

Geologia instituut, 2017. aasta teadus- ja arendustegevuse aruanne

DEPARTMENT OF GEOLOGY

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The department of Geology consists of five research groups and the Division of Collections as well as Särghaua Earth Science Centre.

Division of Bedrock Geology

Division of Isotope Geology

Division of Mineral Resources and Applied Geology

Division of Mining

Division of Quaternary Geology

Geologia instituudi koosseisu kuulub 5 uurimisgruppi, teaduskogude osakond ja Särghaua maateaduste õppekeskus:

- aluspõhjageoloogia osakond
- isotoopgeoloogia osakond
- kvaternaargeoloogia osakond
- maavarade- ja rakendusgeoloogia osakond
- mäeosakond
- teaduskogude osakond
- Särghaua maateaduste õppekeskus

Teadustegevuse ülevaade uurimisgruppide lõikes

Division of Bedrock Geology/aluspõhjageoloogia osakond

Head/osakonnajuhataja: professor/professor Olle Hints

Bedrock geology, including palaeontology and stratigraphy, have been among the key research areas of the Department of Geology since 1950s. As of 2018, the group includes seven researchers and postdocs and five PhD students, who work in close collaboration with other researchers at the department and have also partners worldwide, notably in US, Russia, Sweden, Finland, China, Canada, France, Belgium, Germany and UK.

The main research topics of the group are related to deciphering Earth history through the latest Proterozoic and early Palaeozoic times, ca 400–600 million years ago. During this period the planet underwent major transitions in climate systems and environments, related to changing oxygen levels and perturbations in carbon cycle rarely seen on Earth since then. This interval moreover embraced key events in biological evolution and biodiversification, such as the Cambrian explosion and Ordovician radiation, but witnessed also one of the largest mass extinctions in the history of life. The group is interested in better understanding the interactions between geo- and biosphere processes, in particular, addressing the following:

- Palaeobiodiversity dynamics and its relationships with climate and environmental changes;
- Palaeobiology and evolution of various groups of organisms during early Palaeozoic;
- Global palaeobiogeographic patterns and the role of the Baltic faunal province;
- Paleoclimate perturbations using multiple proxy indicators (such as conodont apatite);

- Changes in carbon, oxygen and sulfur stable isotope composition, reflecting of atmosphere and hydrosphere in deep time.

The group holds leading palaeontological competence in Estonia, and for some fossil groups, leading expertise worldwide (notably for conodonts, chitinozoans and scolecodonts). The main applications of the group's work are related to the high-resolution biostratigraphy of Early Palaeozoic sedimentary rocks, which has resulted in numerous collaborative publications. Most higher-impact studies are nevertheless based on material from the Baltoscandian bedrocks, renowned by little alteration and excellent preservation primary Palaeozoic signatures. Studies conducted at the department have been published in leading research journals including Nature, PNAS and Geology.

The group is responsible for running the mass spectrometry lab for stable isotope geochemistry, SEM for imaging and express geochemistry as well as paleontology lab for extracting microfossils. The group makes also excessive use of the geological and palaeontological collections deposited at the department. These are largest in Estonia and curated at a high international level.

Aluspõhjageoloogia osakond

Aluspõhja geoloogia, sh stratigraafia ja paleontoloogia, on olnud Geoloogia Instituudi üheks keskseks uurimisvaldkonnaks alates instituudi loomisest. 2018. a alguse seisuga on osakonnaga seotud 6 teadustöötajat, järel doktor Hiinast ja 5 doktoranti, teadustegevus toimub Eesti Teadusagentuuri uurimistoetuse jt projektide toel. Osakonna töötajad osalevad mitmete loengukursuse läbiviimisel "Maapõueressursside" õppekava üliõpilastele.

