

Stop 8: Päre quarry

Olle Hints

Location: Latitude 58.84046°N, longitude 24.04279°E; Harju County, Estonia.
Stratigraphy: Telychian, Adavere Regional Stage, Rumba Formation.
Status: Abandoned quarry. Sampling and fossil collecting are welcome.
More information: <https://geoloogia.info/en/locality/10230>



Fig. 8.1. Overview of the Päre quarry. Photo: Olle Hints.

The following text is based on the compilation of Hints (2014).

A shallow disused Päre quarry is located on a flat limestone hillock, ca 5.5 km SW from the Kullamaa village, 1 km W from the Tallinn-Virtsu road (Fig. 8.1). In this outcrop argillaceous nodular limestones of the upper part of the Rumba Formation, Adavere Regional Stage, early Telychian, are exposed in a maximum thickness of ca 3.9 m.

The Päre locality has been known for more than 150 years, referred to as Kattentack in the old literature (after Kattentack/Päre manor). The outcrop is a neostatotype for both the Rumba Formation and the Adavere Regional Stage (Nestor 1993). It is moreover the type locality for several fossil species, in particular corals and stromatoporoids, and the only outcrop of the Osmundsberg bentonite in the East Baltic region.

According to Kaljo & Einasto (1990) the succession of the deepest part of the quarry is described as follows (from the top; see Figs 8.2, 8.3; note that starting from the middle part of bed 5 the section is commonly filled with debris; as of 2024, this part of the succession, including the Osmundsberg K-bentonite, is not accessible):

(1) 1.30 m – irregularly nodular, argillaceous limestone (skeletal packstone) with lens-like interlayers of *Pentamerus*-rudstone and skeletal grainstone. The basal 15 cm is highly argillaceous rock, in the uppermost 40 cm, grainstone lenses are rare.

(2) 0.05 m – argillaceous marlstone lying on a double discontinuity surface.

(3) 1.05 m – different grey argillaceous, mostly irregularly nodular limestones (packstones; containing pentamerid and stromatoporoid rudstone lenses, some beds of microcrystalline limestones and thin marl intercalations.

(4) 0.10 m – grey argillaceous limestone with marl intercalations.

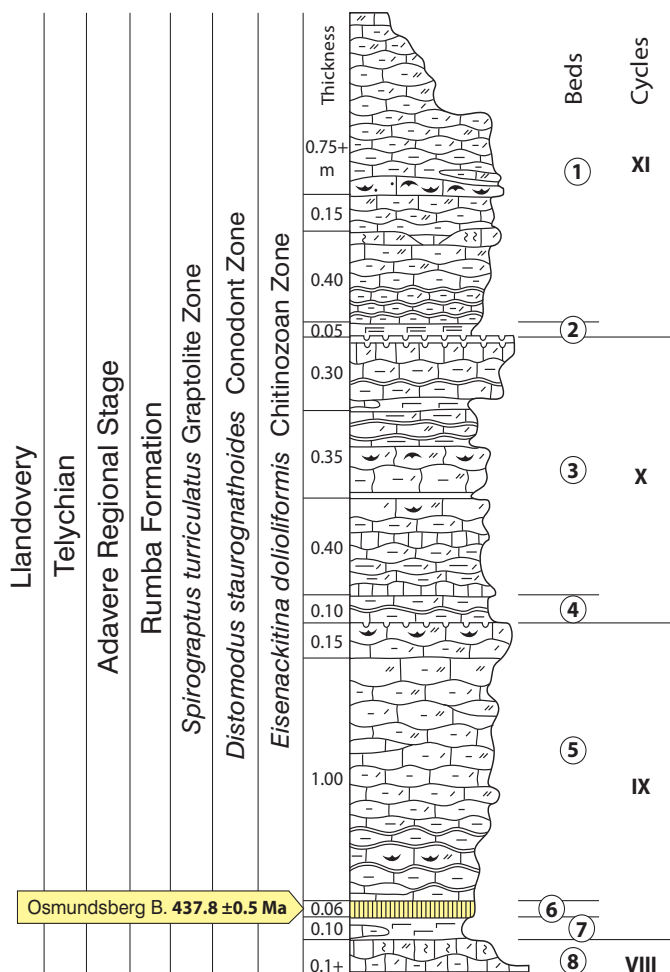


Fig. 8.2. Succession of argillaceous limestones in the Päre quarry. Lithology from Kaljo & Einasto (1990), age of the Osmundsberg bentonite according to Bergström et al. (2008), stratigraphy combined from different sources.



