

The Messel Pit, Central Germany – Fossilized Treasures of the Eocene

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Geotourism is becoming increasingly popular worldwide due to the public's increasing interest in fossils and ancient natural environments. Geotourism is also a "green" industry whose carbon footprint is minimal and same time can provide many employment opportunities. The Royal Tyrrell Museum in Drumheller, Alberta is an outstanding example. This museum attracts visitors from all over the world and at the same time it provides stable, long-term jobs for many people living in Drumheller.

This presentation is about the Eocene-aged fossils discovered in 1871 in Germany's Messel Pit. I made a one-day visit to the Messel Pit in 2011. It is located a half hour drive (30 km) southeast of Frankfurt. The Messel Pit is a UNESCO World Heritage Site. This presentation is primarily based on an in-depth review of all available and relevant published information on the Messel Pit as well as information provided in the museum Meuseumsverein Messel in the nearby town of Messel.

The fossils in the Messel Pit, called 'Grube Messel' in German, are found in the Messel oil shale which is a dark, finely-layered fresh water clay. The oil shale was deposited as decaying mud at the bottom of a deep lake which was surrounded by a tropical rain forest. These sediments are known as the Messel Formation and were laid down 47 million years ago during the Middle Eocene. The Messel Pit originated as a small volcanic crater with a diameter of one kilometer. Based on information obtained from drilling and coring, the Messel Formation extends down to a depth of 180 meters where it overlies Permian-age sandstone and conglomerates.

As early as 1885, the Messel was mined initially for tar and paraffin. Later during the 1920s and during World War II, the Messel Pit was mined for petroleum, mainly gasoline, diesel and heating oil. The open-pit mining was carried out as deep as 60 meters. From 1971 to 1989 the pit was used as a waste disposal site, however a big effort by the local population of Messel and by the German scientific community succeeded in rescuing the site from being filled with waste. In 1995 the Messel Pit was added to the list of UNESCO World Heritage sites.

The following description of the Messel Pit is directly excerpted from the book, "*Window to Primeval Times – World Heritage Site, Messel Pit*". The book's relevant section is the *Fossil Habitat* written by Norbert Micklich and Volker Wilde. This book was published in 2000 by Grube Messel Verwaltungsgesellschaft mdH, c/o Hessisches Ministerium für Wissenschaft und Kunst, Wiesbaden. Micklich and Wilde wrote the following:

QUOTE “The Messel Pit has become famous as a fossil site, mainly because of the mammal record. The skeletons are complete in every detail including skin and fur and many of the birds that have been found have also included the feathers. It is possible to analyze the digestive tracts and there are even examples of pregnant females, including the fetuses. There is no other fossil site in the world that has such a complete and fantastically-preserved mammal fauna. This is of particular importance because at the end of Cretaceous time, after the dinosaurs - the predominant land vertebrates - had become extinct, the mammals began to develop rapidly. The Messel Pit shows that, even in the early stages of this tremendous evolution, there was very soon a remarkable diversity of species. The spectrum ranges from original marsupials, insectivores, bats and prosimians, to exotic specialists as “long fingers”, pangolins and anteaters, to primitive carnivores and ancient even-toed ungulates, the last of which includes what is probably the most famous of the Messel animals, the “Urpferdchen” (small primeval horse *Propalaeotherium*).

However, it is not only the mammals that have made Messel such an important fossil site. Proof has been found of chemofossils, the remains of bacteria, fungus and different kinds of algae. Alongside some ferns and a few conifers, there are examples of over 60 families of flowering plants. What is particularly unusual is the discovery of numerous flowers where even the pollen is preserved together with complete syconium-fruits. This is unusual because in most other sites only isolated seeds have been found. Regarding invertebrates, there are remains of sponges and also swamp and aquatic snails as well as a whole host of insects. These include colorful beetles, ants and wasp-like creatures, bugs, cicadas, cockroaches, grasshoppers, flies, stone and caddisfly larva as well as the remains of butterflies and dragonflies. Other rarities include spiders and crustaceans. Most of the lower invertebrates are bony fishes, of which there are ancient and “modern” species. The variety of reptiles is much larger. Evidence has been found of turtles, alligators, monitors, iguanas and other types of lizards, even tree and constrictor snakes. Birds account for almost half of the land vertebrates that have been found. Of these, there are examples of tiny creatures the size of a medium-sized hummingbird and the remains of giant birds almost two meters in size”.

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According to my research, the most similar analogue to the Messel Pit is the Green River shale of Wyoming which is also Eocene in age. However, the Green River shale does not compare in terms of the complexity of the species nor the amazing degree of preservation of the fossils in the Messel Pit. Also, the depositional environment of the Green River shale is mainly lacustrine and semi-tropical whereas the flora and fauna surrounding the Messel Pit flourished in a hot tropical environment.



Figure 1. Small primitive Messel horse, *Eurohippus parvulus*. Length of almost 60 cm (0.6 m). From: Gruber, G., & Micklich, N., 2007. MESSEL: Treasures of the Eocene. Fossil housed in the Hessisches Landesmuseum Darmstadt, Germany.



Figure 2. Jewell beetle *Buprestidae*. Length 20 mm.
The colors are the same metallic light and dark blues and oranges that once helped it to hide on the forest floor. From: Gruber, G., & Micklich, N., 2007. MESSEL: Treasures of the Eocene. Fossil stored in the Hessisches Landesmuseum Darmstadt, Germany.

Information on the Author

Tako Koning is Holland-born but Canada-raised. He graduated from the University of Alberta in 1971 with a B.Sc. in Geology and with a B.A. in Economics in 1981 from the University of Calgary. He began his career in 1971 working for two years for Continental Laboratories as a mudlogger on offshore drilling rigs on the Grand Banks of Newfoundland. He subsequently worked from 1973 – 2015 for Texaco, Tullow Oil and the USA/UK consulting firm of Gaffney Cline & Associates. He lived and worked as a geologist, exploration manager and VP exploration in Calgary and also thirty years living and working in Indonesia, Nigeria and Angola. Despite being semi-retired and in his middle 70s, he retains a keen interest in paleontology and is an active member of the Alberta Paleontological Society (APS). For the APS he volunteers and annually leads two field trips: (1.) Discovering and studying fossils in the Ordovician Tyndall limestone which clads many buildings downtown Calgary and also in the inner-city neighborhood of Kensington and also the Tyndall Stone which extensively clads the Patrick Burns building at SAIT – the Southern Institute of Technology (2.) He also leads each year a field trip north of Trochu, Alberta to see and study the K-Pg mass extinction boundary which is beautifully exposed at Knudsen’s farm, near Huxley.