Aluspõhja osakonna põhikompetentside hulka kuulub Eesti geoloogilise ehituse, kivimite, kivistite ja arenguloo põhjalik tundmine. Sellised teadmised on vajalikud praktilises geoloogias, kuid põhiliselt leiavad kasutust siiski alusuuringutes, enamasti tihedas rahvusvahelises koostöös. Osakonna peamiste uurimissuundade hulka kuuluvad:

- mikropaleontoloogia ja detailne biostratigraafia;
- elurikkuse dünaamika modelleerimine ja elurikkuse seosed kliima ja keskkonnamuutustega;
- erinevate organismirühmade evolutsioon ja paleobiogeograafilise leviku analüüs;
- paleokliima modelleerimine kasutades sedimentoloogilisi ja geokeemilisi indikaatoreid;
- Paleosoikumi vulkanism, bentoniidikihtide levik ja geokeemia ning stratigraafiline rakendus;
- süsiniku aineriinge muutused Paleosoikumis ning isotoopgeoloogiliste meetodite kasutusvõimalused selle selgitamiseks;
- geodünaamika, magma- ja moondeprotsesside modelleerimine.

Oluline osa aluspõhja osakonna teadustööst baseerub instituudi geoloogilistel ja paleontoloogilistel kollektsioonidel, mida haldab teaduskogude osakond.

Olulisemad 2017. a publikatsioonid:

- **Hints, O., Antonovitš, L., Bauert, G., Nestor, V., Nõlvak, J., Tammekänd, M.** 2017. CHITDB: a database for documenting and analysing diversification of Ordovician–Silurian chitinozoans in the Baltic region. *Lethaia* **xx**, xx-xx. Published online: 12. October 2017. DOI:10.1111/let.12249

- Jarochowska, E., Viira, V., Einasto, R., Nawrot, R., Bremer, O., Männik, P., Munnecke, A. 2017. Conodonts in Silurian hypersaline environments: Specialized and unexpectedly diverse. *Geology* **45**, 3-6. Published online: 3. November 2016. doi:10.1130/G38492.1
- Wright, D. F., Toom, U. 2017. New crinoids from the Baltic region (Estonia): fossil tip-dating phylogenetics constrains the origin and Ordovician–Silurian diversification of the Flexibilia (Echinodermata). *Palaeontology* **60**, 893-910. Published online: 30. August 2017. doi:10.1111/pala.12324

Division of Isotope Geology/isotoopgeoloogia osakond

Head/osakonnajuhataja: senior researcher/vanemteadur Rein Vaikmäe

The Division of Isotope Geology was formed in the early 1970s with the aim of using isotopic and geochemical indicators in polar ice-cores for the study of global climatic variability and environmental changes back in time. Over the years, the division's main research areas have been expanded to hydrogeology, arctic paleoclimatology and environmental change, high-resolution stable isotope *Paleozoic chemostratigraphy* as well as CO₂ capture and storage.

As of 2018, the division's research work will be carried out on three Estonian Research Council projects, several international projects (including EU Horizon 2020) and contracted projects. The research staff includes six researchers, one doctoral student and three engineers holding PhD degrees. The division holds a modern research facility with an international client base including: two Thermo Fisher Delta V Advantage IRMS, with three sample preparation lines (GasBench II for δ¹⁸O and δ¹³C from carbonate rocks; FlashEA 1112 for δ¹³C and δ¹⁵N analyses from organic matter and TC/EA High Temperature Conversion/Elemental Analyzer), and Thermo Dionex ionchromatograph ICS-1100. The Division of Isotope geology is promoted through participation in International conferences workshops and publications of papers in leading international journals within its field including Applied Geochemistry, *Geochimica et Cosmochimica Acta*, *Chemical Geology*, and *Science of the Total Environment*.

Currently the studies of the research group are focused on:

- geochemical isotopic signature of the Estonia Cambrian-Vendian groundwater aquifer and application of new geochemical tracers to infer groundwater age and groundwater origin;
- groundwater numerical models;
- polar paleoclimate and –environmental change;
- CO₂ geological storage and numerical modelling of storage sites.