Fig. 8.3. Deepest part of the quarry; the lower part of the section is covered by debris and thus the 6-cm thick the Osmundsberg bentonite is currently inaccessible. Photo: Olle Hints, 2024.

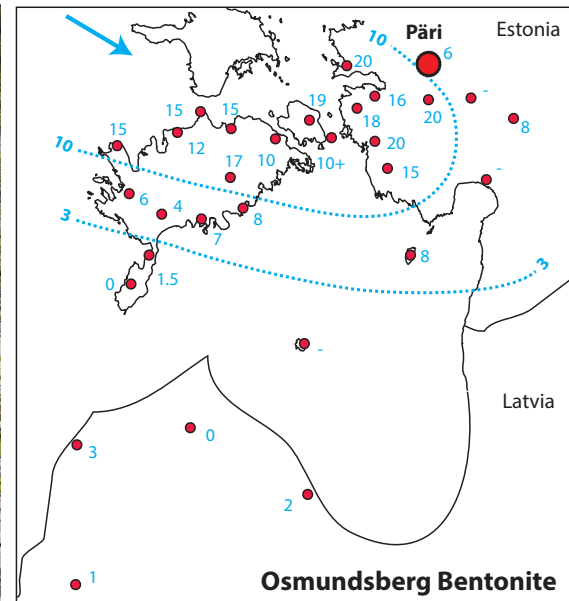


Fig. 8.4. Thickness distribution of the Osmundsberg bentonite in the eastern Baltic area after Kiipli et al. (2006).

(5) 1.15 m – greenish-grey, irregularly nodular, argillaceous skeletal limestone (packstone) with lenses of skeletal grainstone (*Pentamerus*-coquinas). The upper 15 cm contains purer limestone with a pyritic discontinuity surface on the top.

(6) 0.06 m – bioturbated bentonite bed (Osmundsberg bentonite).

(7) 0.1 m – grey calcitic marl with grainstone nodules.

(8) 0.1 m – brownish grey microcrystalline irregularly nodular limestone (packstone).

In drill cores, the Rumba formation is up to 19 m thick, consisting of 12 low-grade depositional cycles (Einasto et al. 1972). Four of these cycles have been identified in the Pärnu Quarry (Fig. 8.2). Usually, a cycle begins with a

thin marlstone layer, upwards the clay content decreases, and grainstone or coquinoïd rudstone lenses appear; each cycle ends with a distinct discontinuity surface (Kaljo & Einasto 1990).

In the lower part of the Pärnu section, a 6 cm thick bioturbated K-feldspar-rich bentonite layer occurs. This is the thickest Silurian volcanogenic layer in Estonia, previously referred to as the “O”-bentonite (Kiipli et al. 2006 and references therein), and now known to correlate with the Osmundsberg bentonite in Scandinavia (Bergström et al. 1998). In its type locality at Osmundsberget, Central Sweden, the bed is 1.1 m thick. In Estonian drill cores, it reaches 20 cm (Kiipli et al. 2006; Fig. 8.4); the thickness map suggests the source area in the direction of Trondheim, Norway. Within-bed mineralogical and geochemical variations suggest that the eruption occurred in two stages. In the Pärnu section, two cycles within the Osmundsberg bentonite are expressed by the variation of carbonate content of burrows within the bed (Kiipli 2008). U-Pb dating of the Osmundsberg bentonite from the type locality in Sweden provided radiometric age of 437.8 ± 0.5 Ma (Bergström et al. 2008).

The Pärnu quarry is rich in shelly faunas, which is generally typical of the Rumba Formation. Characteristic of the Rumba formation, and the Pärnu section, is the abundant occurrence of *Pentamerus oblongus* (Fig. 8.5). Other brachiopods, tabulate corals (*Paleofavosites*, *Catenipora*, *Aulopora*, *Placocoenites*, *Subalveolites*, *Propora*) and stromatoporoids (*Clathrodictyon*) are common, and rugosans (*Calostylis*), gastropods (*Hormotoma*), cephalopods, echinoderms



Fig. 8.5. Erosional surface with cut shells of *Pentamerus oblongus* in the Pärnu quarry. Photo: Olle Hints.



