Microbiological studies - substantial part of the State research program NatRes project “Mineral Resources”

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NatRes program

- State research program NatRes (Nr. 2010.10-4/VPP-5) project „**Mineral Resources**” supported and promoted the collaboration of scientists from various scientific fields from the exploration of the mineral resources, technologies of raw material processing and new product development and value added applications in the area of biotechnologies.

Project “Mineral resources”

- New technologies and innovations are results of efficient scientific collaboration and implementation of engineering solutions.
- This can be characterized by following key words:
  - Local mineral resources;
  - Innovations and engineering solutions;
  - High value added products.

Focus

- State research program NatRes project „Mineral Resources” specific attention to biotechnologies is based on scientific potential regarding novel and outstanding biotechnological products and technologies with particular utilisation of local mineral resources and derivates.
- Project in general supported and promoted the collaboration of scientists from various scientific fields from the exploration of the basic mineral resources, raw material processing and new product development.
- Besides traditional localized in separate laboratories and research groups, the new technologies and multidisciplinary innovations are result of efficient scientific collaboration and implementation of engineering solutions.

Cooperation

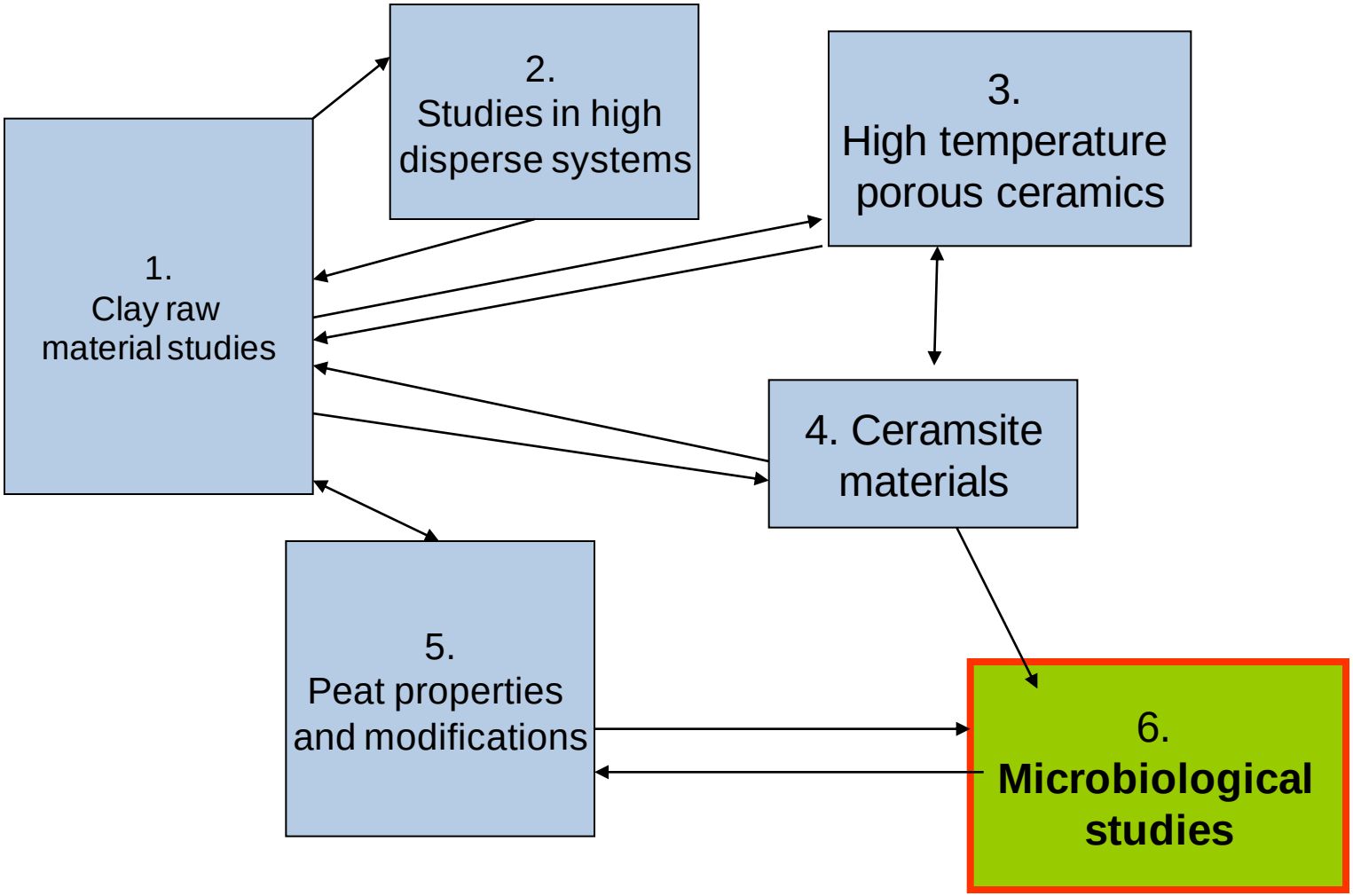
- The project “Mineral Resources” is a multidisciplinary scientific collaboration project, comprising **six** deeply interconnected and **synergic research directions** with high application potential in the national economy during the coming decades.
- The project is being implemented in a close cooperation of the research groups from University of Latvia and Riga Technical University, **focusing on 17 research themes involving scientists in biology, chemistry, geology as well as different scientific areas of environmental and material studies.**

