ERASMUS IP „Soil & Water“ field trip 10.–11.09.2013 Tartu – Kohtla-Nõmme – Ontika – Kiviõli – Mõedaku – Nõmmeveski – Palmse – Altja – Tartu

Aim of the trip: to study oil shale mining area and north coast geology and ecosystems

Time table:
10.09.2013
8:00 departure from Tartu at EMÜ sport hall
11:00 Kohtla-Nõmme oil shale underground mining museum
13:00 lunch at Kohtla-Nõmme museum
14:00 Kohtla-Nõmme oil shale area (open land)
16:00 Ontika Limestone cliff
17:00 Kiviõli ash hill
18:00 arrival to Mõedaku sport base
19:00 dinner and sauna

11.09.2013
8:00 breakfast at Mõedaku
9:00 departure to Lahemaa National Park: Nõmmeveski cascade
11:00 Palmse manor
14:30 lunch at tavern Altja, visit Altja
16:00 departure to Tartu
19:00 arrival to Tartu

Oil Shale
The Baltic Oil Shale basin is located in the north-western border of the East European Plate, reaching from north-eastern Estonia to north-western Russia. The area of the Baltic oil shale basin is approximately 50,000 km^2. The Estonian oil shale (kukersite from the locality name) (Figure 1) is geologically related to Middle Ordovician. The richer kukersite layers are located in the lower part of Kiviõli, part of the Kukruse Stage. The extension of deposits in north-east Estonia is approximately 3000 km^2, and the oil shale comprises there up to fifty laterally continuous kukersite seams having thickness from several cm to 0.9 m. The main components of oil shale are the organic matter (content ranges from 10 up to 60%), carbonate minerals (20 – 70%) and clastic minerals (15 – 60%). The kerogen in the Estonian Ordovician kukersite has a marine origin.


Figure 1. Oil shale in foreground on white sandstone

Kohtla kaevanduspark
The Kohtla mine has been closed since 2001. The museum there was reopened in 02.07.2012
In such mines where the oil shale layer is deep underground, like the Kohtla mine, it sometimes happened that it was necessary to track down a lost calf or buck that had slipped into the tunnels.

Closed wagons were used for transporting miners at the beginning and end of each shift to and from their workplaces in various stations. Tunnels reached as far as up to 6 kilometres, making these trips last for up to 20 minutes (Figure 2). After the visit of the local Miners Museum living and working conditions of the workers were discussed among the students. The major part of the field trip on this site was a study of plant and animal succession on the mining dumps. Many fossil remnants from the Cambrium period were found in the lime stone and most of them could be roughly identified. This part of the field trip provided a comprehensive insight into mining activities abut also into succession on industrial sites and general evolution.