Fig. 8.6. Selected fossils of the Pääri quarry Adavere Regional Stage. Scale bars A, E, I – 1 cm. B–D, F–H, J–M – 5 mm. **A–C** brachiopods; **A** – *Pentamerus oblongus* (Sowerby), GIT 362-85; **B** – *Stegerhynchus borealis* (von Buch), GIT 173-28; **C** – *Hesperorthis davidsoni* (Verneuil), GIT 126-13. **D** – rugose coral *Prodarwinia speciosa* (Dybowski), GIT 397-675. **E–M** tabulate corals; **E** – *Aulopora assueta* Klaamann, GIT 94-49; **F** – *Placocoenites pellicula* Klaamann, GIT 398-899, **G** – *Catenipora elegans* (Fischer-Benzon), GIT 180-83; **H** – *Catenipora exilis* Klaamann, GIT 94-39; **I** – *Adaverina acclinis* (Klaamann), GIT 94-61; **J** – *Sinopora callosa* Klaamann, GIT 94-63; **K** – *Heliolites* sp., GIT 393-4; **L** – *Subalveolitella majuscula* Klaamann, GIT 91-17; **M** – *Paleofavosites jaaniensis* Sokolov, GIT 180-36.

and trilobites (*Calymene*, *Encrinurus*) may also be found (Fig. 8.6).

However, chitinozoans, conodonts (*Panderodus* spp., *Ozarkodina* sp.) and thelodonts (*Thelodus* sp.) are virtually absent or very rare (Kaljo & Einasto 1990). Therefore, the biostratigraphic age of the section can only be inferred indirectly, based on the tracing of the Osmundsberg bentonite in biostratigraphically well-dated

sections (like Osmundsberg North, central Sweden, and the Viki drill core, western Estonia). According to these correlations, the section in the Pääri quarry corresponds to the *Spirograptus turriculatus* Graptolite Zone (Bergström et al. 2008), *Eisenackitina dolioliformis* Chitinozoan Zone and *Aspelundia? expansa* Conodont Zone (and possibly *Pterospiriferus eopennatus* ssp. n. 1 Conodont Zone).

References

- Bergström, S. M., Huff, W. D., Kolata, D. R., 1998. The Lower Silurian Osmundsberg K-bentonite . Part I: stratigraphic position , distribution , and palaeogeographic significance. *Geological Magazine*, **135**, 1–13.
- Hints, O., 2014. Stop B3: Päre outcrop. In: 4th Annual Meeting of IGCP 591, Estonia, 10-19 June 2014. Abstracts and Field Guide. University of Tartu, Tartu, p. 180–182.
- Kiipli, E., Kiipli, T., Kallaste, T., 2006. Identification of the O-bentonite in the deep shelf sections with implication on stratigraphy and lithofacies, East Baltic Silurian. *GFF*, **128**, 255–260.
- Kiipli, T., Orlova, K., Kiipli, E., Kallaste, T., 2008. Use of immobile trace elements for the correlation of Telychian bentonites on Saaremaa Island, Estonia, and mapping of volcanic ash clouds. *Estonian Journal of Earth Sciences*, **57**, 39–52.
- Kaljo, D., Einasto, R., 1990. Locality 8:1 Päre outcrop. In: Kaljo, D. & Nestor, H. (eds). *Field Meeting Estonia 1990. An Excursion Guidebook*. Institute of Geology, Estonian Academy of Sciences, Tallinn. p. 179–180.
- Einasto, R., Nestor, H., Kala, E., Kajak, K., 1972. Correlation of the Upper Llandoveryan sections in West Estonia. *Proceedings of the Academy of Sciences of the Estonian SSR. Chemistry and Geology*, **21**, 333–343. [in Russian]
- Kiipli, T., 2008. Excursion A: Ordovician and Silurian bentonites of Estonia. In: Hints, O., Ainsaar, L., Meidla, T. & Männik, P. (eds). *The Seventh Baltic Stratigraphical Conference. Abstracts & Field Guide*. The Geological Society of Estonia, Tallinn. p. 83–92.
- Nestor, H., 1993. *Catalogue of Silurian stratigraphical units and stratotypes in Estonia and Latvia*. Institute of Geology, Estonian Academy of Sciences, Tallinn. 23 pp.
- Bergström, S. M., Toprak, F. Ö., Huff, W. D., Mundil, R., 2008. Implications of a new, biostratigraphically well-controlled, radio-isotopic age for the lower Telychian Stage of the Llandovery Series (Lower Silurian, Sweden). *Episodes*, **31**, 309–314.