Themes of scientific research

- Mentioned above themes of scientific research are:
  - Evaluation of clay in Latvia regarding possibilities to develop new technologies and products (V. Segliņš),
  - Technology and research of high dispersion system obtaining based on Latvian clays for innovative application in sorption processes, environment technologies, medicine and cosmetics (L. Bērziņa-Cimdiņa),
  - New ceramics products and technologies (G. Sedmale),
  - Energy saving high porosity expanded clay ceramic technologies (V. Švinka),
  - Peat and sapropel as substrates for new added value technologies and products (M. Kļaviņš) and
  - Novel biotechnological products and technologies based on ceramsite (O. Mutere).

Internal logistics in the project (2011-2012)

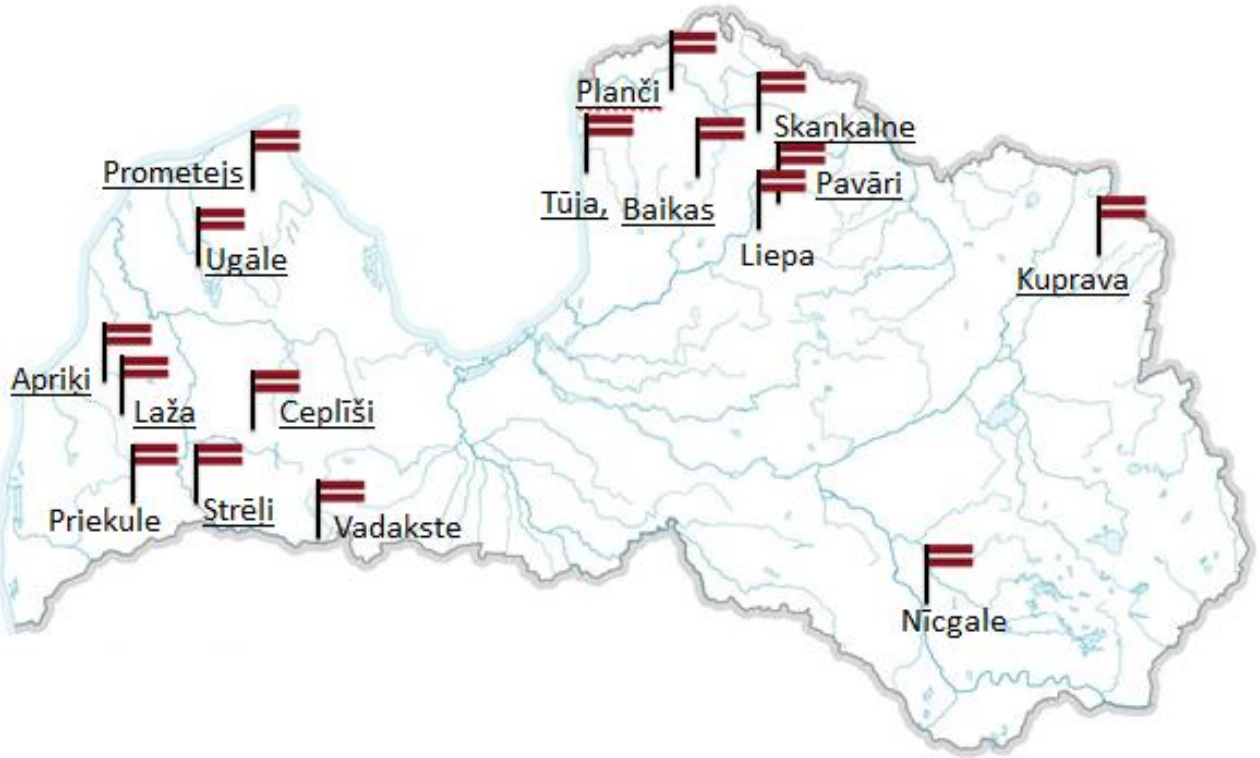
Assistance, the data flows and exchange of scientific results



