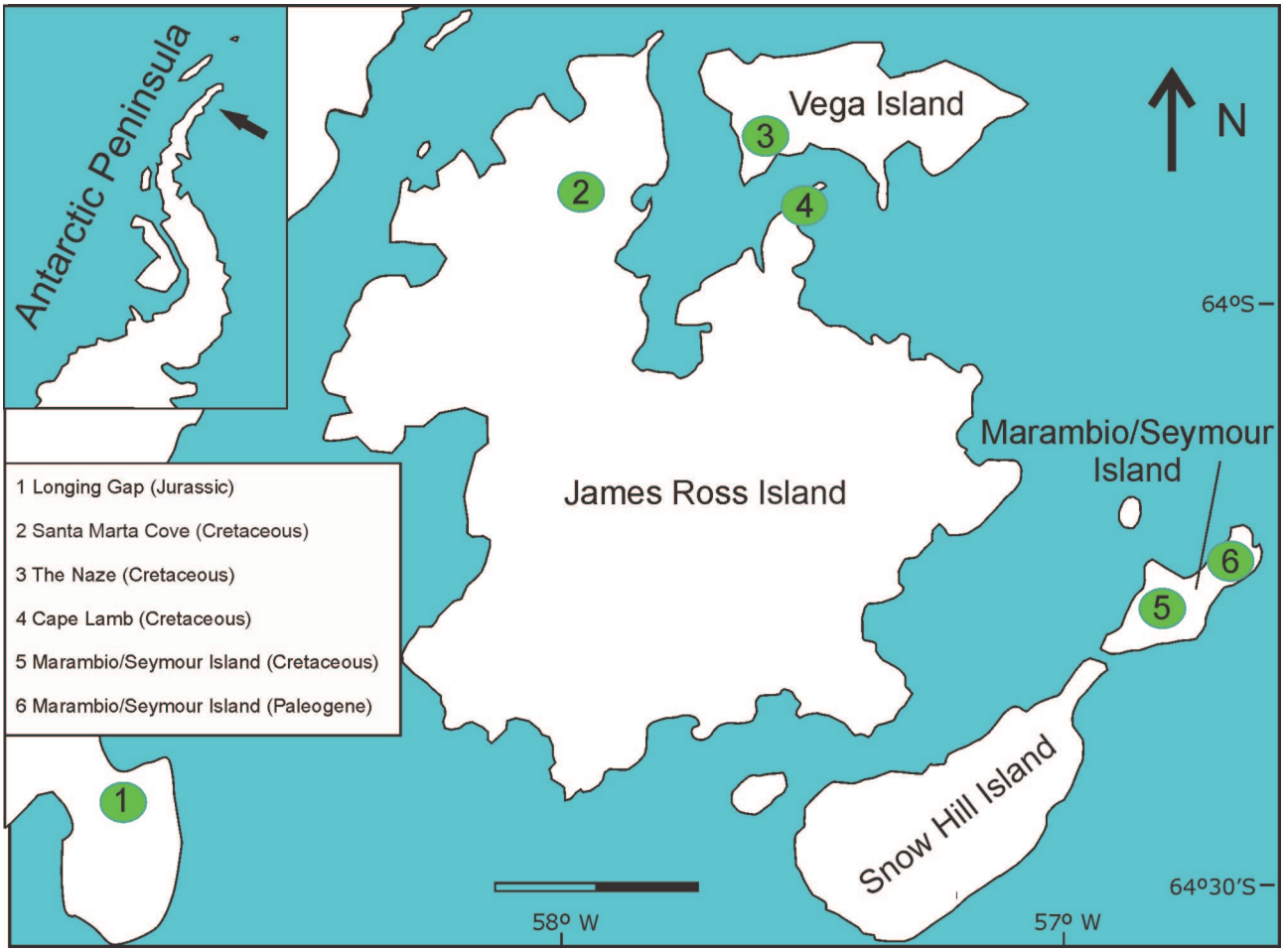


Figure 6. Schematic map of the James Ross Basin, Weddell Sea, northeastern Antarctic Peninsula. Green circles indicate areas worked by the **IAA-MLP** teams. Scale bar= 20 km

antarctica/). The second reason the collection is important is that it helps researchers to understand the effects of current climate change on marine communities in Antarctica since the Jurassic to the Paleogene and even during Holocene times (*e.g.*, Cione *et al.*, 2007; Acosta Hospitaleche *et al.*, 2022).

FIRST AGREEMENT BETWEEN THE DIRECCIÓN NACIONAL DEL ANTÁRTICO AND THE MUSEO DE LA PLATA: EXHIBITION OF THE ANTARCTIC FOSSIL VERTEBRATES OF THE MUSEUM

The first of many agreements was signed in the 1970s between the authorities of the AA, Dr. Néstor Fourcade (1921–2023) (Fig. 1.2), head of the Department of Geology, and Dr. Rosendo Pascual (1925–2012), head of the DPV of the MLP.

Consequently in 1977, it was inaugurated in the museum the "*Sala Antártica*" (Fig. 7), where the public could learn about Antarctic discoveries and what they tell us about the present and past life in Antarctica. This exhibition exhibited the skeleton of a giant fossil penguin found in the Paleogene of Antarctica, on the Submeseta Formation, Marambio (Seymour) Island.

This skeleton (Fig. 8.1) was assembled from the first material collected by the geologist Rodolfo del Valle of the IAA during 1974–1975 (uncatalogued collection CX 60-201-CX 60-322, 121 specimens). Later, these fossils were finally taken out of public display in 1998, when they were moved into storage and returned to the IAA. In 1995, the exhibition of the skeleton of the giant fossil penguin moved to Tokyo, Japan (Fig. 8.2).

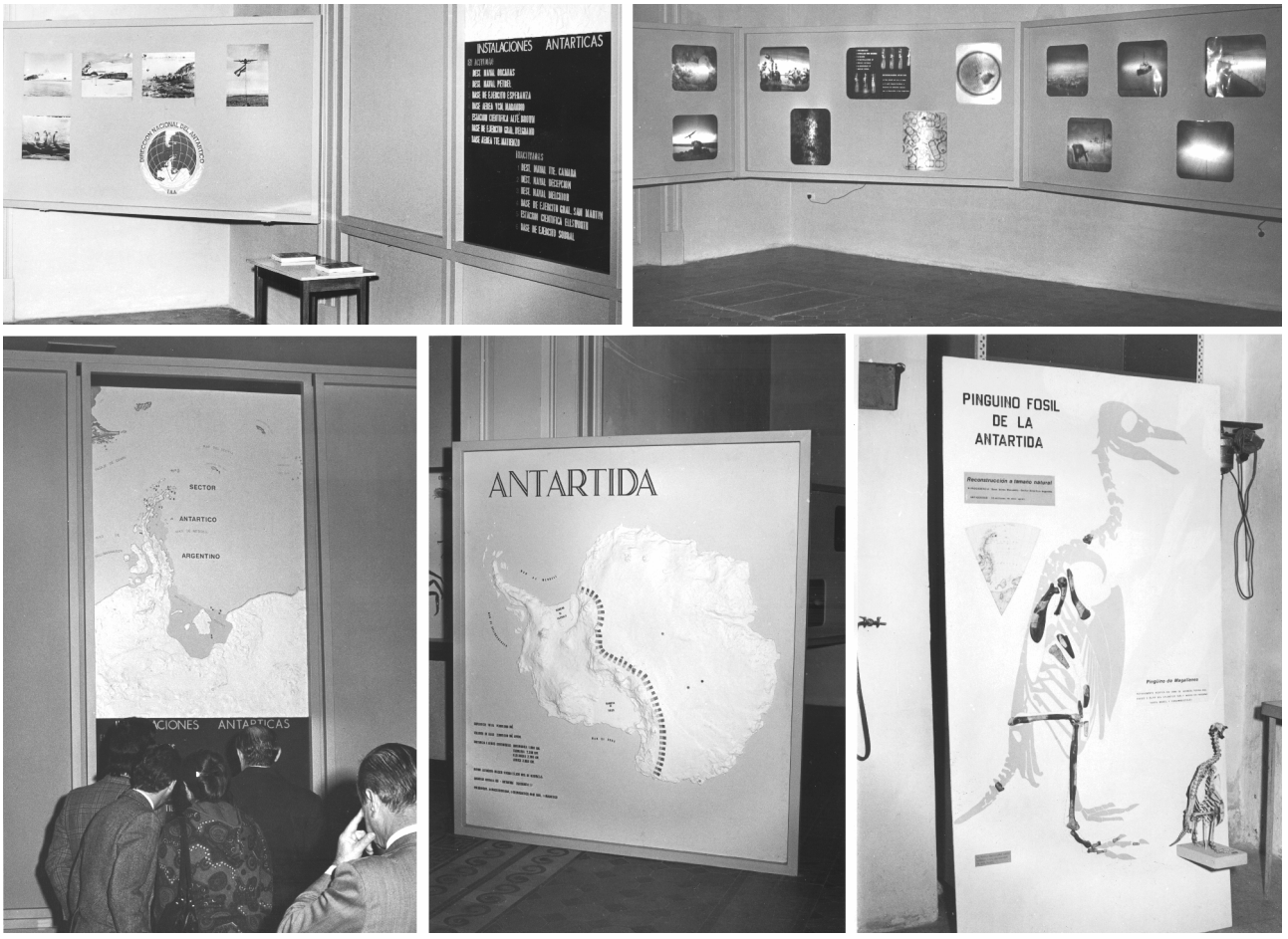


Figure 7. Opening of the "*Sala Antártica*" in the **MLP**, 1977.

