Multiple issues when preparing and preserving Late Miocene beaked whale (Gram Fm.) for research and exhibition

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Introduction
A fossil whale was discovered in Gram Clay Pit (Late Miocene, Gram Fm.) in 1986. It turned out to be the first fossil of a beaked whale (Ziphiidae) to be found in Denmark. Various institutions around the world were interested in the specimen for the first beaked whale fossil from Gram consisting of only a damaged skull and a few postcranial elements. The paleomagnetic characteristics are present making the specimen of great value to science. In 1985-86 the best preserved parts, the mandible, maxilla and several teeth, were prepared for study on the spot as well as for conservation in 2005. The mandible was mounted on an exhibitor along with 46 teeth. Fused remains in 2005 made it possible to start the preparation and conservation of the cranium. Remains of the whole specimen began in 2013. Since very few fossils have been prepared and exhibited before, this fossil needs media both when exhibited and for handling. Casts were made of the main parts of the mandible to ease research and store the specimen. In the process new, severe pyrite oxidation was found hidden beneath the fossil surface of the cranium. The very unprepared and prepared specimen of the preservation measures.

Preparation
Preparation was performed in collaboration with different persons, mainly to remove degraded pyrite within the unfilled matrix. Adhesive and supports were needed to stabilize the fossils. The preparation was done with brushes with metal tines and sandblasting followed by consolidation with PEG in situ. The last part of the mandible was preserved in 2003 with the same methods. The whole jaw was removed and fixed and both jaws were put on display in 1987. In 2006 funds finally made it possible to start the preparation and conservation of this cranial. The jaw was done with brushes and soap: Lignocellulose among the bone cavity was removed with a mushroom chip. In the crown parts the oxidation was used on the layer of soft material between connection and fossil causing damage to the latter and also to the removal (fig. 4).

Pyrite oxidation
Pyrite oxidation was severe apart in some country stored, especially parts of the whole fossil with no preparation done and without treatment, prepared specimen show the best good climate. But the later happened out of sight below the surface of the fossil (fig. 5 and 6). Consequently, a revision of the remedial and especially the preventive methods of pyrite oxidation of the museum started.

Molding and casting
The specimen shows at the moment beached fossil. Where from the first fossil of a beached fossil only a few parts of the mandible have been elucidated the specimen was decided to make casts of most parts of the mandible. 3D scan and printing were not an option for financial reasons. Because of the specimen’s morphologic characteristics, the thin part was a suitable part to be castable to safeguard the fossil while making the model. Dental modeling was made (Ullenbroek/Bedding). The mandible was turned to be the best solution. It was easy to apply and could cover very big cracks, areas of holes of crania and open spaces. It was also easy to remove and to enlarge the model. The model was casted in 6 cm line and a method was developed to sketch the specimen from a row of millimeter sticks (fig. 7).

Conclusions
The beaked whale fossil is highly vulnerable to fragmentation and displacement, it makes the fossil, particularly the cranium, very more fragile.

References
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