Isotoopgeoloogia osakond

Isotoopgeoloogia osakond moodustati Geoloogia Instituudis eelmise sajandi 70-ndate aastate algul eesmärgiga kasutada isotoop-geokeemilisi analüüsimeetodeid ja indikaatoreid globaalsete kliima- ja keskkonnamuutuste uurimisel. Osakonna algusaastatel kujunes põhiliseks uurimissuunaks paleoklimatoloogia ja eelkõige polaaralade jääpuursüdames talletunud isotoopandmestiku dešifreerimine. Viimase aastakümne jooksu on osakonna isotoopuuringud laienenud ja hõlmavad enda alla põhjavee isotoopkoostise, vanuse ja päritolu probleemid ning numbriliste mudelite rakendamist. Jätkuvalt ollakse edukad polaaralade isotoop-põhiste paleokliima- ja keskkonnamuutuse lahendamisel. Uue uurimissuunana on lisandunud CO₂ sidumine ja geoloogiline ladustamise temaatika.

2018. a alguse seisuga on osakonnaga seotud 6 teadustöötajat, 1 doktorant, 3 teaduskraadiga tehnilist töötajat. Teadustöö toimub Eesti Teadusagentuuri uurimistoetuste ja välisprojektide, sh EL Horisont 2020 projektide toel. Osakonna töötajad osalevad mitme õppeaine õpetamisel „Maapõueressursside“ õppekava üliõpilastele. Osakonnal on teadustööks välja arendatud kaasaegne isotoop-geokeemiliste analüüside infrastruktuur, sh kaks firma Thermo Fisher Scientific stabiilsete isotoopide suhte mõõtmise massispektromeetrit ja ioonkromatograaf ICS-1100. Välispartnerite kaudu on osakonnal juurdepääs ka unikaalsele veeproovide vääriskaaside sisalduse ning vääriskaaside isotoopanalüüside aparatuurile.

Olulisemad 2017 a publikatsioonid:

- Gerber, C., **Vaikmäe**, R., Aeschbach, W., Babre, A., Jiang, W., Leuenberger, M., Lu, Z.-T., Mokrik, R., Müller, P., **Raidla**, V., Saks, T., Waber, H.N., Weissbach, T., Zappala, J.C., Purtschert, R. 2017. Using ^{81}Kr and noble gases to characterize and date groundwater and brines in the Baltic Artesian Basin on the one-million-year timescale. *Geochimica et Cosmochimica Acta* **205**, 187-210. Published online: 31. January 2017.
[doi:10.1016/j.gca.2017.01.033](https://doi.org/10.1016/j.gca.2017.01.033)
- Barbaro, E., Spolaor, A., Karroca, O., Park, K.-T., **Martma**, T., Isaksson, E., Kohler, J., Gallet, J.C., Bjorkman, M.P., Cappelletti, D., Spreen, G., Zangrando, R., Barbante, C., Gambaro, A. 2017. Free amino acids in the Arctic snow and ice core samples: Potential markers for paleoclimatic studies. *Science of the Total Environment* **607-608**, 454-462. Published online: 27. July 2017. <https://doi.org/10.1016/j.scitotenv.2017.07.041>
- Sauer, S., Crémière, A., Knies, J., **Lepland**, A., Sahy, D., **Martma**, T., Noble, S.R., Schönenberger, J., Klug, M., Schubert, C.J. 2017. U-Th chronology and formation controls of methane-derived authigenic carbonates from the Hola trough seep area, northern Norway. *Chemical Geology* **470**, 164-179. Published online: 12. September 2017.
<https://doi.org/10.1016/j.chemgeo.2017.09.004>

Division of Mineral Resources and Applied Geology

Head/osakonnajuhataja: researcher/teadur Rutt Hints

The research group mainly deals with subjects concerning future mineral resources of Estonia, targeting issues related to genesis, distribution and physical-chemical characteristics of the potential deposits. Moreover, a number of projects dealing with environmental geology, enrichment technologies of mineral raw materials, as well as with development of data systems for digital sharing of geological information, have been carried out during last few years.

The core competences of the work group are related to geology of organic rich mineral resources (black shales, oil shales, peat) as well as sedimentary calcareous rocks. Work group has long-term expertise on investigations of paleoenvironmental condition and diagenetic processes, including extensive studies on stratigraphy and alteration pathways of Paleozoic volcanic-sedimentary complexes and on Ordovician-Silurian climatic and paleomarine changes.