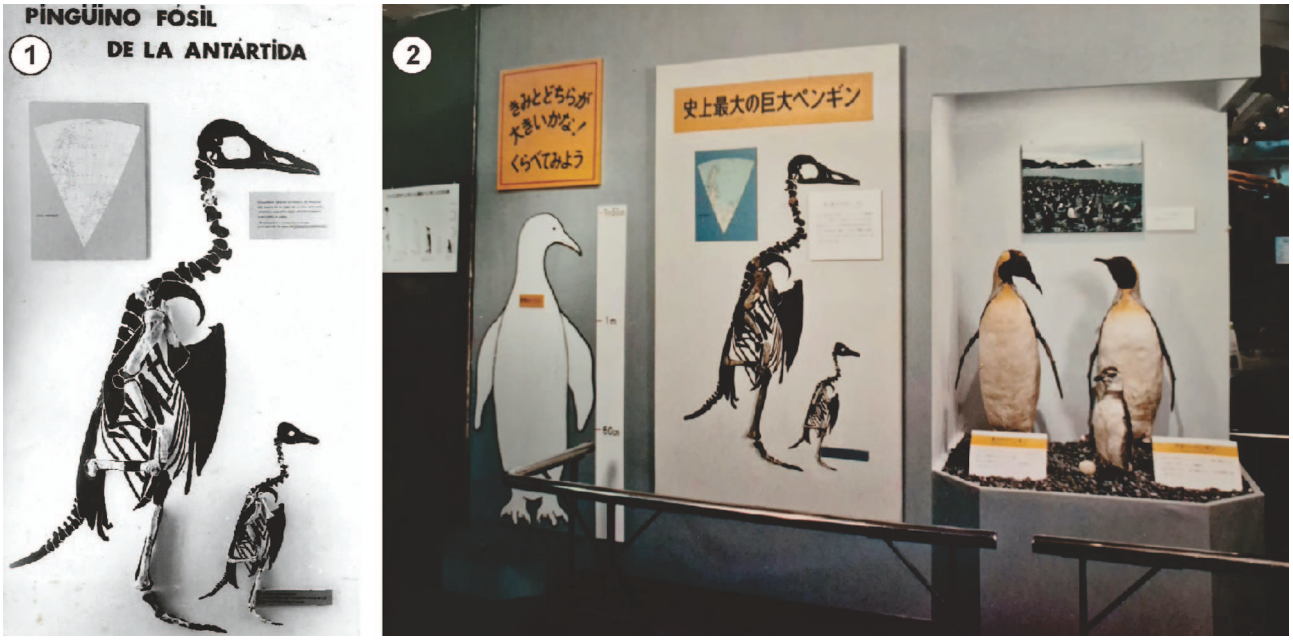


Figure 8. 1, Exhibition of the antarctic giant fossil penguin skeleton in the **MLP,** 1990; **2,** Exhibition of the giant fossil penguin skeleton in the National Museum of Science of Tokio, 1995.

ANTARCTIC VERTEBRATE PALEONTOLOGY COLLECTION OF THE MLP: FOSSIL VERTEBRATE COMPOSITION

The antarctic fossil vertebrate collection of the MLP currently has more than 32,000 specimens that range in age from the Jurassic to the Oligocene and Holocene (Montalti *et al.*, 2009; Acosta Hospitaleche *et al.*, 2022). The collection boasts specimens that collectively represent all major vertebrate groups, including 22 holotypes (Tab. 2), such as those of the iconic non-avian dinosaurs *Antarctopelta oliveroi* (Salgado & Gasparini, 2006) and *Trinisaura santamartaensis* (Coria *et al.*, 2013) and avian dinosaurs *Vegavis iaai* (Clarke *et al.*, 2005; Acosta Hospitaleche & Worthy, 2021), *Conflicto antarcticus* (Tambussi *et al.*, 2019), *Crossvallia unienwillia* (Tambussi *et al.*, 2005; Acosta Hospitaleche *et al.*, 2016), *Aprosdokitos mikrotero* (Acosta Hospitaleche *et al.*, 2017), *Tonniornis mesetaensis*, *Tonniornis minimum* (Tambussi *et al.*, 2006; Tambussi & Acosta Hospitaleche, 2007), and *Notoleptos giglii* (Acosta Hospitaleche & Gelfo, 2015); the plesiosaur elasmosaurid *Vegasaurus molyi* (O'Gorman *et al.*, 2015); SANUs litoptern *Notiolofos arquinotiensis* (Bond *et al.*, 2006) and astrapothere *Antarctodon sobrali* (Bond *et al.*, 2011). This extensive record of extinct vertebrates offers fascinating insights into the history of the Antarctic continent and its biota and has inestimable scientific value. Most of these specimens come from the James Ross Basin, NE of the Antarctic Peninsula (Fig. 6).

The stratigraphic distribution of the taxonomic major groups represented in the MLP antarctic fossil vertebrate collection from Larsen and James Ross basins (Jurassic, Late Cretaceous, and Paleogene), Antarctic Peninsula is shown in Figure 9.

The collection has roughly tripled in size since the late 2000s and the numbers of type and figured specimens have increased accordingly. This growth continued until 2015, as the MLP maintained an active collecting program included in the "*Programa Antártico Argentino*" of the DNA-IAA. Spanning more than 80 million years geologic time, the collection is especially important in Late Cretaceous marine reptiles and avian and non-avian dinosaurs (Reguero *et al.*, 2013a, 2022), turtles, teleostean fishes, and sharks; and Paleogene sphenisciforms (Fig. 10), flying birds, turtles, teleostean fishes, and sharks. Noteworthy individual fossils

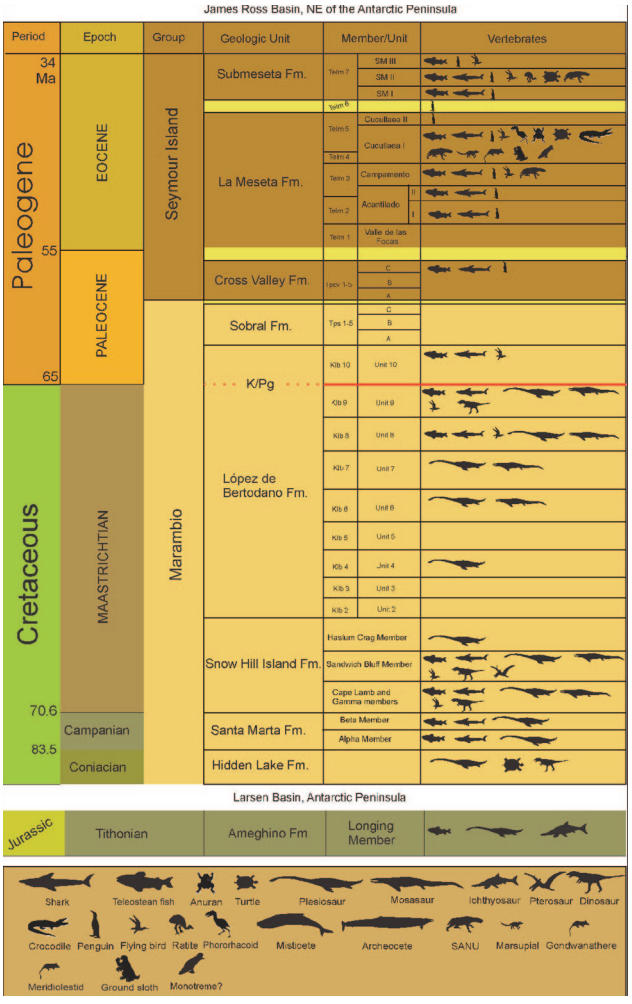


Figure 9. Geology and vertebrate paleontology from Antarctic Peninsula. Time scale, chronostratigraphy and major groups of vertebrate's record for the Jurassic, Late Cretaceous and Paleogene rocks in Larsen and James Ross basins, Antarctic Peninsula. Temporal and sedimentary units not to scale.

or assemblages include a spectacularly diverse and well-represented fauna from the Eocene terrestrial mammals (marsupials, litopterns, astrapotheres, gondwanatheres, and meridiolestids; Reguero *et al.*, 2013b).

Selected highlights of the Antarctic fossil vertebrate collection of the MLP include.:

Late Cretaceous fishes (Cione *et al.*, 2018), mosasaurs, and plesiosaurs taxa from Cape Lamb Member of the Snow Hill Island Formation from James Ross and Vega islands, James Ross Basin. Notable genera include *Edaphodon*, *Vegasaurus*, *Taniwhasaurus*, and *Leiodon* (mosasaurs).