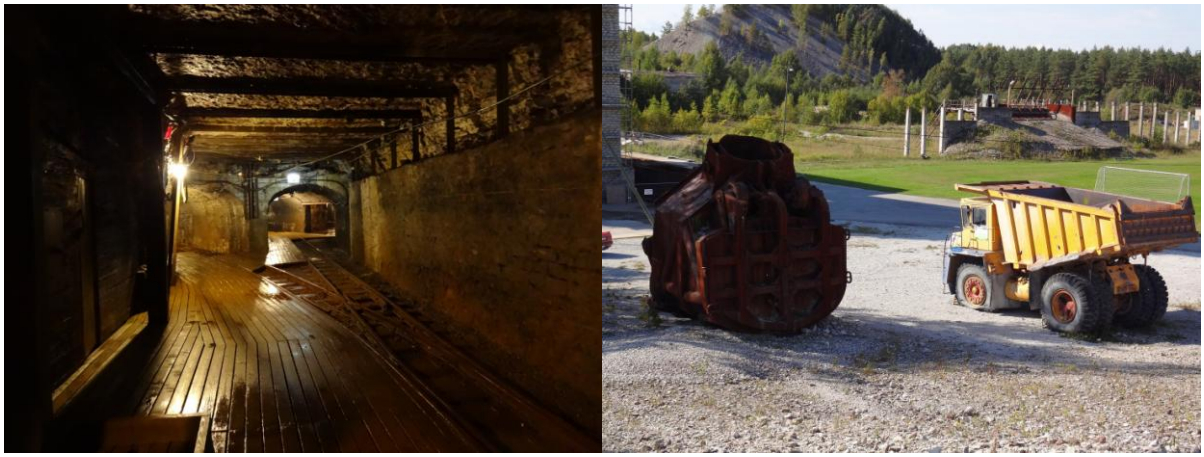

Figure 2. Kohtla kaevanduspark

Kiviõli Oil Shale Processing & Chemicals Plant

The Kiviõli Oil Shale Processing Plant (Figure 3), founded in 1922, represents one of the oldest enterprises in Estonia, engaged in producing oil shale products and speciality chemicals. Nowadays the production activity of the Kiviõli Oil Shale Processing Plant develops in two directions, i.e. oil shale retorting to produce shale oil and to produce oil shale–based chemicals, whereas shale oil is appreciated for relatively low levels of paraffinic hydrocarbons that determine the specific routes of their processing. The production of the enterprise reaches up to 45,000 tons S-1 shale oil, 7000 tons shale road oil and 10,000 tons road shale bitumens per year. At the same time Kiviõli Keemiatööstuse OÜ produces thermal and electric energy (110 000 MWh and 35 million kWh per year). The participants discussed intensively problems with site reclamation and alternative use of renewable energy.

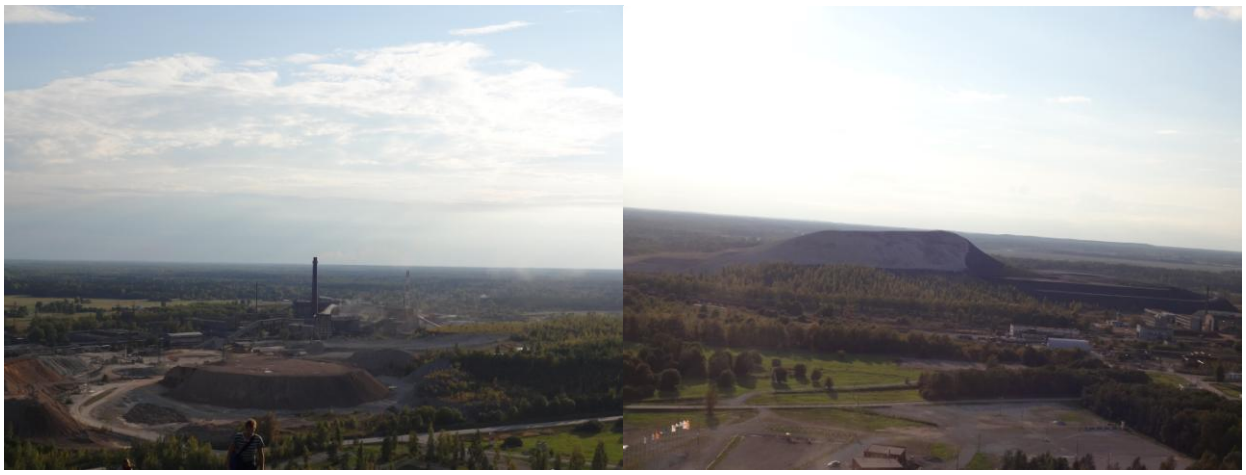

Figure 3. Kiviõli Oil Shale Processing Plant and waste hill.

Ontika Limestone cliff

The North-Estonian cliff is the steep northern margin of the flat limestone plateau. Usually, the upper part of the escarpment, exposed above the sea level, is considered as the Klint. However, the

erosional escarpment bordering North Estonia continues under the sea, with steep slopes or several terraces, down to the basement at a depth exceeding 100 m. Thus, the total height of the escarpment below and above the present sea level reaches about 150 m. In this escarpment, Vendian, Cambrian and Ordovician rocks are exposed.

Estonia's highest limestone cliff, the Ontika cliff that is up to 55 metres high, is like a stone nature book, revealing the layers of various eras to the viewer. The best place to see the cliff is from the observation platform built near the Valaste cascade. The Ontika Limestone cliff is the highest part of the over 1,100-km-long Baltic limestone bank that starts in Sweden on the Island of Öland and ends in Russia near Lake Ladoga. The limestone cliff runs 23 kilometres from the Village of Saka to the vicinity of Toila, thus being the longest uninterrupted part of the cliff. Valaste Waterfall situated on the Ontika Limestone Cliff is the highest in Estonia with its fall of 30 metres. The steadily eroded material provides opportunities for pioneer plants, which were demonstrated together with the underlying processes by the teachers.