In 2017 new research activities were launched as part of EU-funded strategic R&D initiative targeting enrichment of shelly phosphorite resources, Ordovician black shales and exploration of potential ore deposits of Estonian crystalline basement.

As part of the project funded by EIT Raw Materials initiative (Horizon 2020) the work group is developing web-based educational information system for sharing core logging data. The system is designed to provide common access point to complex analytical datasets of mineral exploration

collected with traditional and novel core logging techniques by different research institutions across Europe.

The work group manages modern analytical facilities including ICP-MS, XRF and XRD labs, allowing complex set of geochemical, mineralogical and petrological studies to be carried out. Other research capabilities include fieldwork instruments for in situ studies of geochemical properties of rocks, complemented by GIS-based data management.

The active collaboration partners of the work group come from numerous organizations from Estonia and abroad, including Estonian Geological Survey, University of Tartu, Estonian University of Life Sciences, Finnish Geological Survey and University of Lorraine.

Maavarade- ja rakendusgeoloogia osakond

Uurimisrühma tegevuses on kesksel kohal Eesti nn tuleviku maavarade geokeemilise koostise, geneesi ja leviku uuringud. Neile lisanduvad maapõue ja merekeskkonna keskkonnaseisundit, maavarade efektiivsemaid rikastamistehnoloogiaid ja geoloogiliste andmete digitaalset kättesaadavust edendavad projektid.

Esiletõstmist väärib rühma mitmekülgne kompetents orgaanikarikaste setteliste maavarade, sh põlevkivide, mustade kiltade ning turba, aga ka karbonaatsete kivimite geoloogilistes uuringutes. Töörühm omab ühtlasi pikaajalist kogemust paleokeskkondade ja sette kivimite tekkeprotsesside käsitlemises, sealhulgas paleosoiliste vulkaanilis-setteliste kivimite stratigraafia ja elementide mobiilsuse ning Ordoviitsiumi ja Siluri kliima ja mereliste tingimuste interpreteerimisel.

2017. aastast osaletakse RITA strateegilise TA toetamise projekti raames Eesti fosforiidi rikastamise ja aluskorra potentsiaalsete metalliresursside uuringutes. Käimasolevate arendusprojektide hulka kuulub ka maagiotsingute komplekskateabe jagamist ja analüüsi toetava veebipõhise õppeotstarbelise infosüsteemi loomine. EIT Raw Materials'i vahenditest finantseeritava (Horisont 2020) projekti raames arendatav infosüsteem on unikaalne digilahendus, mis koondab erinevat tüüpi uuringuandmeid partneritelt üle Euroopa.

Osakonna T&A tegevus tugineb instituudi kaasaegsel analüütilisel kompleksil (XRD, XRF, ICP-MS, SEM-EDS), mis lubab teostada erinevaid kivimite ja maavarade geokeemilisi, mineraloogilisi ja petrograafilisi uuringuid. Lisandub võimekus maavarade füüsikalise-keemiliste omaduste in situ uuringuteks välitöödel ja puursüdamikest. Töörühma täiendavad kompetentsid hõlmavad geoprotsesside modelleerimist ja GIS-põhist infoanalüüsi. Uurimisrühma kasutada on instituudi Särghaua maateaduste keskuse unikaalne puursüdamike kollektsioon.

Uurimisrühma aktiivsete koostööpartnerite hulka kuuluvad töögrupid Eesti Geoloogiateenistusest, Tartu Ülikoolist, Soome Geoloogiateenistusest ning mitmest välisülikoolidest ja TTÜ allüksustest, sh materjali- ja keskkonnatehnoloogia instituudist ning põlevkivi kompetentsikeskusest.

