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Preliminary report - Surficial geology at Portimojärvi, Ranua

MAP SHEET 3524 06 D

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Abstract
Geological Survey of Finland (GTK) was carried out preliminary study for interpreting surficial geology in the Asentolampi target area in Portimojärvi, Ranua at the end of August 2007. The work was ordered by Areva Resources Finland Oy. The study included aerial photo and elevation model interpretation with some field work. An aim of the study was to distinguish the main glacigenic deposit types in the target area, and estimate glacial transport mechanisms and processes, and also distance for the uranium bearing surficial boulders.
The ground in the Asentolampi target is composed of ribbed moraine field where unique ridges are oriented perpendicular to the last ice flow direction from the west to the east. Between the ridges, peat bogs are common. In places washed boulder fields or shore banks are seen as a mark of shallow water and lacustrine environment during the Ancylus phase of early Baltic Sea. Also, one marginal, partly stratified deposit occurs on the top of the ribbed moraine ridge. Ice flow direction has been some what from the west to the east, and as an experience from the other ribbed moraine areas nearby, it seems so that glacial transport distance has been very short, only some 50-200 m for local rocks. The tops of the ridges are usually covered by the large boulders that represent very short transport distance.
The structure and composition of ribbed moraine ridges and an estimation of transport distances of mineralized material must be checked with surficial geological, stratigraphical and geochemical studies.

Keywords
Surficial geology, glacial morphology, moraine deposits, ribbed moraine, peat bog, glacial transportation, Asentolampi, Ranua

Geographical area
Finland, Lapland province, Ranua, Portimojärvi, Asentolampi

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Ordered by Erkki Vanhanen, Areva Resources Finland Oy. Order nro 0713 and it has been carried out under the skeleton agreement dnro K129/53/2004 for year 2007.

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Tiivistelmä

Geologian tutkimuskeskus (GTK) toteutti Areva Resources Finland Oy:n toimesta alustavan maaperätulkinnan Asentolammin kohdealueella Portimojärvellä, Ranualla elokuussa 2007. Työ sisälsi alueen geomorfologisen tulkinnan pohjautuen ilmakuviin ja korkeusmalliin sekä maastotarkistukseen. Erityisesti selvitettiin jäätikkösyntyisten maaperämuodostumien esiintymistä ja arvioitiin muodostumien kerrostumisprosesseja ja sitä kautta moreeniaineksen ja uraanipitoisten pintalohkareiden kuljetusmatkoja.

Alueen maaperää halitsevat jäätikön liikesuuntaan (lännestä itään) nähden poikittaiset moreeniharjanteet, ribbed-moreenit, joiden välissä esiintyy soita ja lampia. Harjanteiden pinnalla on yleisesti paikoin isojakin lohkareita, joiden kuljetusmatka ei näytä olevan kovin pitkä (50-200 m). Paikoin on nähtävillä huuhtoutuneita kivikoita ja rantatasanteita merkkinä jäätikön jälkeisesti järvivaiheesta (Ancylus-järvivaihe). Alueen kaakkoisosassa on myös kapeaksi reunamoreeniksi tulkittu harjanne ribbed-moreeniharjanteen päällä.

Ribbed-moreeniharjanteiden pintaosan moreeniaineksen ja pintalohkareiden on todettu aiemmissa lähialueella tehdyissä tutkimuksissa edustavan hyvin (lyhyestä kuljetusmatkasta johtuen) alla olevan kallioperän koostumusta. Paksuimmilla maapeitteen alueilla monivaiheinen kuljetus voi tosin olla myös mahdollista, jolloin kuljetusmatkat voivat olla paikoin pidempiä. Moreeniharjanteiden rakennetta ja moreenin kuljetusmatka-arviota tulee selvittää maaperän stratigrafisilla ja geokemiallisilla tutkimuksilla.