Late Cretaceous iconic dinosaur taxa from Cape Lamb Member of the Snow Hill Island Formation from James Ross

TABLE 2 – MLP Antarctic fossil vertebrate collection: holotypes and type localities from the James Ross Basin, Antarctic Peninsula

Class	Species	Catalog number	Formation	Age	Type locality	References
Chondrichthyes	*Edaphodon snowhilliensis*	MLP-PV 08-XI-30-1	Snow Hill Island	Early Maastrichtian	SMC IAA 2/11, JRI	Gouiric-Cavalli *et al.* (2015)
Dinosauria	*Trinisaura santamartaensis*	MLP-PV 13-I-16-1	Snow Hill Island	Early Maastrichtian	SMC IAA 1/08, JRI	Coria *et al.* (2013)
Dinosauria	*Antarctopelta oliveroi*	MLP-PV 08-III-1-1	Snow Hill Island	Early Maastrichtian	SMC IAA 1/86, JRI	Salgado & Gasparini (2006)
Plesiosauria	*Vegasaurus molyi*	MLP-PV 86-X-28-1	Snow Hill Island	Early Maastrichtian	VEG IAA 2/93, VI	O'Gorman *et al.* (2015)
Aves	*Vegavis iaai*	MLP-PV 93-I-5-1	López de Bertodano	Late Cretaceous	VEG 9303, VI	Tambussi *et al.* (2006)
Aves	*Tonniornis minimum*	MLP-PV 93-I-3-1	Submeseta	Late Eocene	DPV 10/84. MI	Tambussi *et al.* (2006)
Aves	*Toniornis mesetoensis*	MLP-PV 93-I-6-3	Submeseta	Late Eocene	DPV 10/84, MI	Tambussi *et al.* (2006)
Aves	*Crossvallia unienwillia*	MLP-PV 93-X-1-145	Cross Valley	Late Paleocene	IAA 2/04, MI	Tambussi *et al.* (2005)
Aves	*Aprosdokitos mikrotero*	MLP-PV 00-I-10-1	Submeseta	Late Eocene	DPV 16/84, MI	Acosta Hospitaleche *et al.* (2017)
Aves	*Notoleptos giglii*	MLP-PV 00-I-1-19	Submeseta	Late Eocene	DPV 16/84, MI	Acosta Hospitaleche & Gelfo (2016)
Aves	*Conflicto antarcticus*	MLP-PV 12-I-20-305	López de Bertodano	Early Paleocene	IAA 3/06, MI	Tambussi *et al.* (2019)
Aves	*Antarctoboenus carlinii*	MLP-PV 07-III-1-1	La Meseta	Early–Middle Eocene	IAA 2/95, MI	Cenizo *et al.* (2016)
Mammalia	*Derorhynchus minutus*	MLP-PV 95-I-10-8	La Meseta	Early–Middle Eocene	IAA 1/90, MI	Goin *et al.* (1999)
Mammalia	*Pauladelphys juanjoi*	MLP-PV 96-I-5-44	La Meseta	Early–Middle Eocene	IAA 1/90, MI	Goin *et al.* (1999)
Mammalia	*Xenostylos peninsularis*	MLP-PV 95-I-10-2	La Meseta	Early–Middle Eocene	IAA 1/90, MI	Goin *et al.* (1999)
Mammalia	*Perrodelphys coquinense*	MLP-PV 94-III-15-10	La Meseta	Early–Middle Eocene	IAA 1/90, MI	Goin *et al.* (1999)
Mammalia	*Marambiotherium glaciaris*	MLP-PV 96-I-5-11	La Meseta	Early–Middle Eocene	IAA 1/90. MI	Goin *et al.* (1999)
Mammalia	*Woodburnodon casei*	MLP-PV 95-I-10-1	La Meseta	Early–Middle Eocene	IAA 1/95, MI	Goin *et al.* (2007)
Mammalia	*Antarctodolops mesetaense*	MLP-PV 04-III-1-2	La Meseta	Early–Middle Eocene	DPV 6/84, MI	Chornogubsky *et al.* (2009)
Mammalia	*Pujatodon ektopos*	MLP-PV 96-I-5-12	La Meseta	Early–Middle Eocene	IAA 1/90, MI	Goin *et al.* (2018)
Mammalia	*Notiolofos arquinotiensis*	MLP-PV 14-I-10-20	Submeseta	Late Eocene	DPV 16/84, MI	Bond *et al.* (2006)
Mammalia	*Antarctodon sobrali*	MLP-PV 95-I-10-6	La Meseta	Early–Middle Eocene	DPV 2/84, MI	Bond *et al.* (2011)

Abbreviations: JRI, James Ross Island, Antarctic Peninsula; MI, Marambio Island, Antarctic Peninsula; VEG, Vega Island; VI, Vega Island, Antarctic Peninsula

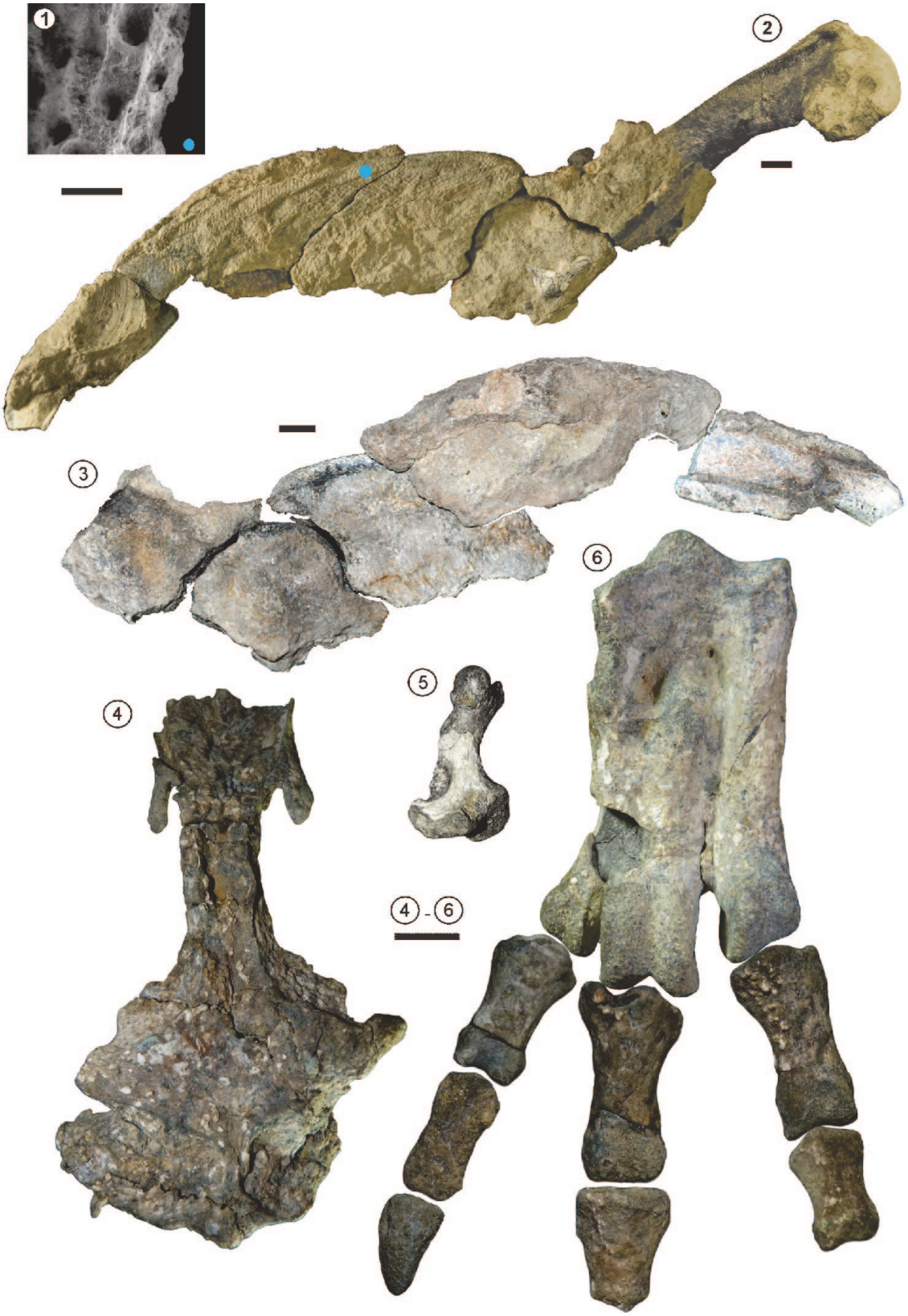


Figure 10. Sphenisciformes: **1–3,** ***Palaeeudyptes gunnari***; **1,** fossilized tegument showing the skin fibres (**MLP-PV 14-I-10-22**); **2–3,** mineralized skin preserving tegument; **4–6,** ***Anthropornis grandis***; **4,** skull; **5,** quadrate; **6,** tarsometatarsus with phalanges (**MLP-PV 14-XI-27-84**). Scale bar= 10 mm

and Vega islands, James Ross Basin. Notable genera include the non-avian dinosaurs *Antarctopelta* and *Trinisaura*.

Late Cretaceous birds from Vega and Seymour (Marambio) islands, such as *Vegavis iaai* (Fig. 11), *Polarornis gregorii*, and many specimens are still under examination (Acosta Hospitaleche *et al.*, 2024).

Late Cretaceous and early Paleocene vertebrates from the K/Pg of Marambio (Seymour) Island, James Ross Basin (Cione *et al.*, 2018; Reguero & Goin, 2021).

Eocene marine vertebrates (fishes, turtles, birds, and whales) from the Paleogene La Meseta and Submeseta formations of Marambio (Seymour) Island, James Ross Basin (Bona *et al.*, 2010; Buono *et al.*, 2016; Cenizo *et al.*, 2016; Acosta Hospitaleche & Gelfo, 2017; Acosta Hospitaleche & Reguero, 2020; Charnelli *et al.*, 2024).

Largest Spheniscifórmes of the world (Acosta Hospitaleche & Jadwiszczak, 2011; Acosta Hospitaleche, 2013, 2014, 2016; Jadwiszczak & Acosta Hospitaleche, 2013; Jadwiszczak *et al.*, 2013; Acosta Hospitaleche *et al.*, 2019a, 2019b, 2020) that constitute an almost complete sequence from the late Paleocene to the earliest Oligocene?–latest Eocene (Acosta Hospitaleche & Di Carlo, 2010, 2012; Acosta Hospitaleche & Reguero, 2010, 2011; Acosta Hospitaleche *et al.*, 2012, 2016; Haidr & Acosta Hospitaleche, 2017a, 2017b; Irazoqui & Acosta Hospitaleche, 2021).