Research

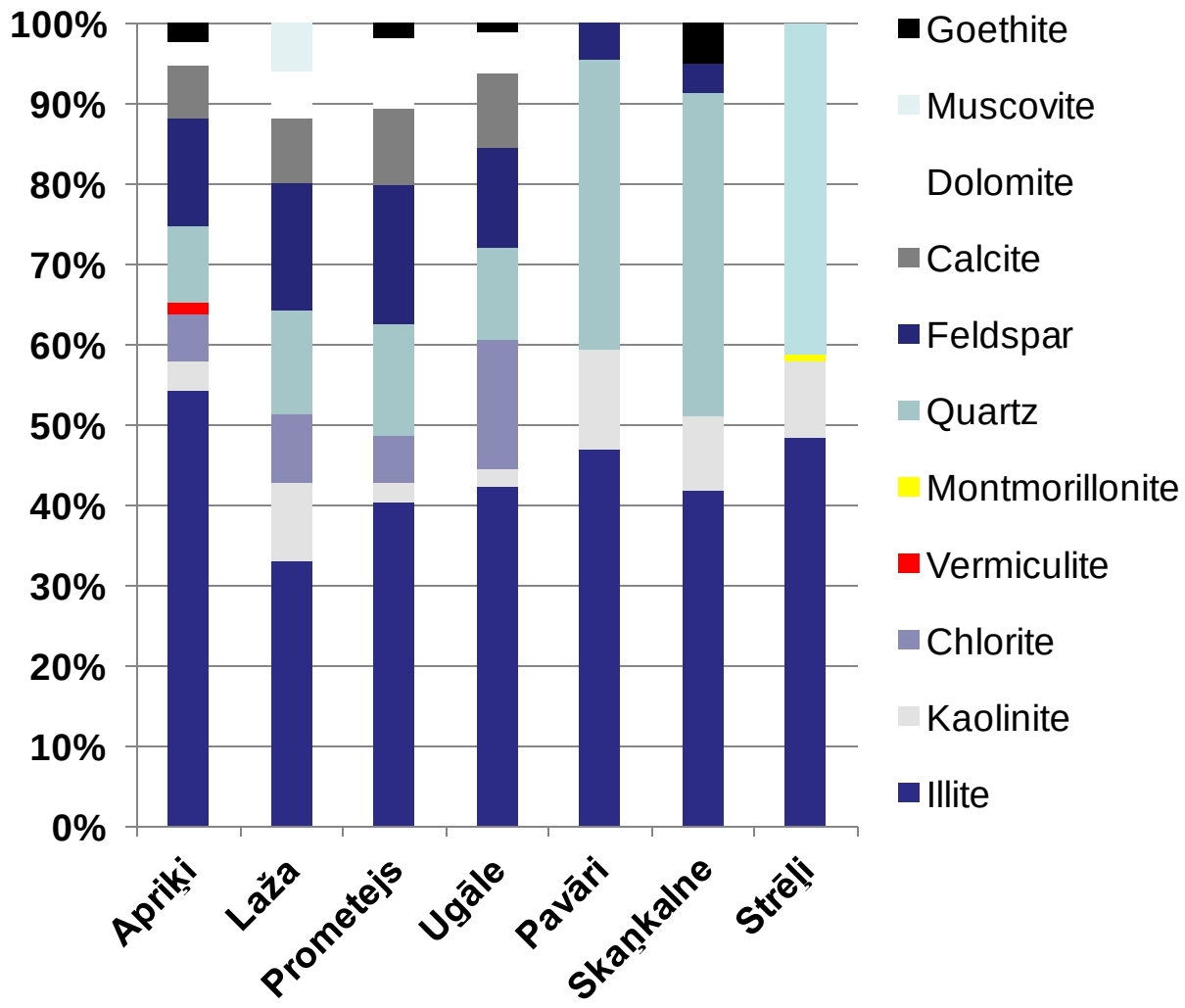
- Mentioned above themes of scientific research are from evaluation of clay resources in Latvia to novel biotechnological products and technologies based on ceramsite with high potential of commercial development in the future. There are two major issues to be stressed as value added- new technologies and products, both as measurable scientific results regarding clay ceramics, peat extracts and biotechnology.
- The wide extent and numerous dimensions of the research themes, most likely, have stimulated the exchange of ideas, scientific discussions and interaction, facilitating the achievement of high scientific results.