Asiasanat (kohde, menetelmät jne.)
Maaperägeologia, glasiaalimorfologia, moreenimuodostumat, ribbed-moreeni, suo, jäätikön kuljetus, Asentolampi, Ranua

Maantieteellinen alue (maa, lääni, kunta, kylä, esiintymä)
Suomi, Lapin lääni, Ranua, Portimojärvi, Asentolampi

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Muut tiedot
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1 INTRODUCTION

Study area situates in the northeastern side of Portimojärvi village, northern Ranua. The ground of the area is composed of glaciogenic deposits, mainly till and moraine ridges with bouldery surface, and peat deposits in between the ridges. The ridges are 500-1000 m in length, 100-200 m in width and 5-15 m in height, and they are oriented almost in north-south direction indicating last glacial flow direction from the west to east (Fig. 1). The same type of ridge morphology continues all around the study area, although changing to a flat relief (ground moraines) after some kilometers from the study area to the southward.

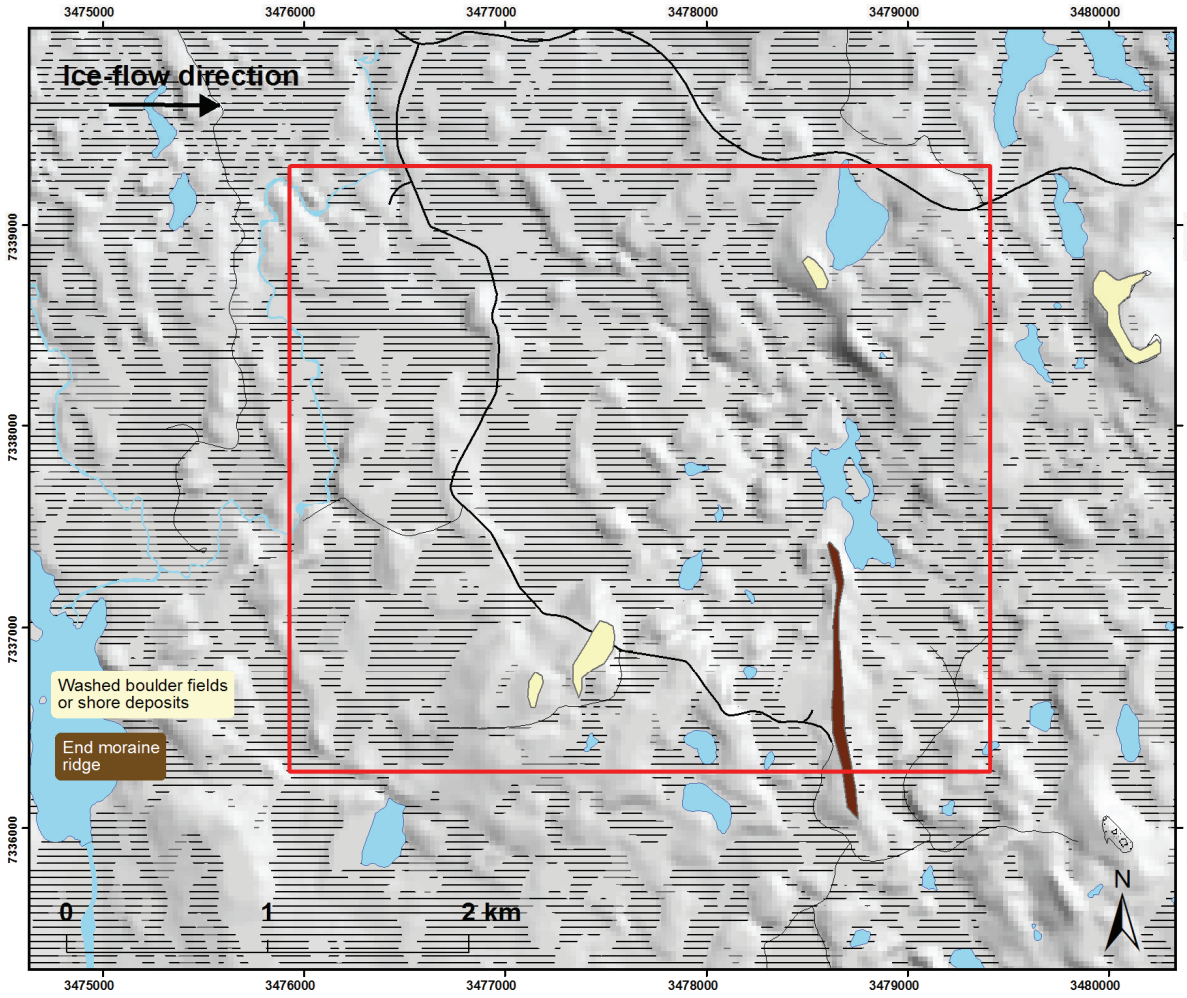

Fig.1. Elevation model of the study area. The ground is composed of ribbed moraine ridges. Last glacial flow direction has been from the west to east. Topographic features © National Land Survey of Finland, permission number 13/MYY/07.