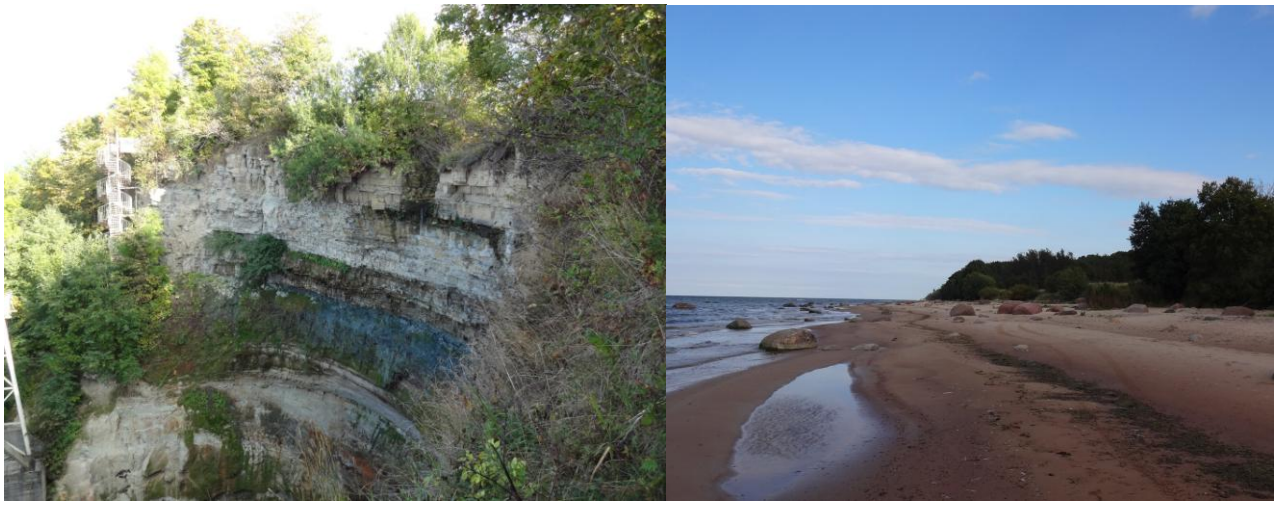

Figure 4. Ontika limestone cliff and northern coastline of Estonia.

Lahemaa National Park

The national park, established in 1971, was the first national park in Estonia and indeed anywhere in the former Soviet Union. The sea makes up almost a third of it; two-thirds of the land is covered by forest. Its area covers 725 km². In Lahemaa (Land of Bays) you will find stony and sandy seashores, bogs, pine forests, old-growth forests, cliff forests, alvars and rivers that have cut into the limestone cliff. You will also find many geological (Nõmmeveski waterfall, Figure 5), historical and architectural monuments. There are many erratic boulders, which were brought over from Finland by continental ice. On the coastal filed trip, different pathways of plant succession were introduced to the students.

South of the national park are the large Kõrvemaa areas covered by mires and forests, which expand the living space of moose, boars, brown bears, lynxes, and foxes. Among the birds observed here during the trip were the Black Woodpecker (*Dryocopus martius*) and the Common Crane (*Grus grus*) feeding on the fields around Sagadi.