Eocene terrestrial vertebrates (anurans, crocodiles, marsupials, litopterns, astrapotheres, gondwanatheres, and meridiolestids) (Goin *et al.*, 1999, 2006; Bond *et al.*, 2006, 2011; Martinelli *et al.*, 2014; Mörs *et al.*, 2020; Bona *et al.*, 2022).

Eocene continental birds (falcons, terror birds, and probably flightless ratites) from the Submeseta and La Meseta formations in Marambio (Seymour) Island (Cenizo *et al.*, 2016; Acosta Hospitaleche *et al.*, 2019a, 2019b; Acosta Hospitaleche & Jones, 2024).

SOURCE OF VERTEBRATE FOSSILS AND ANTARCTIC LOGISTIC

The DNA-IAA provides financial and logistic resources to optimize transportation costs to Antarctica and camping in the field.

FAA supports DNA-IAA campaigns providing plane and helicopter flights (Fig. 12.1–12.2). DNA takes care of camp logistics and clothes (Fig. 12.3–12.4).

DNA-UNLP Agreements and IAA-MLP Protocols:

Since 1983, several agreements and collaboration protocols have been signed between DNA-IAA and MLP (Facultad de Ciencias Naturales y Museo, UNLP); the following documents, among others, have contributed achieving the continuity of the collaboration between these institutions:

In 1983, the DNA - IAA and the MLP signed an official agreement.

In December 2013, the UNLP and the DNA signed the agreement: "*Convenio de Colaboración Recíproca en el Campo de la Investigación Científica y Tecnológica en Materia Antártica entre la Universidad Nacional de La Plata y la Dirección Nacional del Antártico*".

In June 2014, the IAA director, MLP director, and DPV head signed a "*Protocolo de Colaboración*" between these institutions.

In 2019, the IAA and the UNLP-MLP signed a "*Protocolo Específico de Cooperación Académica*".

NATURE AND ORIGIN OF THE ANTARCTIC FOSSIL VERTEBRATE COLLECTION OF THE MUSEO DE LA PLATA

The IAA's first geologic investigations and fieldworks in Marambio (Seymour) Island started in 1974. Doctor R. Pascual from the MLP and Dr. Carlos Rinaldi (1930–2017) (Fig. 1.3), director of the IAA, through a bilateral collaboration, the first antarctic fossils vertebrates were gathered by personnel of the MLP during the IAA GEOANTAR program (1973–1974, 1974–1975, 1975–1976, 1977–1978) geologic campaigns in the James Ross Basin, NE of the Antarctic Peninsula (Fig. 4).

The participation of researchers and technicians of the MLP in the collecting activities in the field of more than four decades (1974–2015) can be resumed in the following four periods: a) IAA GEOANTAR Program 1974–1982; b) DNA-MLP agreement – IAA Paleomarambio 1983–1993; c) DNA-MLP agreement – IAA Geomarambio 1994–2009; and d) Plan Annual Antártico DNA – IAA Paleovertebrados 2010–2015.

Period IAA GEOANTAR Program 1974–1982

The IAA invited the MLP to participate in the IAA

Figure 11. ***Vegavis iaai*** (holotype **MLP-PV 93-I-3-1**); **1,** ninth cervical vertebra in dorsal view; **2,** third thoracic vertebra in cranial view; **3,** fourth thoracic vertebra in caudal view; **4,** coracoid in dorsal view; **5,** left scapula in lateral view; **6,** right humerus in cranial view; **7,** left tibiotarsus in caudal view; **8,** left ulna in ventral view; **9,** radius; **10,** left femur; **11,** right femur; **12,** left humerus in cranial view; **13,** proximal fragment of right humerus; **14,** left *ossa coxae* in medial view; **15,** right *ossa coxae* in lateral view;**16,** proximal right tarsometatarsus; **17,** distal end left tarsometatarsus; **18,** *synsacrum*. Scale bar= 10 mm

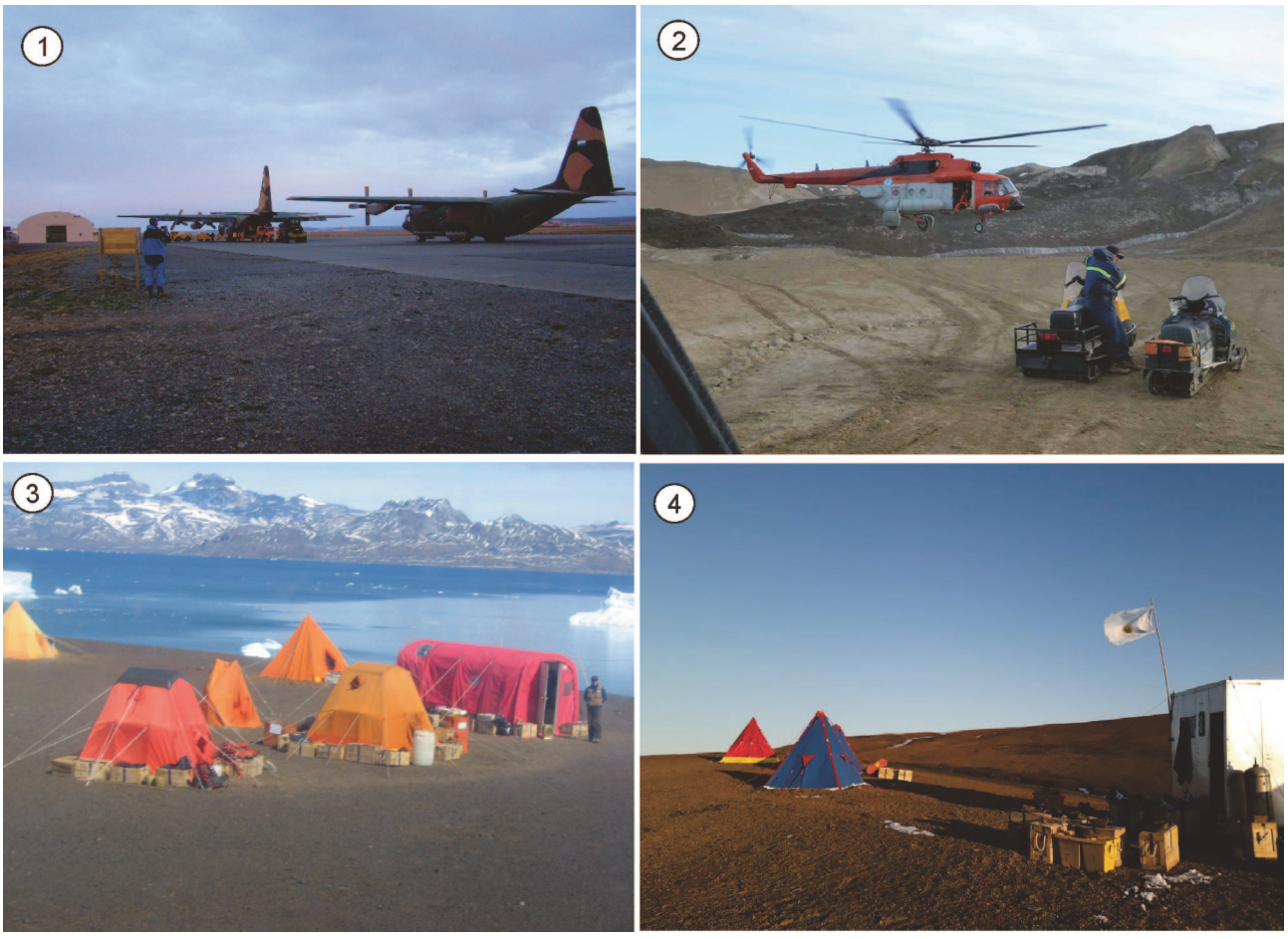


Figure 12. 1, Hercules C-130 in Río Gallegos, Santa Cruz loading cargo to flight to Marambio (Seymour) Island; **2,** MI helicopter of the **FAA** repleneshing the "*Casa de Botes*" shelter, Bahía López de Bertodano, Marambio (Seymour) Island; **3,** "*Geomarambio*" camp in Cape Lamb, Vega Island, 2005; **4,** "*Paleovertebrados Jurásico*" camp and shelter in Longing Gap, Antarctic Peninsula, 2015.

GEOANTAR program. In 1974, Omar J. Molina (1937–2022) (Fig. 1.4), chief of technicians of the DPV, was invited by the IAA to visit Marambio (Seymour) Island (Fig. 6). Molina collected a few fragments of Sphenisciformes from the La Meseta Formation (16 specimens, uncatalogued MLP collection) (O'Gorman *et al.*, 2024).

In the summer of 1975, José María Ageitos and Oscar Eduardo Odreman Rivas from the MLP participated in the IAA GEOANTAR program and visited Marambio (Seymour) Island.

In 1977–1978, two vertebrate paleontologists of the MLP, Dr. E.P. Tonni and Dr. A.L. Cione, visited Marambio (Seymour) Island and collected fossil vertebrate specimens, being the first professionals commissioned by the MLP to participate in the fieldworks in Antarctica (Fig. 13.1–13.2). The fossil vertebrates collected by Tonni and Cione were the first antarctic specimens officially incorporated into the DPV-MLP (Cione *et al.*, 1977; Tonni & Cione, 1978).