Olulisemad 2017 a publikatsioonid:

1) **Kiipli, E., Kiipli, T., Kallaste, T., Pajusaar, S.** 2017. Trace elements indicating humid climatic events in the Ordovician–early Silurian. *Chemie der Erde – Geochemistry* **77**, 625-631. Published online: 8. June 2017. <https://doi.org/10.1016/j.chemer.2017.05.002>

2) **Kiipli, T., Hints, R., Kallaste, T., Verš, E., Voolma, M.** 2017. Immobile and mobile elements during the transition of volcanic ash to bentonite—an example from the early Palaeozoic sedimentary section of the Baltic Basin. *Sedimentary Geology* **347**, 148-159. Published online: 05. December 2016. <http://dx.doi.org/10.1016/j.sedgeo.2016.11.009>

Division of Mining

Head/osakonnajuhataja: Erik Väli

Division of Mining has a long history, its activities began in 1938. In autumn 2016 in the course of structural reformation, the independent Institute of Mining was joined to Department of Geology. Nowadays research and education staff of division run research and lectures topics by occupational qualifications system of mining engineering (permissions given by Estonian Qualifications Authority), developing the necessary skill set for mining engineers.

Division of Mining competences are in field of geotechnology and mining engineering, economical evaluation in mineral exploration, mineral processing (design of separation technologies), sustainable use of mineral resources, environmental protection and circular economy in minerals usage.

Division of Mining is equipped with Laboratory of Mining Conditions and mining related softwares for design and modelling mining works and plans. Laboratory equipment is used widely in education and research projects.

Department of Geology is responsible to represent TTÜ in EIT Raw Materials, initiated by the EIT (European Institute of Innovation and Technology) and funded by the European Commission. This network is the largest and strongest consortium in the raw materials sector worldwide. Its vision is the European Union where raw materials are a major strength. Its mission is to boost competitiveness, growth and attractiveness of the European raw materials sector via radical innovation and guided entrepreneurship.

With cooperation of EIT Raw Materials partners, TTÜ and Department of Geology have partnership in 10 educational and research oriented projects in 2017. EIT Raw Materials project proposal call for 2018 already announce that TTÜ have cooperation within 18 projects.

Some significant innovation projects in EIT Raw Materials include:

- Visual3D – One tool to trigger a higher degree of investment in exploration and to secure ultimately the domestic supply of both main commodities and critical raw materials is to enhance our understanding of the Earth’s crust below the surface—and the major aspect is here to optimise our understanding about the 3rd dimension in geology.
- Re-Activate - The project objective is developing superior technical infrastructure to create synergies to merge and further develop advanced technologies and methodologies for re-activation of former mine sites.
- GATEWAY - The project addresses all value chain themes and will be focused on in Latin American and African regions. By integrating business development activities to existing education, research projects and networks, we aim at forming new approaches to support sustainable business development in developing countries.
- ADMADP develops the doctoral training in the existing Advanced Materials Doctoral Programme (ADMA-DP) to fulfill the quality criteria of the EIT-labelling in doctoral training.

Mäeosakond

TTÜ geoloogia instituudi mäeosakonnale pandi alus 1938. a, kui ülikoolis loodi mäeinseneride koolitamiseks mäeosakond. Ülikooli viimase struktuurireformi käigus liideti 2016. a septembris senine energeetikateaduskonna mäeinstituut geoloogia instituudiga omaette osakonnana. 2018 a alguse seisuga töötab osakonnas kuus doktorikraadiga teadustöötajat/õppejõudu. Mäeosakonna

õppejõud annavad olulise panuse „Maapõueressursside“ õppekava õpetamisel, seda nii bakalaureuse kui ka magistritasemel. Osakonna teadustöö toimub peamiselt läbi riiklike kui ka ettevõtete rahastatud rakendusuuringute projektide. Osakonna tegevusega on tihedalt seotud riiklikult akrediteeritud mäetingimuste labor, mille kompetentside hulka kuulub muuhulgas maavõngete seismograafiline uurimine, müra mõõdistamised läbi helirõhu taseme mõõtmiste, markšeidermõõtmised, kivimite ja täitematerjalide geomeetriliste omaduste määramine ning purunemiskindluse määramine Los Angeles meetodil jmt.

Mäeosakonna kompetentsi kuulub :

- kaevanduste ja maavarade töötlemise tehnoloogiate projekteerimine;
- ressursitõhususe meetmete ja tehniliste lahenduste leidmine ning hindamine;
- ringmajandusega seotud ettevõtlussuundade arendamine.

