The Museu Nacional/UFRJ in Antarctica and its fossil vertebrates.

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INTRODUCTION

During the XXV OPERANTAR (2006 – 2007), an expedition of seven researches from the Museu Nacional/UFRJ and two alpinists carried out the first Brazilian paleozoological field work in Antarctica. Named Project PALEOANTAR this expedition was funded by the CNPq and had in its main purpose to collect fossils and rocks in order to provide a better understanding of the ancient paleoecossistems present in this area during the Late Cretaceous. The team set camp for 37 days in James Ross Island, Peninsula Antarctica (Fig.1), the southernmost camping expedition organized by PROANTAR until then. Research effort was concentrated in the northwest portion of the island, where the team explored the outcrops of the Marambio and Gustav groups. During the field work, over 2,500 Kg of fossils and rock samples were collected, mostly consisting of invertebrates and plant material. Among the few vertebrate specimens found there were nineteen plesiosaurian vertebrae, propodial and autopodial elements regarded as belonging to a single individual (labeled MN 7163-V) which is housed in the paleovertebrates collection of Museu Nacional/UFRJ. It was also found fish scales and teeth, including shark teeth.

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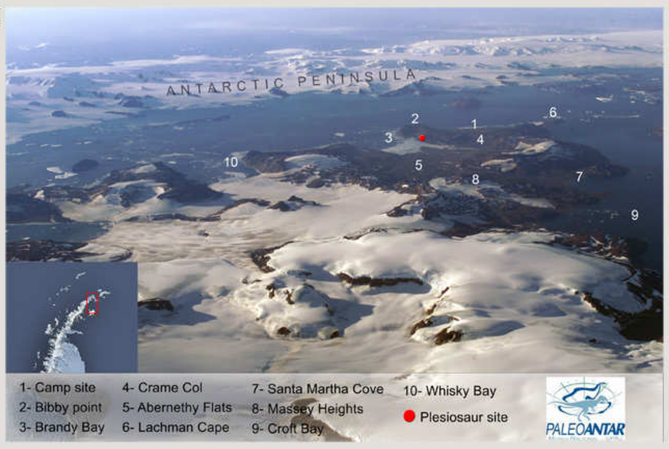

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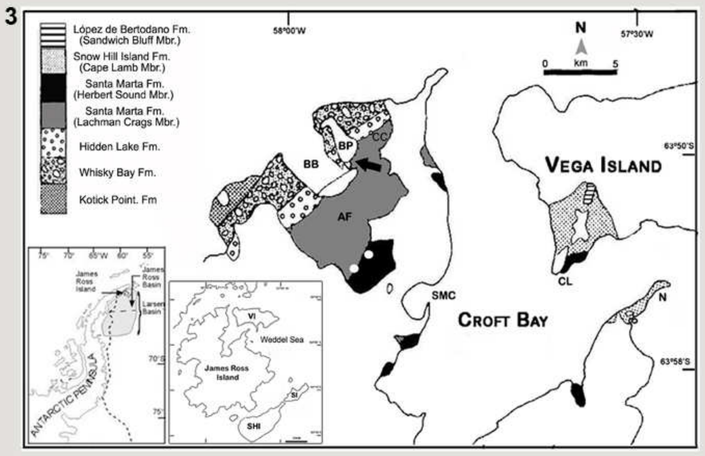

Fig.1. Aerial view from the James Ross Island and the Antarctic Peninsula generated by the Dryden Historical Aircraft Photo Collection - NASA. **Fig.2** Picture of the camp site. **Fig.3** Map of the northwestern region of James Ross Island and its stratigraphial units (Modified from Pirrie *et al* 1992.). **Abbreviations: BB**, Brandy Bay; **BP**, Bibby Point Plateau; **AF**, Abernethy Flats; **SMC**, Santa Marta Cove; **CC**, Crame Col.; **CL**, Cape Lamb; **N**, the Naze; **SHI**, Snow Hill Island; **SI**, Seymour Island; **VI**, Vega island. **Dark arrow**, plesiosaur site. **White circles**, shark teeth site.

GEOLOGICAL BACKGROUND

The James Ross Basin was formed as a back-arc basin relative to the magmatic-arc created during the subduction of the Protopacific plate beneath Southern Gondwana. It created an accretion of sediments which is 5km thick, and is one of the most important Cretaceous sequiences in the Southern Hemisphere. The fossil vertebrates collected are provenient from the Santa Marta Formation of the Marambio Group (Fig.3) and corresponds to the upper Coniacian-upper Campanian stages. The plesiosaur remains were found in an area where the Lachman Crags Member of that unit crops out, and have been interpreted as a marine mid to outer-shelf below storm wave base paleoenvironment. One set of shark teeth was found in this same unit, but much closer to the transition to the Herbert Sound Member, and one other teeth was found within this last one, which represents a shallowing in the shelf basin.