The fossil vertebrate prospecting, surface collecting, and larger-scale quarrying by personnel from the MLP started in the beginning of 1980s. In the antarctic summer of 1981–1982, the IAA-MLP team prospected the outcrops of the López de Bertodano Formation (Unit 9, Upper Cretaceous, Fig. 13.3) in the south of Marambio (Seymour) Island. This resulted in the recovery of an articulated postcranial skeleton of a non-aristonectine elasmosaurid plesiosaur on January 28th, 1982 (Fig. 13.4). The skeleton of the elasmosaurid was taken back by plane to the MLP by Víctor A. Melemenis, technician of the DPV, and prepared in the laboratories of this institution. It was one of the first plesiosaur articulated skeletons recovered from Antarctica and one of the first collected in quarrying within permafrost.

An initial report was published by Gasparini *et al.* (1984). O'Gorman *et al.* (2021) recently published new data on this skeleton.

Four CAV were done during this period: 1977, 1978, 1979, and 1982. Eight collection transactions were recorded in the DPV Record Book of Fossil Vertebrates: MLP-PV 78-X-26-1, MLP-PV 78-XI-1-1, MLP-PV 78-XI-2-1, MLP-PV 82-I-28-1, MLP-PV 82-IV-23-1, MLP-PV 83-I-12-1, MLP-PV 83-V-20-1, and MLP-PV 83-V-30-1. The number of specimens collected during this period and housed in the MLP is estimated to be 880. Participants /collectors of the IAA-MLP are listed in Table 3.

Period DNA-MLP agreement – IAA Paleomarambio 1983–1989

In January 1986, the geologist Eduardo Bernardo Olivero and his team ("IAA *Bioestratigrafía*") found an almost complete skeleton of a non-avian dinosaur in the marine horizons of the Snow Hill Island Formation (Upper Cretaceous) in the Caleta Santa Marta, James Ross Island.

Figure 13. Period **IAA GEOANTAR** Program 1974-1982; **1–2, GEOANTAR** Program, Paleogene of Marambio (Seymour) Island, Dr. E.P. Tonni prospecting horizon of the La Meseta Formation, paleontologist's team in camp, Marambio (Seymour) Island, 1977; **3–4, GEOANTAR** Program, López de Bertodano, Marambio (Seymour) Island, Víctor A. Melemenis and collaborators of the **IAA** recovering the skeleton of an elasmosaurid in the Cretaceous of the López de Bertodano Formation, 1982.

TABLE 3 – Participants / collectors of the IAA-MLP Antarctic vertebrate paleontology project

Name	Institution	Country	CAVs
María Alejandra Abello	MLP-CONICET	La Plata, Argentina	IAAGeomarambio; IAA Paleovertebrados
Carolina Acosta Hospitaleche	MLP-CONICET	La Plata, Argentina	IAA Geomarambio; IAA Paleovertebrados
Cecilia Besendjak	IAA	CABA, Argentina	IAA Geomarambio
Leonel Acosta Burlaille	MLP	La Plata, Argentina	IAA Paleovertebrados
José María Ageitos	IAA-MLP	La Plata, Argentina	IAA Paleovertebrados
Pablo Amoedo	IAA-UBA	CABA, Argentina	IAA Geomarambio
Eugenia Arnaudo	MLP-CONICET	La Plata, Argentina	IAA Paleovertebrados
Nicolás Bauzá	MLP-CONICET	La Plata, Argentina	IAA Paleovertebrados
Cecilia Besendjak	IAA	CABA, Argentina	IAA Geomarambio
Mauricio Bigurrarena	MLP	La Plata, Argentina	IAA Paleovertebrados
Paula Bona	MLP-CONICET	La Plata, Argentina	IAA Geomarambio; IAA Paleovertebrados
Mónica Buono	CENPAT-CONICET	Puerto Madryn, Argentina	IAA Paleovertebrados
†Fernando Calabozo	IAA	CABA, Argentina	IAA Criología
Juan Canale	Museo de El Chocón-CONICET	Río Negro, Argentina	IAA Paleovertebrados
Ariana Paulina Carbajal	IMBIOMA	Río Negro, Argentina	IAA Paleovertebrados
Magalí Cárdenas	MACN-CONICET	CABA, Argentina	IAA Paleovertebrados
Bárbara Cariglino	MACN-CONICET	CABA, Argentina	IAA Paleovertebrados
Alfredo A. Carlini	MLP-CONICET	La Plata, Argentina	IAA Paleomarambio
Silvio Casadío	UN La Pampa-CONICET	La Pampa, Argentina	IAA Geomarambio
Ignacio Cerda	UNRN	Río Negro, Argentina	IAA Paleovertebrados
Laura Chornogubsky	MACN-CONICET	CABA, Argentina	IAA Paleovertebrados
Alberto L. Cione	MLP-CONICET	La Plata, Argentina	DNA-MLP agreement
Andrea Concheyro	IAA	CABA, Argentina	IAA Geomarambio, IAA Micropaleontología
Ornela E, Constantini	MLP	La Plata, Argentina	IAA Paleovertebrados
Rodolfo A. Coria	UNRN-CONICET	Río Negro, Argentina	IAA Paleovertebrados
Mario A. Cozzuol	MLP-CONICET	La Plata, Argentina	DNA-MLP agreement
Miguel Criscenti	MLP	La Plata, Argentina	IAA Paleomarambio
Martín de los Reyes	IAA	La Plata, Argentina	IAA Paleovertebrados
Federico Degrange	MLP-CONICET	La Plata, Argentina	IAA Paleovertebrados
Gerardo Fabris	MLP	La Plata, Argentina	GEOANTAR, DNA-MLP agreement
Marta S. Fernández	MLP-CONICET	La Plata, Argentina	IAA Geomarambio; IAA Paleovertebrados
Javier N. Gelfo	MLP-CONICET	La Plata, Argentina	IAA Geomarambio, IAA Paleovertebrados
Daniel García López	INSUGEO-CONICET	Tucumán, Argentina	IAA Paleovertebrados

TABLE 3 – Continuation

Name	Institution	Country	Plan Anual Antártico (CAVs)
Gabriel Giordanengo	UBA	CABA, Argentina	IAA Bioestratigrafia
Soledad Gouiric Cavalli	MLP-CONICET	La Plata, Argentina	IAA Paleovertebrados
Yanina Herrera	MLP-CONICET	La Plata, Argentina	IAA Paleovertebrados
Facundo Huidobro	IAA-UBA	CABA, Argentina	IAA Geomarambio
Ari Iglesias	IMBIOMA-CONICET	Río Negro, Argentina	IAA Paleovertebrados
Facundo Irazoqui	MLP-CONICET	La Plata, Argentina	IAA Paleovertebrados
Guillermo M. López	MLP	La Plata, Argentina	IAA Geomarambio; IAA Paleovertebrados
Jorge Lusky	IAA	CABA, Argentina	IAA Bioestratigrafía
Rolando Maidana	FAA	CABA, Argentina	IAA Geomarambio, Air Force logistic
Sergio A. Marenssi	IAA	CABA, Argentina	IAA Geomarambio
Daniel Martinioni	IAA	CABA, Argentina	ÍAA Bioestratigrafia
Gabriela Massaferro	UBA	CABA, Argentina	IAA Geomarambio
Víctor A. Melemenis	MLP	La Plata, Argentina	GEOANTAR, DNA-MLP agreement
Florencia Milanese	IAA-CONICET	CABA, Argentina	IAA Bioestratigrafía
†Omar J. Molina	MLP	La Plata, Argentina	GEOANTAR, DNA-MLP agreement 1974
Juan José Moly	MLP	La Plata, Argentina	IAA Geomarambio, IAA Paleomarambio, IAA Paleovertebrados
Alejandro Monti	IAA-UBA	CABA, Argentina	IAA Geomarambio
Nahuel Muñoz	MLP-CONICET	La Plata, Argentina	IAA Paleovertebrados
Francisco Mussel	IAA	CABA, Argentina	IAA Bioestratigrafia
Laura Net	IAA-UBA	CABA, Argentina	IAA Geomarambio
Laura Nicoli	MACN-CONICET	CABA, Argentina	IAA Paleovertebrados
†Oscar E. Odreman Rivas	MLP, Servicio Geológico y Minero	Venezuela	GEOANTAR, DNA-MLP agreement 1975
José P. O'Gorman	MLP-CONICET	La Plata, Argentina	IAA Geomarambio; IAA Paleovertebrados
Eduardo B. Olivero	CADIC-UNTdF-CONICET	Ushuaia, Argentina	IAA Bioestratigrafía
Alejandro Otero	MLP-CONICET	La Plata, Argentina	IAA Paleovertebrados
Leandro Pérez	MLP-CONICET	La Plata, Argentina	IAA Paleovertebrados
Fernanda Podestá	IAA	CABA, Argentina	IAA Paleovertebrados
Pablo Puerta	MPEF-CONICET	Chubut, Argentina	IAA Paleovertebrados
María Eugenia Raffi	CADIC-UNTdF	Ushuaia, Argentina	IAA Bioestratigrafia, IAA Paleovertebrados
Marcelo A. Reguero	IAA-MLP-CONICET	La Plata, Argentina	GEOANTAR, IAA Paleomarambio, IAA Geomarambio, IAA Paleovertebrados
Marco A. Ríos	IAA	CABA, Argentina	DNA-IAA logistic
Gervasio Robles	IAA-UBA	CABA, Argentina	IAA Geomarambio
Flavia Salani	UBA	CABA, Argentina	IAA Geomarambio