2017 a T&A olulisematest arendusprojektidest väärivad märkimist:

- Täitmisega kaevandamistechnoloogia kasutuselevõtu võimaluste analüüs;
- Turbaalaste uurimistulemuste digitaliseerimine ja andmebaasi koostamine;
- Ettevõtlikkus ringmajanduse suunaga integreeritud materjalide töötlemises.

Mäeosakonna vanemteadur Veiko Karu, kes on Euroopa Tehnoloogia- ja Innovatsiooninstituudi (EIT) teadus- ja innovatsiooni kogukondade teaduskoostöö võrgustiku (EIT Raw Materials) TTÜ-poolsete tegevuste koordinaator, algatas ja viis läbi mitmeid maavaratööstuse innovatsiooniga seotud alamprojekte:

- Visual3D projekt, mille raames tegeleti kolmemõõtmeliste geoloogiliste visualiseerimismudelite loomise ning analüüsiga;
- RE-Active projekt, mille raames uuriti kaevandamisega tekkivate panilate erinevate taaskasutamiste võimalusi.

Division of Quaternary Geology

Head/osakonnajuhataja: professor/professor Siim Veski

Quaternary geology, paleoecology and related research disciplines explaining the current paradigm of actualism in geology, have been one of the principal targets of research at the Department of Geology since the 1950s. At present, the research group comprises of eight researchers and postdocs and three PhD students, who work in close collaboration as a targeted team, as well as with other groups in the department. We have fruitful collaboration worldwide, notably in US, Russia, Sweden, Finland, Canada, Germany, UK, the Netherlands, Switzerland, Latvia, Lithuania and Belarus.

The main research aim of the Quaternary group is reconstruction of past ecosystems, vegetation history, climate and environmental change, both natural and manmade, at high temporal resolution during the last 15,000 years through multidisciplinary and multiproxy studies of natural archives such as lake, bog and marine sediments. The Quaternary is known for rapid climate change, glacial advances and retreats, constant drift of biota between glacial and warm refugia, sea level fall and rise with each period of freezing and thawing. It's also known as the period of the rise of mankind and its progressively increasing impact upon the environment. The group focusses on better understanding the interactions between Quaternary geo- and biosphere processes, in particular, addressing the following:

- Postglacial retreat of the ice sheet;

- Paleoclimate variation using multi-proxy analyses (such as pollen and chironomid based inference models);
- Paleobiodiversity (terrestrial and aquatic), functional and phylogenetic diversity dynamics and relationships with climate and environmental changes;
- Past human impact upon landscapes, waterbodies, vegetation structure and landcover;
- Shoreline displacement of the Baltic Sea.

The group holds leading position in Quaternary and palaeoecological studies in the Baltic realm. The main strengths of the group's work are related to the high-resolution paleo-datasets of geographically and climatically constrained area. Studies conducted at the department have been published in leading research journals including Nature Communications, Geology, GCB, QSR, JQS, and JVS.

The group hosts several labs of biostratigraphy, dating, geochemistry, granulometry, and takes use of mass spectrometry lab for stable isotope geochemistry.

Kvaternaarigeoloogia osakond

Kvaternaari geoloogia ja sellega liituvad erialad on olnud geoloogia instituudi üheks oluliseks uurimisvaldkonnaks alates instituudi loomisest 1947. a. 2018. a alguse seisuga on osakonnaga seotud kaheksa teadustöötajat ja järel doktorit ning kolm doktoranti, teadustegevus toimub peamiselt Eesti Teadusagentuuri uurimistoetuste toel. Osakonna kõik töötajad osalevad mitmete loengukursuse läbiviimisel "Maapõueressursside" õppekava üliõpilastele.