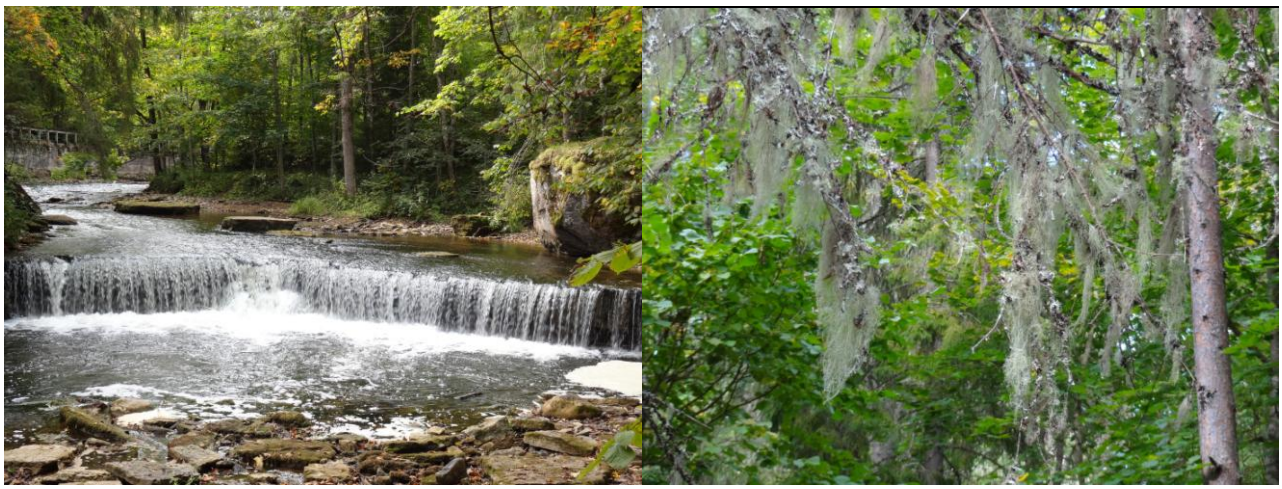

Figure 5. Nõmmeveski waterfall and *Usnea* sp indicating the clean air

The shoreline and cultural heritage of Lahemaa are intertwined – from here, fishermen went to the islands of Finland to catch fish and seals; the sea was used for friendly trade as well as for the smuggling of salt and spirits. The most famous fishing villages here are the captains' village of Käsmu, the fishermen's village of **Altja** (Figure 6) and the village of spirit smugglers, Viinistu.

There are also four large historic manor complexes in the area, three of which have been renovated: **Palmse** (Figure 6), Sagadi and Vihula. The visit of Palmse was used to elucidate settlement history and former land use together with the ownership structure.

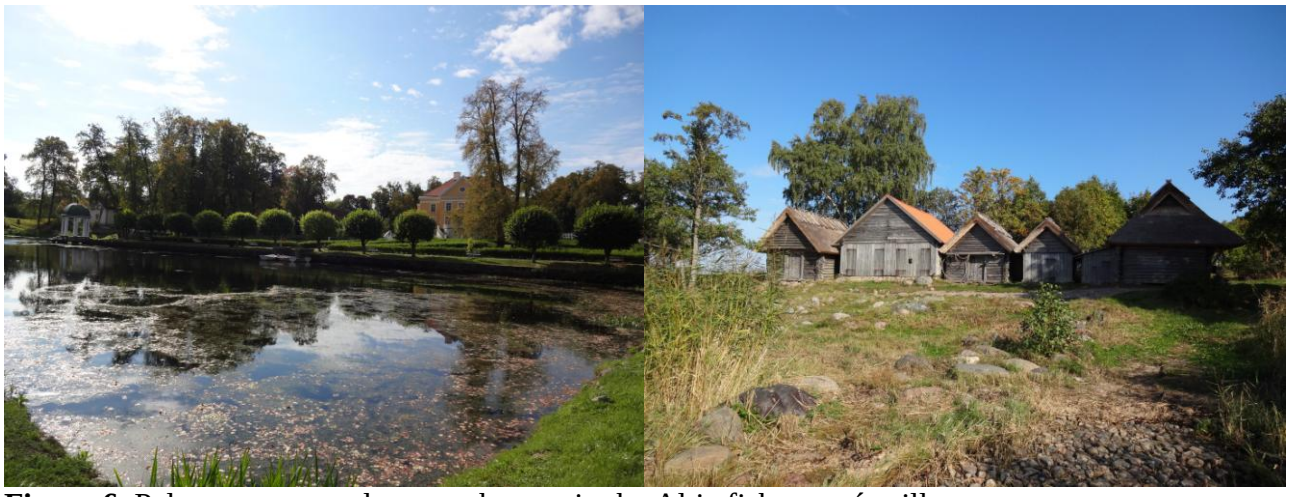

Figure 6. Palmse manor and storage houses in the Altja fishermen´s village.