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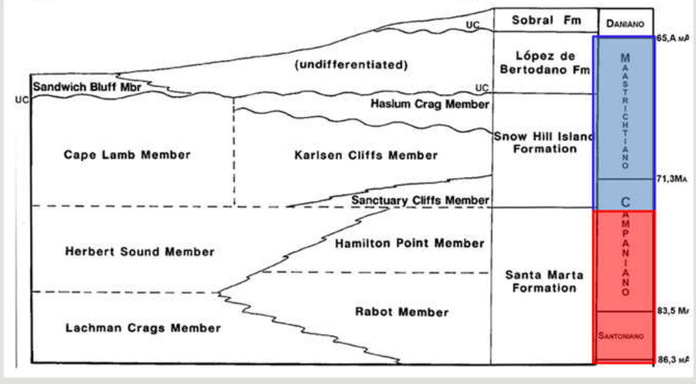

Fig. 4. Snow storm coming over the researchers during field work at |James Ross Island. **Fig. 5**. Stratigraphic column of the Marambio group, with the previously known temporal distribution of plesiosaur in Antarctica **(blue)** and the new temporal range **(red)** with including this new specimen (MN 7163-V).

DESCRIPTION

The vertebrate material is quite fragmentary due to the hard weather peculiarities of Antarctica. The plesiosaur specimen consists of the proximal part of a propodial bone (humerus or femur), multiple paddle elements and also nineteen vertebral centra, from the cervical and caudal regions (Fig. 6 & 7). The caudals are identified by the presence of chevron facets on its ventral surface. The cervical vertebrae are amphicoelous and possess a pair of subcentral foramina, which are diagnostic for the clade Plesiosauria. The propodial head bone is marked by the presence of numerous vascular foramina and rugosities which indicate that a cap of cartilage covered this region.The paddle elements include the first mesopodials (carpal or tarsal elements), one metapodial and many phalanxes, which were mainly preserved at their epiphysial ends, as these are more likely to be preserved. The shark teeth are extremely scarce and are marked by the presence of two denticles on each side of the main cuspid. Also, the main cuspid is quite narrow, and is therefore associated to basal lamnid sharks (Fig 9).

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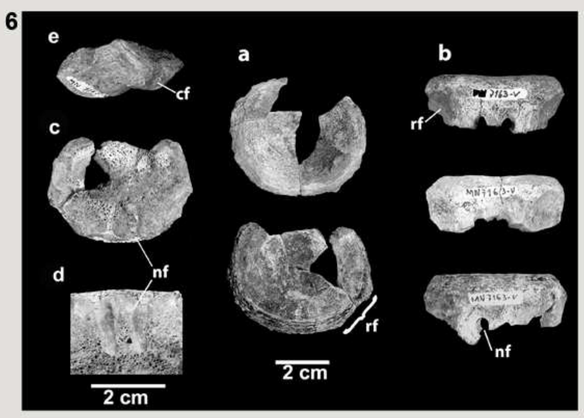

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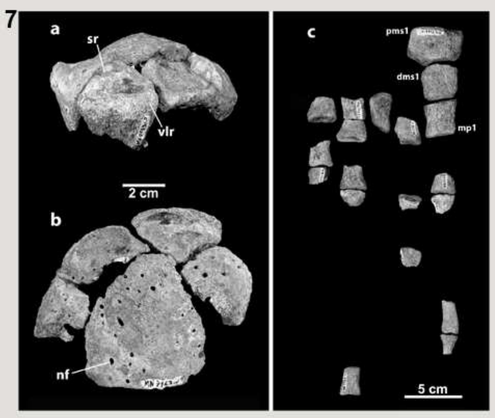

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Fig. 6. Cervical vertebrae centra of MN 7163-V in: **a**, anterior/posterior view; **b,** ventral view; **c**, internal view; **d**, detailed image of subcentral foramina in internal view. And caudal vertebra centra in: **e**,postero-lateral view. **Abbreviations: cf**, chevron facet; **nf**, nutritive foramen; **rf**, rib facet.

Fig. 7. Paddle elements: **a**, propodial head partially reconstructed in ventral view and **b**, proximal view; **c**, autopodial elements, including some articulated proximal elements belonging to digit I. **Abbreviations: dms1**, first distal mesopodial; **mp1**, first metapodial; **pms1**, first proximal mesopodial; **sr**, surface rugosities; **vlr**, ventrolateral ridge. **Fig. 8**. Field work where plesiosaur bones were found. **Fig. 9**. Shark tooth among invertebrate fossils.

DISCUSSION AND CONCLUSIONS

Based on strontium isotopes ($^{87}Sr/^{86}Sr$) and fission track thermochronology analysis (McArthur *et al.* 2000; Svojtka *et al*. 2009) , the lowermost levels of the Santa Marta Formation, including the base of the Lachman Crags Member, was deposited during the transition of the Coniacian to the Santonian (ca. 86Ma). Considering that MN 7163-V was collected close to the lower limits of Lachman Crags Member (Fig.3 & 5), we attribute this specimen as being of Santonian age (86.3-83.5Mya) making it the oldest plesiosaur record from Antarctica so far. Both sets of shark teeth were found in more recent deposits, both regarded as early Campanian.

Most of plesiosaurs´ fossil records from Antarctica known so far are assigned either to the Elasmosauridae or to *Aristonectes*, a clade which has been previously regarded to the Cimoliasauridae (= Aristonectidae) and also to the Elasmosauridae. It is not clear what is the position of MN 7163-V within the Plesiosauria. However, both elasmosaurids and *Aristonectes* are characterized by the presence of platycoelous cervical vertebrae, which are not present in Mn 7163-V. Therefore, this specimen represents a new group of plesiosaurs previously unkown from Antarctica and indicate the rich potential of this region for the study of fossil vertebrates.

REFERENCES

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