Töögrupi teadustulemused on pälvinud rahvusvahelise tunnustuse ja on võimaldanud viljakat ühistööd mitmete oma ala maailma juhtivate teaduskollektiividega, pakkudes uudseid lahendusi pärastjääaegse taimestiku, kliima, inimtegevuse ja keskkonnamuutuste vaheliste seoste väljaselgitamisel. Töögrupi arendustöö on avardanud võimalusi koostööks teiste teadusharudega nagu klimatoloogia, ökoloogia ja arheoloogia. Osakonna teadurid publitseerivad oma teaduseriala tippajakirjades nagu Nature Communications, Global Change Biology, Quaternary Science Reviews, Journal of Quaternary Science, Journal of Biogeography ja Journal of Vegetation Science.

Osakonna peamiste uurimissuundade hulka kuuluvad:

- Pärastjääaegse kliima rekonstrueerimine eri analüüsimeetoditega;
- Pärastjääaegse maakatte ja taimestiku rekonstrueerimine;
- Õietolmuandmete põhised ökoloogilised seosed ja paleomitmekesisus;
- Mineviku maakasutus ning ökosüsteemide kohanemine põllundusliku maakasutuse muutustega;
- Pärastjääaegne jäätaande kronoloogia ja paleogeograafia;
- Läänemere varasemate staadiumite areng ning keskkonnaseisund.

Töörühmal on uurimistööks vajalik uurimiskeskond: puurimisvarustus, setteproovide külmhoidla, ettevalmistuslaborid proovide eeltöötlemiseks ning biogeokeemiline teadusaparatuurikompleks.

Olulisemad 2017. a publikatsioonid:

- Feurdean, A., **Veski**, S., Florescu, G., Vannièrè, B., Pfeiffer, M., O'Hara, R.B., Stivrins, N., **Amon**, L., **Heinsalu**, A., **Vassiljev**, J., Hickler, T. 2017. Broadleaf deciduous forest counterbalanced the direct effect of climate on Holocene fire regime in hemiboreal/boreal region (NE Europe). *Quaternary Science Reviews* **169**, 378-390. Published online: 20. June 2017. <https://doi.org/10.1016/j.quascirev.2017.05.024>

- **Grudzinska, I., Vassiljev, J., Saarse, L., Reitalu, T., Veski S.** 2017. Past environmental change and water intrusion into coastal Lake Lilaste, Latvia. *Journal of Paleolimnology* **57**, 257-271. Published online: 09. February 2017. DOI:10.1007/s10933-017-9945-3
- **Stivrins, N., Liiv, M., Heinsalu, A., Gaška, M., Veski, S.** 2017. The final meltdown of dead-ice at the Holocene Thermal Maximum (8500-7400 cal. yr BP) in western Latvia, eastern Baltic. *The Holocene* **27**, 1146-1157. Published online: 6. January 2017. <https://doi.org/10.1177/0959683616683255>

Division of Collections

Head/osakonnajuhataja: Ursula Toom

Geological collections are essential part of many branches of geosciences and the Department of Geology holds the largest geocollection in Estonia. The Division of Collections ensures preservation and accessibility of physical collections (fossils, rock samples, drill cores, micropaleontological preparations etc), as well as the archives and electronic information system accessible online (<http://geokogud.info/git>). The latter has been developed in the department, but is now used also by other geocollection holders in Estonia. The Division of Collections has close collaboration with other natural history collections in Estonia and since 2011, the department is a partner in the national research infrastructure roadmap object "Natural history archives and information network". Further projects to integrate collections, databases and research data are underway. The professional development of the electronic information system is ongoing. Geocollections are available and searchable in international data networks CETAF, GeoCAsE, BioCAsE, GBIF, OpenUP!-Europeana, SESAR.

Geological collections are deposited in Tallinn and in Pärnumaa Särghaua Earth Science Centre in storages designed and equipped for the geocollections. The department also includes a high-level digital photography laboratory.

The department has the competence for the comprehensive work with geological collections, the researchers and students are closely involved. Collections are constantly being used for the research, teaching and nature education. Department have a visitors all over the world, loans of samples and paleontological specimens for scientific purposes are accepted.