TABLE 3 – Continuation

Name	Institution	Country	Plan Anual Antártico (CAVs)
Leonardo Salgado	UNRN-CONICET	Río Negro, Argentina	IAA Paleovertebrados
Rodolfo Sánchez	IAA	CABA, Argentina	IAA Geomarambio
Sergio N. Santillana	IAA	CABA, Argentina	IAA Paleovertebrados
Alejandra Sosa	MLP-CONICET	La Plata, Argentina	IAA Paleovertebrados
Jorge Strelin	IAA	CABA, Argentina	IAA Criología
Marianella Talevi	UNRN-CONICET	Río Negro, Argentina	IAA Paleovertebrados
Claudia P. Tambussi	MLP-CONICET	La Plata, Argentina	IAA Geomarambio; IAA Paleovertebrados
Marcelo Tejedor	CENPAT-CONICET	Puerto Madryn, Argentina	International agreement IAA-NSF
David Tineo	CIG-CONICET	La Plata, Argentina	IAA Paleovertebrados
Eduardo P. Tonni	MLP-CIC	La Plata, Argentina	DNA-MLP agreement 1977
Carolina Vieytes	MLP-CONICET	La Plata, Argentina	IAA Paleovertebrados
Ana Vrba	UBA	CABA, Argentina	IAA Geomarambio
Sergio F. Vizcaíno	MLP-CONICET	La Plata, Argentina	IAA Paleomarambio, IAA Geomarambio
Virginia Villamayor	MLP	La Plata, Argentina	IAA Paleovertebrados
Foreign researchers			
Thomas Mörs	NRM	Sweden	International agreement IAA-NRM
Johan Hangström	NRM	Sweden	International agreement IAA-NRM
Miles Eccleston	Trent University	Canada	International agreement IAA
Michael O. Woodburne	UCR	USA	International agreement IAA-NSF
William J. Zinsmeister	Purdue University	USA	International agreement IAA-NSF
Judd Case	Eastern Washington University, Cheney	USA	International agreement IAA-NSF
James Martin	South Dakota School of Mines and Technology, Rapid City	USA	International agreement IAA-NSF
John Foster	SD Geological Survey, Rapid City	USA	International agreement IAA-NSF
Philip J. Currie	Royal Tyrrell Museum, Alberta	Canada	International agreement IAA-MLP
E.B.Koppelhus	Royal Tyrrell Museum, Alberta	Canada	International agreement IAA-MLP
Dan Chaney	National Museum of Natural History, Smithsonian Institution, Washington	USA	International agreement IAA-NSF
Andreij Gazdzicki	Academy of Sciences, Warzaw	Poland	International agreement IAA-Poland
Andreij Tatur	Academy of Sciences, Warzaw	Poland	International agreement IAA-Poland
Ross Macphee	AMNH, New York	USA	International agreement IAA-NSF
Ascanio Rincón	Venezuelan Institute for Scientific Research	Venezuela	International agreement IAA-Venezuela
Manuel Montes	Instituto Geológico y Minero de España (IGME), Madrid	Spain	International agreement IAA-IGME
Francisco Nozal	Instituto Geológico y Minero de España (IGME), Madrid	Spain	International agreement IAA-IGME
Fernanda Quaglio	Universidade Federal de São Paulo	Brazil	International agreement IAA-MLP

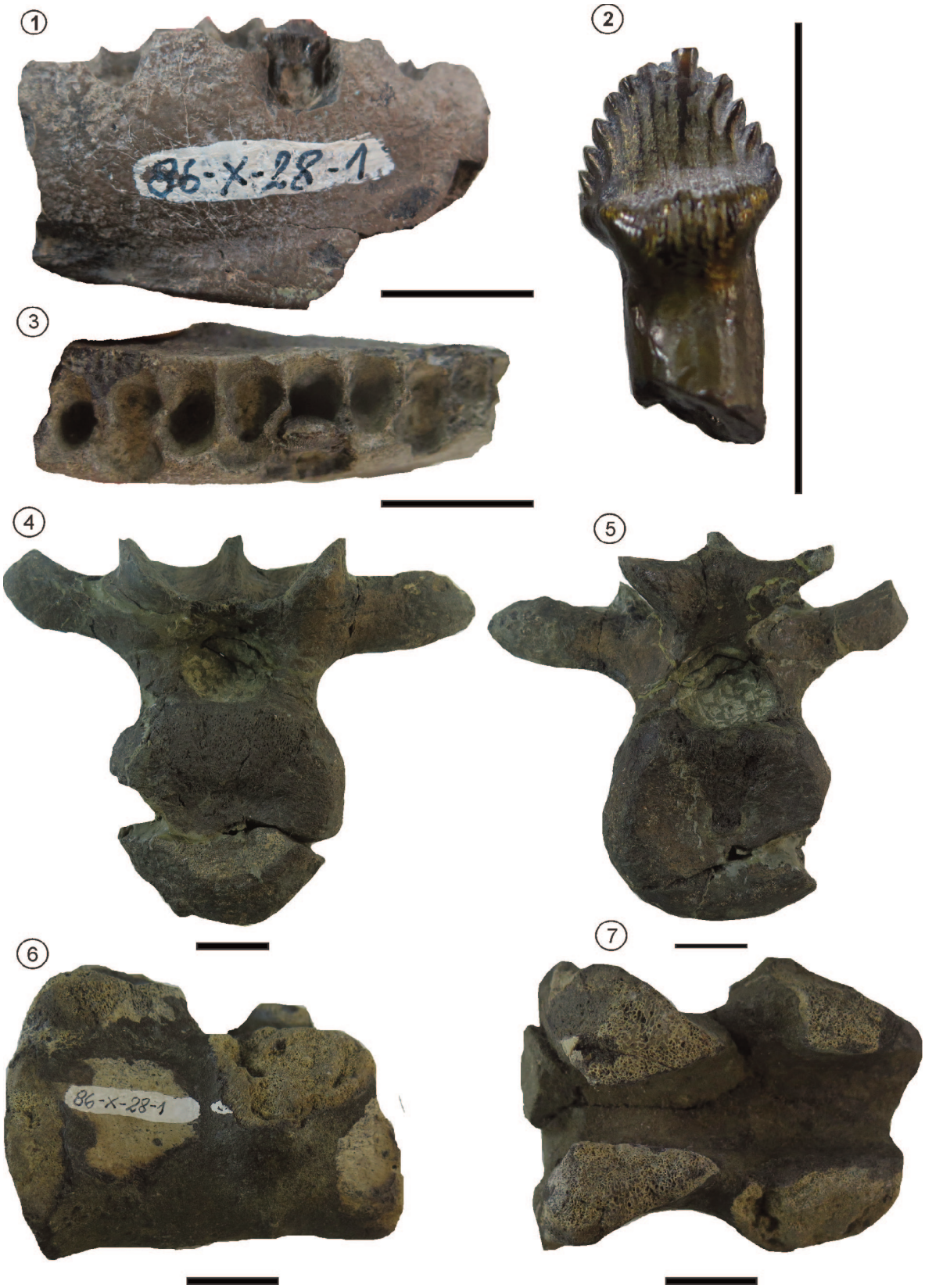


Figure 14. ***Antarctopelta oliveroi*** (holotype **MLP-PV 86-X-28-1**); **1, 3,** left dentary in **1,** medial and **3,** dorsal views; **2,** teeth in labial view; **4–5**, dorsal vertebra in **4,** anterior and **5,** dorsal views; **6–7,** dorsal vertebrae from the presacral; **6,** lateral and; **7,** dorsal views. Scale bar= 20 mm.

Figure 15. Commemorative stamp designed by Correo Argentino for the discoveries of fossil vertebrates in Antarctica; **1,** discovery of marine reptiles in Antarctica in 1992; **2,** discovery of ***Antarctopelta oliveroi*** in 1986.

The holotype (Fig. 14) is the only known specimen of this genus and species and was the first dinosaur ever found in Antarctica (Fig. 15). The excavation was completed over several field seasons (1987, 1988, and 2011) due to the frozen ground and harsh weather conditions. Much of the skeleton is in poor condition, as many of the bones nearest to the surface were subjected to years of fragmentation and weathering. *Antarctopelta oliveroi* was not named until 2006 (Salgado & Gasparini, 2006).

Six CAV were carried out during this period: 1983, 1984, 1986, 1987, 1988, and 1989. Eight collection transactions were recorded in the DPV Record Book of Fossil Vertebrates: MLP-PV 83-I-12-1, MLP-PV 83-V-20-1, MLP-PV 83-V-30-1, MLP-PV 84-II-1-1, MLP-PV 86-V-30-1, MLP-PV 87-II-1-1, MLP-PV 88-I-1-1, and MLP-PV 89-III-2-1. The number of specimens collected in this period and housed in the MLP is estimated at 3,100 specimens. Participants /collectors of the IAA-MLP are listed in Table 3.

Period DNA-MLP agreement – IAA Geomarambio 1990–2009

1990 was the year of the beginning of the fieldworks in camps of the DNA-IAA in Antarctica. All the vertebrate paleontologists from the MLP participated in the IAA Geomarambio group during this period (Fig. 16.1–16.2, Table 3)

In 1991 and 1992, two fieldworks in the Paleogene of Marambio (Seymour) Island were carried out by an international agreement between IAA and the Academy of Science of Warsaw, Poland (Fig. 16.3, Tab. 3).

In 1993, the extraction of the skeleton of the elasmosaurid *Vegasaurus molyi* (Fig. 17) in Cape Lamb, Vega Island started. The excavation was completed over several field seasons (1998, 2005) due to the frozen ground and harsh weather conditions.