The ridge morphology in the study area is typical for that area. It is a part of larger Portimojärvi ribbed moraine field (cf. Aario & Peuraniemi 1992) which starts about 20 km from the west and continues almost 20 km to the eastwards, as far as Simojärvi Lake. Bedrock outcrops are rare. Ribbed moraine is a special moraine type that was formed under subglacial conditions quite far from the glacier margin in the contact zone of warm- and cold-based glacier (Lundqvist 1969,

Hättestrand 1997, Sarala 2003 and 2005). In those conditions glacial dynamics has favored the development of transverse ridge morphology and subsequent quarrying in between the ridges.

According Sarala (2005) the ribbed moraine formation was a two-step process. During the first stage, a strong tensional flow fractured the cold-bed glacier and the subglacial sediments into blocks which moved under the ice sheet and formed the ridge morphology. During the second stage, the flowing glacier transported the material loosened between the blocks by the freeze-thaw process and redeposited it on the surfaces of the new ridges. That is why the uppermost till and the surface of the ridges are enriched of boulders and debris coming from the local bedrock surface. The surface of ridges is usually covered by the field of angular boulders and the size of them varies from small stones to huge boulders (> 10 m^3) (Fig. 2). It is worth noticing that the quarrying process is reaching the bedrock surface only if pre-existing sediment cover is not too thick (maybe more than 10 m).

Fig. 2. Large boulders on the top of ribbed moraine ridge near Tanelinlampi, on NE part of the study area. Photo P. Sarala.

During the last deglaciation glacier's margin was bordered by the Ancylus Lake. Ancylus Lake covered area afterwards about 1,500 years until it changed to Litorina Sea (ca. 7,800 years ago). The highest water level of the Ancylus Lake was about 210-215 m (a.s.l.) and for Litorina Sea about 90 m (a.s.l.). Water body and the shore phases during the isostatic land uplift have had an affect to the surface of ridges. Boulder fields are better seen, because part of the fine till material was washed away. In places, stratified shore deposits from sand to gravel and washed boulder fields exist having thickness from some ten of centimeters to several meters. Ancient shore terraces can even found in the slope of some higher hills (Fig. 3). Glaciofluvial deposits and marginal deposits are rare, although one small end moraine ridge was found on top of the ribbed moraine morphology.

Fig. 3. Ancient shore terraces on the northern slope of Linjakankaat hill, on southern part of the study area. Photo P. Sarala.

2 TRANSPORT DIRECTION AND DISTANCE OF BOULDERS AND TILL

The transport direction and distance of boulders and other till material are affected by two different glacial flow phases. The older one, which represents probably the Middle Weichselian glacial advance phase (ca. 50-70 ka ago), has flown from the north or north-northwest to the southeast. The till unit of that age has composed of basal till and the transport distance of till material has been moderate or long (1-5 km). Of that glaciation phase large drumlin field with north-northwest orientation around Ranua village and in southwestern Lapland is a remark (Fig. 4).

During the Late Weichselian glaciation (ca. 9,500-25,000 years ago) southern Lapland area was located under cold-base, mostly stagnant glacier core. During the deglaciation phase, glacier was divided into passive and active ice-lobes. Ranua-Pudasjärvi-Kuivaniemi-Tornio area stayed under passive ice-lobe (Fig. 4). Under active-ice conditions, like in the area of active Kuusamo ice-lobe, during the ribbed moraine formation, older drumlin field was cut away. Glacial flow direction was from the west to east. The ribbed moraine morphology has formed under this flow phase and the uppermost tills (usually 3-5 m) in the ridges are representing active phase of glacier.