Clay example: Sites studied in details



There much more sites available, however, the raw material is available for new ideas and studies in details

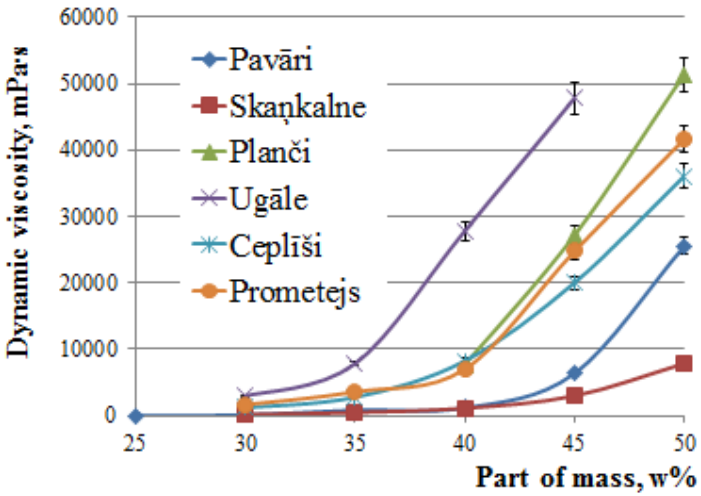
Typical clay mineral composition



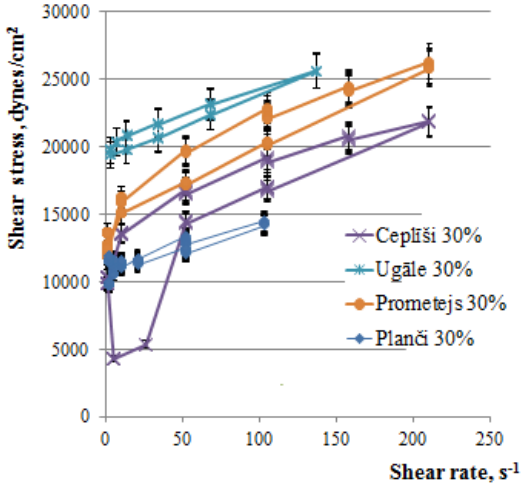
There is a lot of space for new products and innovations *versus* averaging for simple traditional products wit low profile in economics terms

Properties and impact factors of high dispersive systems

Mentioned above is easy to recognize as variability of property of clay, for example, in tests of this modified high dispersive system.