In 1998, 2001, and 2005, three fieldworks in the Paleogene of Seymour/Marambio and Cretaceous of Cape Lamb, Vega islands were carried out together with US researchers (an international agreement between IAA and the NSF, USA (Fig. 17.4, Tab. 3).

In 2006 and 2007, two fieldworks in the Paleogene and Cretaceous of Marambio (Seymour) Island were carried out together with Spanish researchers (an international agreement between IAA and the Instituto Geológico y Minero de España, Spain) (Montes *et al.*, 2013) (Fig. 17.5, Tab. 3).

During the 2007 CAV, a wonderful specimen of a flying bird was recovered from sediments of the early Paleocene belonging to the López de Bertodano Formation at Marambio (Seymour) Island. The skeleton of *Conflicto antarcticus* was described as an anseriform by Tambussi *et al.* (2019) (Fig. 18).

During the 2008 CAV, an incomplete and semi articulated specimen of an ornithopod dinosaur, *Trinisaura santamartaensis* (Coria *et al.*, 2013), was collected by Juan José Moly and Rodolfo A. Coria (Tab. 3) from deposits of the Snow Hill Island Formation in Santa Marta Cove, James Ross Island (Fig. 19).

In the summer of 2008, fieldwork in the Cretaceous of

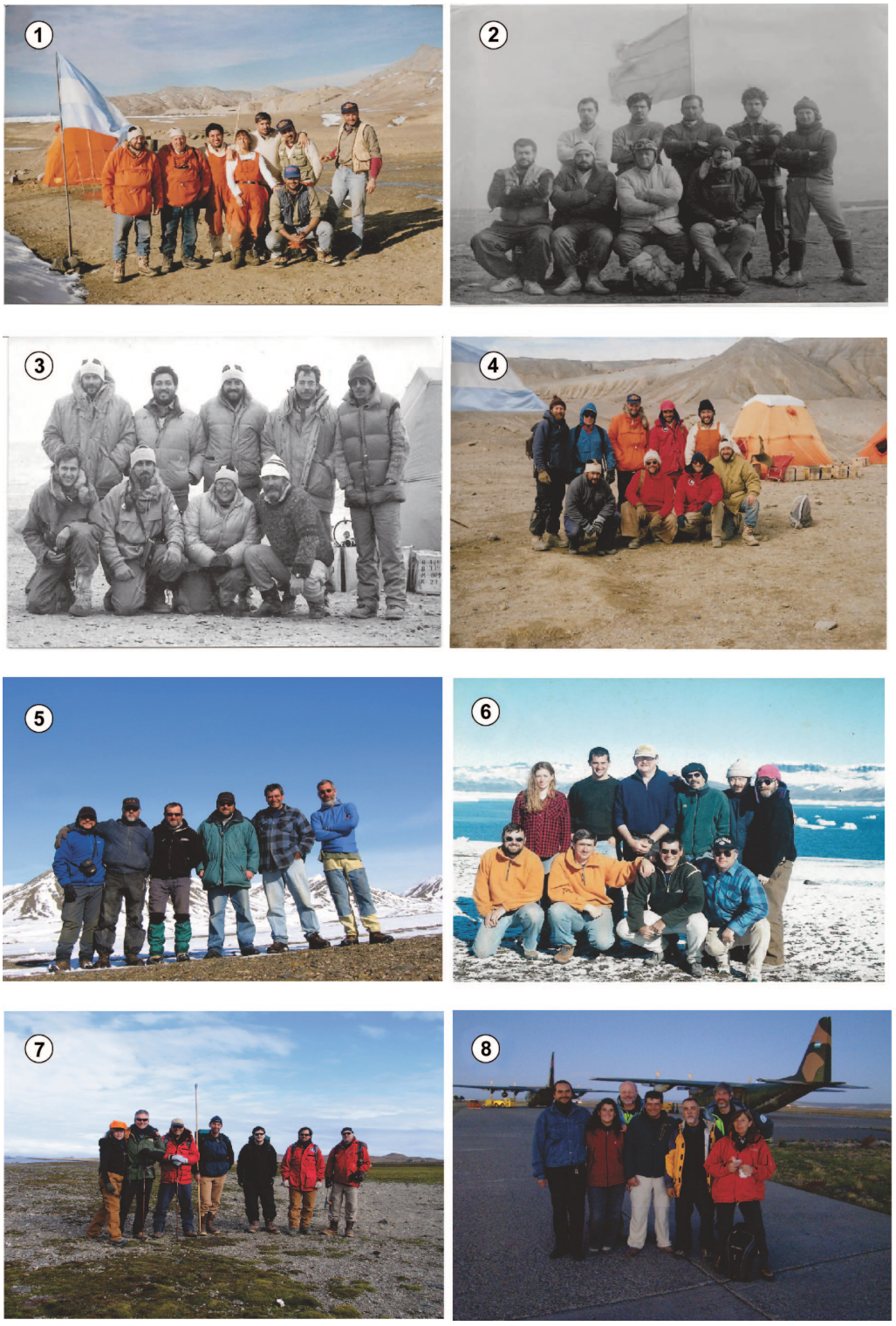


Figure 16. Period **IAA GEOANTAR** Program 1974–1982, Period **DNA-MLP** agreement – **IAA** Paleomarambio 1983–1989 and Period **DNA-MLP** agreement – **IAA** Geomarambio 1990–2009: **1–2,** teams of Geomarambio, Paleogene of Marambio (Seymour) Island; **1,** 1989; **2,** 1990; **3,** team international agreement **IAA**-Poland, Paleogene of Marambio (Seymour) Island, 1992; **4,** team international agreement **IAA-NSF** (USA), Paleogene of Marambio (Seymour) Island, 1991; **5,** team international agreement **IAA-IGME** (Spain), Paleogene of Marambio (Seymour) Island, 2006; **6,** team international agreement **IAA-NSF** (USA), Cretaceous of Cape Lamb (Vega Island), 1991; **7,** team international agreement **IAA-NSF** (USA), Cretaceous of Byers Peninsula (Livingston Island), 2008; **8,** team international agreement **IAA-NRM** (Sweden), Paleogene of Marambio (Seymour) Island, 2009.

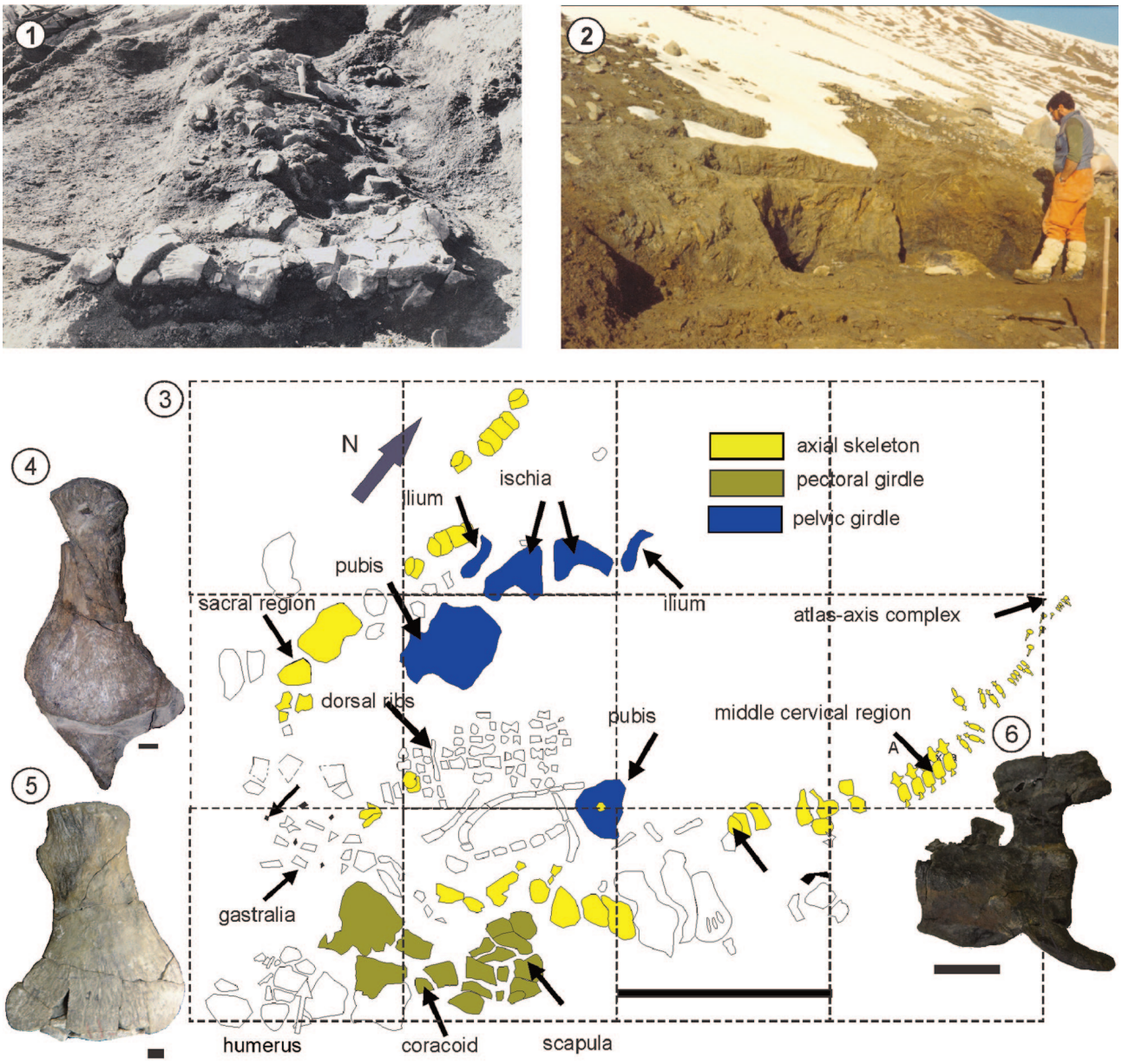


Figure 17. ***Vegasaurus molyi*** (holotype **MLP-PV 93-I-5-1**). **1–2,** quarry. 1, early quarry stage of work (1989) and 2, a more advanced stage of quarry process (1993); **3,** quarry diagram. The side lengths of the squares equal 50 cm; **4,** right femur in ventral view; **5,** left humerus in ventral view; **6,** atlas-axis complex in left lateral view. Scale bar= 20 mm (4, 5, 6).

the Livingston Island was carried out together with US researchers (an international agreement between IAA and the NSF) (Fig. 16.7, Tab. 3).