Specific regulations on using the collections can be found:

http://geokogud.info/git/teaduskogude_kasutamise_kord_en.pdf

Teaduskogude osakond

TTÜ geoloogia instituudile kuuluvad Eesti suurimad geoloogilised kollektioonid, mis on moodustunud instituudi pikaajalise teadustegevuse käigus. Mitmekülgne esemeline materjal: kivimproovid, kivistised, puursüdamikud, mikropaleontoloogilised preparaadid ja käsikirjalised arhiivimaterjalid ning andmebaas moodustavad ühtse terviku. Kollektioone kasutatakse igapäevaselt teadustegevuses, õppetöös ja kraadiõppes ning loodushariduses, seda nii Eesti kui ka paljude välisülikoolide poolt.

Teaduskogude osakonna ülesandeks on kollektioonide ja nendega seonduva korrastamine, kataloogimine ning kättesaadavaks tegemine avalike portaalide (<http://geokogud.info>) ja (<http://fossiilid.info>) kaudu. Instituudi kollektioonid kuuluvad Eesti teaduse infrastruktuuri teekaardi "Loodusteaduslikud arhiivid ja andmevõrgustik (NATARC) koosseisu ning on

kättesaadavad rahvusvahelistes andmevõrgustikes (CETAF, GeoCAsE, BioCAsE, GBIF, OpenUP!-Europeana, SESAR).

Kollektsioone hoiustatakse Tallinnas ja Särghaua väibaasis, selleks spetsiaalselt ehitatud ja sisustatud hoidlaruumides. Teaduskogude osakonna koosseisu kuulub tiptasemel digifoto labor. Rahvusvaheliselt tunnustatud Eesti geokogude infosüsteem, mis liidab tervikuks Eesti geoloogia rahvuskollektsiooni, on välja töötatud geoloogia instituudis ning infosüsteemi professionaalne arendus jätkub. Osakonnal on vajalik kompetents igakülgseks tööks geoloogiliste kollektsioonidega, kaasatud on instituudi teadurid ja õppurid. Kollektsioonide kasutamist reguleerib kogude kasutamise ja säilitamise kord (http://geokogud.info/git/teaduskogude_kasutamise_kord.pdf)

Loetelu uurimisgrupi liikmetest, kes on riiklike T&A-ga seotud otsustuskogude liikmed (töötaja nimi, ametikoht ning otsustuskogu nimetus ja positsioon otsustuskogus).

Atko Heinsalu - Eesti Teadusagentuuri loodusteaduste ja tehnika ekspertkomisjoni liige;

Olle Hints - HTM teaduskollektsioonide ekspertnõukogu, aseesimees;

Olle Hints - Eesti Teadusagentuuri avatud teaduse ekspertkomisjon, esimees;

Olle Hints - Eesti teaduse infrastruktuuri teekaardi "Loodusteaduslikud arhiivid ja andmevõrgustik (NATARC)", nõukogu liige;

Siim Veski - Eesti Teadusagentuuri bio- ja keskkonnateaduste ekspertkomisjoni liige;

Uurimisgrupis osalenud järel doktorite ning TTÜ-st järel doktorantuuri suundunud uurimisgrupi töötajate loetelu:

Leeli Amon, Bishop's University, Sherbrooke, Quebec, Kanada, 01.01.2017-01.05.2017, Quebec järel doktoritoetus

Leeli Amon, Holland, Utrecht Ülikool/ Saksamaa, GeoForschungsZentrum, Potsdam, 01.09.2017-31.10.2018, ETAG personaalse uurimistoetuse järel doktoritoetus

Ieva Grudzinska, Šveits, Berni Ülikool, 01.09.2017-31.08.2018, Šveitsi valitsuse stipendium

Yan Liang, TTÜ geoloogia instituut, 1.09.2017- 31.08.2019, ETAG Mobilias Plus järel doktoritoetus (juhendaja prof Olle Hints)

Valle Raidla, Saksamaa, Heidelbergi Ülikool, 1.06.2015-31.05.2017, ETAG personaalse uurimistoetuse järel doktoritoetus

Normunds Stivrins, Soome, Helsinki Ülikool, 1.01.2015-31.08.2017, Helsingi Ülikooli järel doktoritoetus

Geologia instituudi 2017. a teadusartiklid (1.1 kategooria):

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