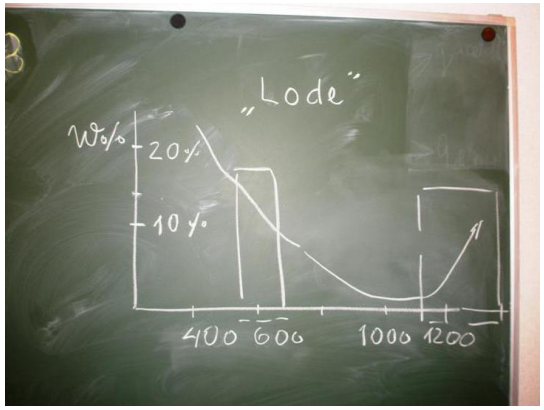


Dynamic viscosity of clay suspensions depending on solid phase concentration



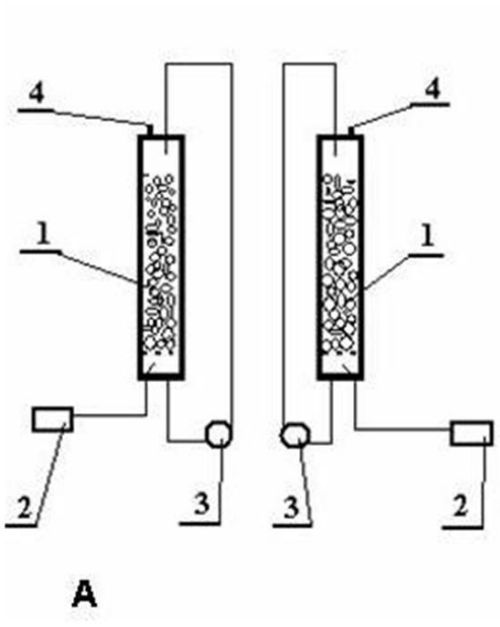
Hysteresis loops of 30% clay-water suspensions

Ceramsite design and new products



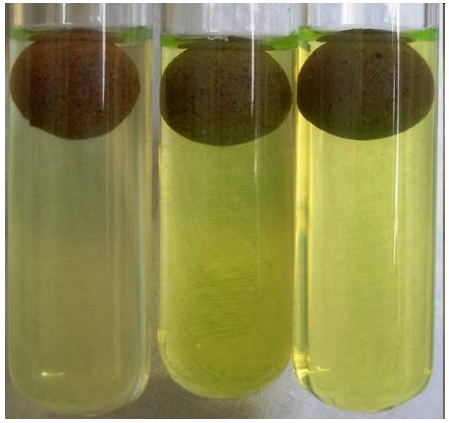
Ceramsite = high porosity expanded clay ceramic