Eighteen CAVs were done during this period: 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1998, 2000, 2001, 2002, 2004, 2005, 2006, 2007, 2008, 2009, and one PreCAV: 1996. Twenty three collection transactions were recorded in the DPV Record Book of Fossil Vertebrates: MLP-PV 90-I-20-1, MLP-PV 91-II-4-1, MLP-PV 91-II-5-1, MLP-PV 92-II-2-1, MLP-PV 93-I-3-1, MLP-PV 93-X-1-1, MLP-PV 94-III-15-1, MLP-PV 95-I-10-1, MLP-PV 96-I-5-1, MLP-PV 98-I-X-1, MLP-PV 99-XII-1-1, MLP-PV 00-I-1-1, MLP-PV 00-I-5-1, MLP-PV 00-I-10-1, MLP-PV 01-I-1, MLP-PV 02-XII-20-1, MLP-PV 04-III-1-1, MLP-PV 04-III-2-1, MLP-PV 04-III-3-1, MLP-PV 05-I-1-1, MLP-PV 07-III-1-1, MLP-PV 07-III-2-1, and MLP-PV 08-XI-30-1.

Figure 18. ***Conflicto antarcticus*** (holotype **MLP-PV 07-III-1-1**); **1,** quadrate; **2,** skull; **3,** right humerus in caudal view; **4,** left humerus in cranial view; **5,** furcula in cranial view; **6,** sternum; **7,** left tibiotarsus in cranial view; **8,** coracoid in ventral view; **9,** left radius; **10,** syrinx; **11,** left carpometacarpus in medial view; **12,** right carpometacarpus in medial view; **13,** postcranial remains; **14,** right phalanx *proximalis digitimajoris* in medial view; **15–22,** vertebrae.

Figure 19. ***Trinisaura santamartaensis*** (holotype **MLP-PV 08-III-1-1**); **1,** pubis in left lateral view; **2,** ischium in left lateral view; **3,** caudal vertebrae in left lateral view; **4,** left femur in left lateral view; **5,** diagram showing the illustrated elements of pelvis. Scale bar= 50 mm.

The number of specimens collected in this period and housed in the MLP is estimated at 14,500 specimens. Participants/collectors of the IAA-MLP of the IAA-MLP are listed in Table 3.

Period Plan Anual Antártico DNA – IAA Paleovertebrados 2010–2015

Since 2010, the vertebrate paleontological investigations of the IAA-MLP were included in the PAA of the DNA-IAA (Ministerio de Relaciones Exteriores, Comercio Internacional y Culto) (IAA Paleovertebrados).

Three fieldworks (2012, 2013, and 2014) in the Paleogene of Marambio (Seymour) Island and Cretaceous of the Vega Island were carried out together with Swedish researchers (international agreement between IAA and the NRM, Sweden) (Fig. 16.8; Tab. 3).

Finally, six CAVs were done by the IAA Paleovertebrados teams during this period (Fig. 20): 2010, 2011, 2012, 2013, 2014, and 2015; and as a result, twelve collection transactions were recorded in the DPV Record Book of Fossil Vertebrates: MLP-PV 10-XII-1-1, MLP-PV 11-II-20-1, MLP-PV 11-II-21-1, MLP-PV 12-II-10-1, MLP-PV 12-I-20-1, MLP-PV 13-I-25-1, MLP-PV 13-I-26-1, MLP-PV 14-I-10-1, MLP-PV 14-I-20-1, MLP-PV 15-I-7-1, MLP-PV 15-I-10-1, and MLP-PV 15-I-12-1. The number of specimens collected in this period and housed in the MLP is estimated at 12,200 specimens. Participants/collectors of the IAA-MLP are listed in Table 3.

After that, the Antarctic Repository of Paleontological and Geological Collections of the IAA was created through

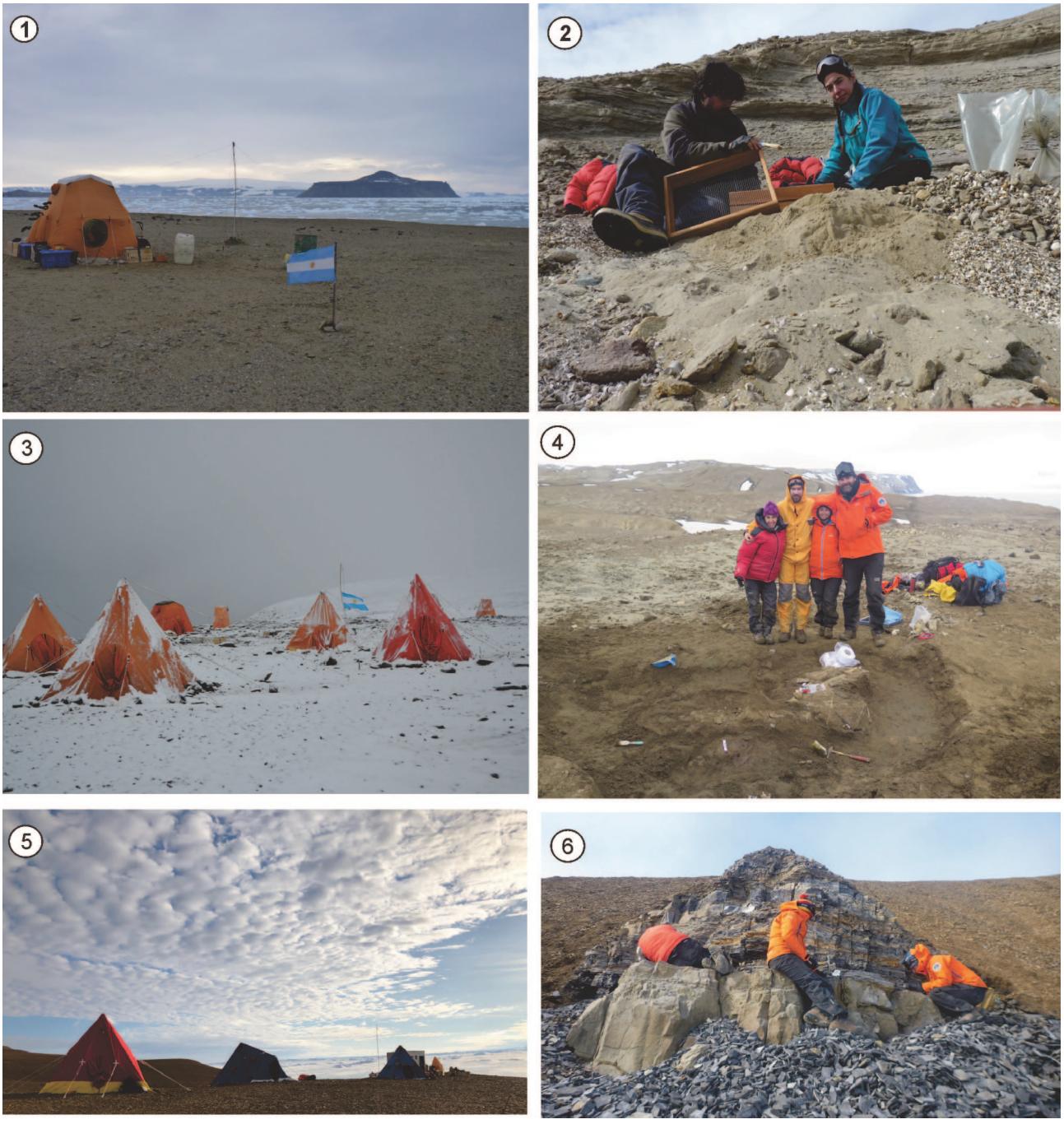


Figura 20. Period **PAA DNA–IAA** Paleovertebrados 2010–2015; **1–2,** *Paleovertebrados Paleógeno*, camp and team Paleogene of Marambio (Seymour) Island, 2012; **3–4,** *Paleovertebrados Cretácico*, camp and team Cretaceous, 3, Cape Lamb, Vega Island, 2015, and 4, Marambio (Seymour) Island, 2018; **5–6,** *Paleovertebrados Jurásico*, camp and team Jurassic of Cape Longing, Antarctic Peninsula, 2020.

DNA provision No. 9 "T"/15 in October 1st, 2015. Since then, all paleontological remains and geological samples (fossils and rocks) collected on the Antarctic continent during the development of scientific activities organized by the IAA (DNA-MRECIC) are deposited there in compliance with the provisions of the PAA. It means that, within the framework of the same work project, the Paleovertebrados groups working in Antarctica continue collecting fossil vertebrates but they are deposited in the IAA repository since the CAV 2016.

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