Transport distance of surficial boulders should be thought as bimodal media because the boulders can be divided into two groups. One group is composed of boulders which represent long transport distance and have multiple glacial transport background. Rounded quartzites, mafic volcanites and granites can be counted in this group in the study area. Other group is distinguished as angular, usually larger boulders than far-traveled boulders, and of which rock compo-

sition is changing at the same way than in the underlying bedrock. The amount of local boulders can be even 100 % but usually about 40-60 %. Transport distance of the boulders in this local boulder group is usually very short: 50-200 m. This is phenomenon that is useful when mapping bedrock and also, when estimating the size of mineralization. If local boulders are found as surficial boulders on a large area in the ribbed moraine area, the indication of large mineralization in the bedrock is clear. Same phenomenon is also seen in till geochemistry.

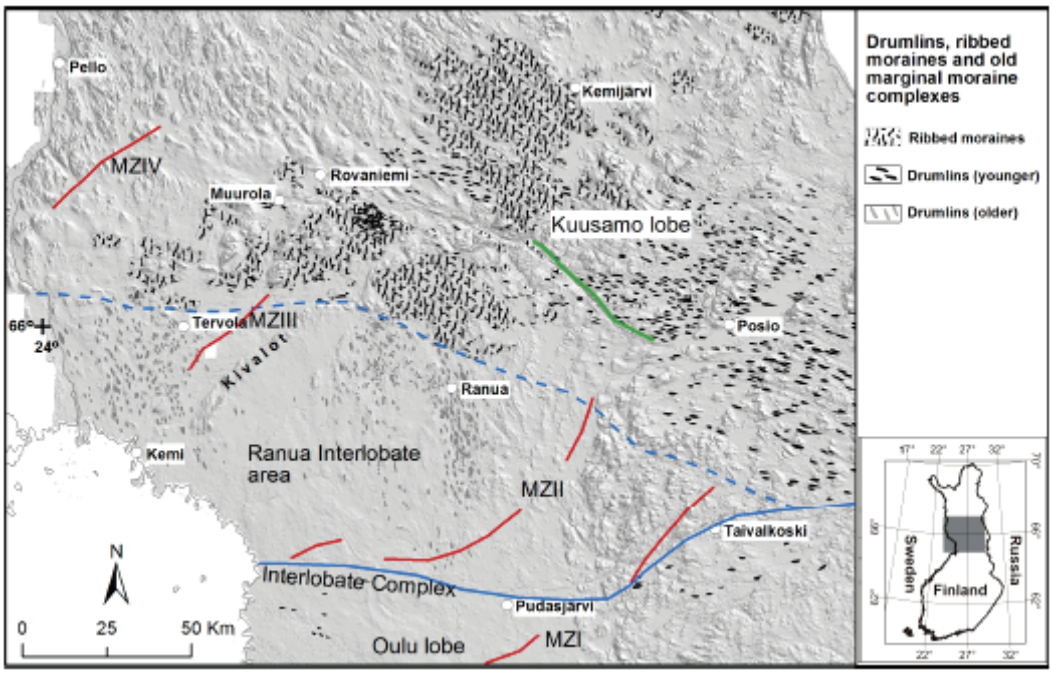

Fig. 4. The occurrence of streamlined drumlins and flutings with transverse ribbed moraines, old marginal zones MZI-MZIV (red) and ice-lobe boundaries (blue) in southern Finnish Lapland.

3 SUMMARY

Glacial morphology of the study area is composed of ribbed moraines oriented perpendicular to the last glacial flow direction. Glacial flow direction for local boulders is from west to east. Bedrock is poorly exposured. The existence of mineralized boulder fields on large areas on the top of ribbed moraine ridges is a positive indication of large mineralization in the bedrock at the study area. Boulders are easily detected by their radiate characteristic. Transport distance is usually short (50-200 m).

4 FUTURE STUDIES

Till stratigraphy and vertical distribution of boulders in till in the ribbed moraine ridges need more investigation. For that purpose, tractor excavations should be carried out in the study area. Till and pebble sampling for till geochemistry, heavy mineral studies and stone counting can be done at the same time. Also, some preliminary drilling program could be planned for taking samples from the most anomalous areas in the bedrock, under peatlands.