Biofiltration

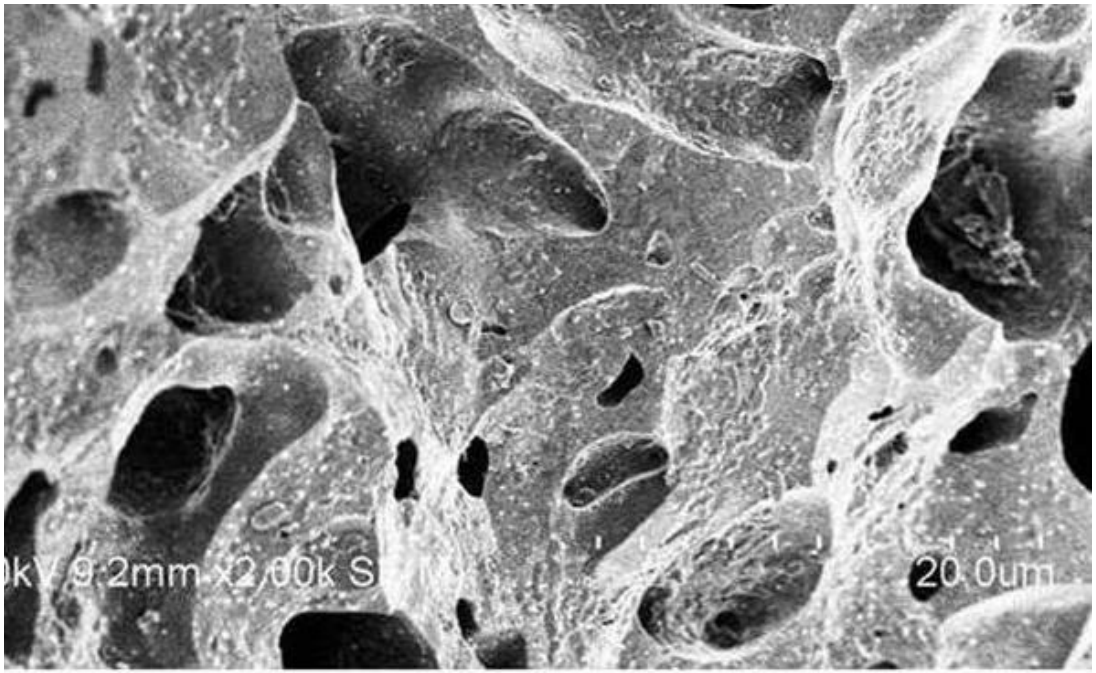


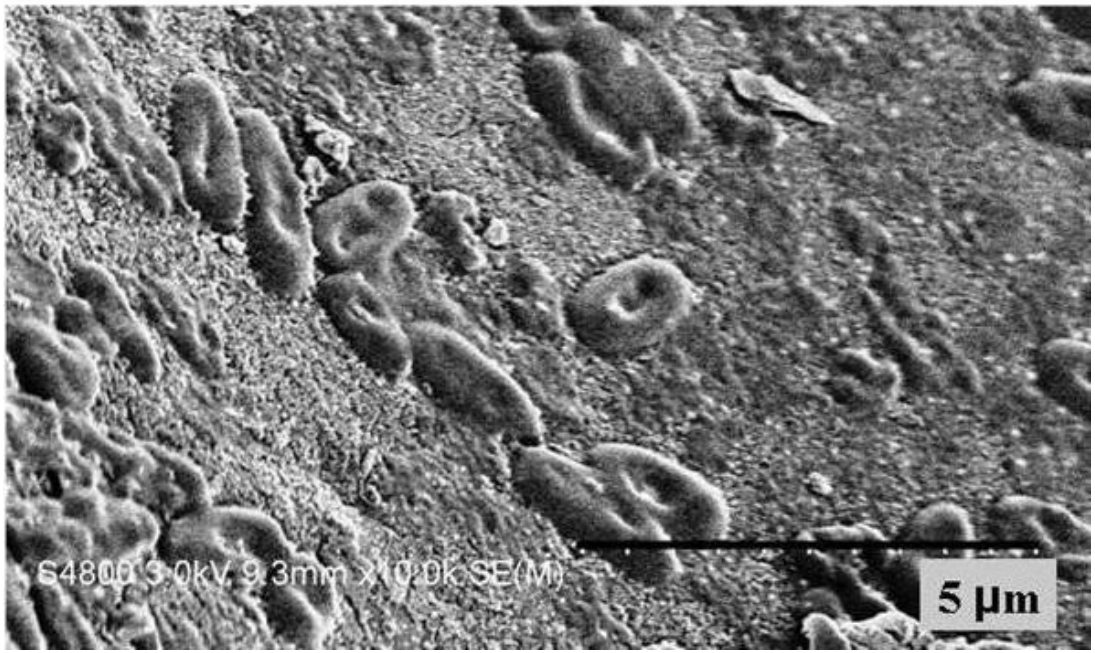
Mag.Biol. Katrīna Potapova performs the experiment with two-columns biofiltration model

From special ceramsite design to biotrickling



In details





Scanning electrom micrographs of the surface of ceramic beads with bacteria cells

Peat properties and new products

From peat bog to high value added sorbents and extracts

Results 2011

- The cooperation and partnership between the scientists have stimulated the exchange of ideas; scientific discussions and interaction are resulted in the achievement of high scientific results already on the second year of the project.
- The results are proved by 3 **doctoral thesis** presented, new researchers involved in the project, one monograph issued, 29 **papers** published in international journals and collective monographs, numerous articles and thesis published in Latvia, but the most significant achievement is the registration of 5 **patents**.
- These patents cover three main and the most efficient research fields with high economic value – technologically advanced products – ceramics, high value added peat products and **biotechnological solutions.**

Long-term perspective

- However, project developed new technological solutions and innovative products do not ensure their introduction in the scale of industrial production, even if such products are useful and economically substantiated.
- There are needs for long term state support for mineral processing industry. At current conditions scientists have limited possibilities to promote and support modernization of the production and, in terms of the current project, this issue is one of the most significant factors in broad sense imposing further development.

More information

- More information available at:
  - National Research Program No. 2010.10-4/VPP-5 “Sustainable Use of Local Resources (Entrails of the Earth, Forest, Food and Transport) – New Products and Technologies (NatRes)”
  - http://www.kki.lv/index.php?lang=en&id=113
  - University of Latvia - http://www.lu.lv/vpp/zeme/


Thank you for your attention!