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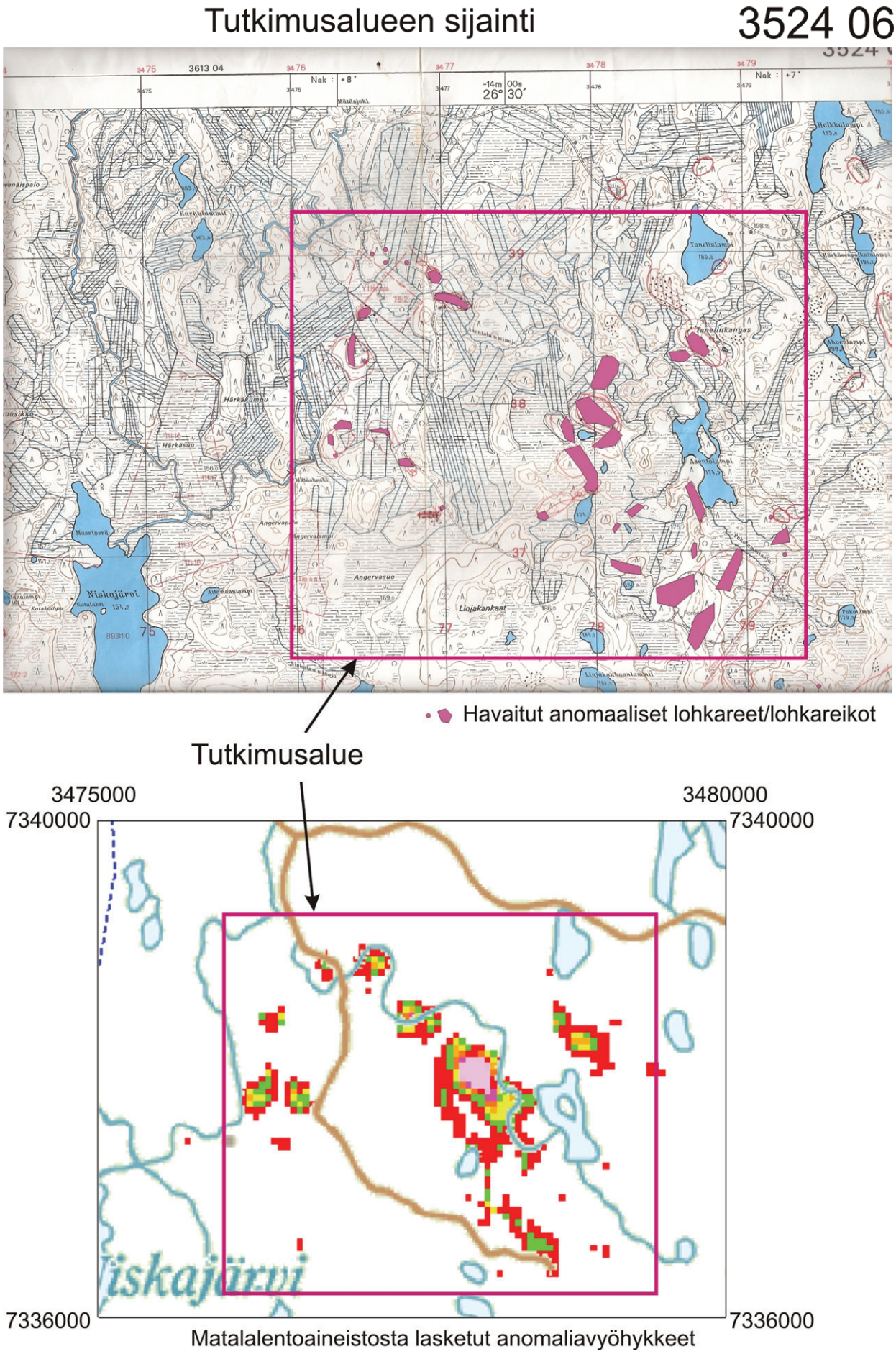
APPENDIX

Maps for the anomalous surfacial boulder fields and anomalous zones in the bedrock.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