Questionnaire
Summary of the main activities of a research institute of the Slovak Academy of Sciences

Period: January 1, 2012 - December 31, 2015

1. Basic information on the institute:

1.1. Legal name and address

Earth Science Institute of the Slovak Academy of Sciences
(Geological Institute of the Slovak Academy of Sciences until 30.06.2015)
Dúbravská cesta 9, P.O.Box 106, 840 05 Bratislava

1.2. URL of the institute web site

http://www.geo.sav.sk

1.3. Executive body of the institute and its composition

Directoriat	Name	Age	Years in the position
Director	RNDr. Igor Broska, DrSc.	61	2010 -
Deputy director	RNDr. Pavol Siman, PhD. RNDr. Ján Madarás, PhD. RNDr. Ladislav Brimich, CSc.	53 49 66	2010 - 2013 2013 - 2015 2015 -
Scientific secretary	Mgr. Adam Tomášových, PhD.	38	2010 -

1.4. Head of the Scientific Board

RNDr. Marian JANÁK, DrSc.

1.5. Basic information on the research personnel

1.5.1. Number of employees with university degrees (PhD students included) engaged in research projects, their full time equivalent work capacity (FTE) in 2012, 2013, 2014, 2015, and average number of employees in the assessment period

	2012		2013		2014		2015		total		
	number	FTE	number	FTE	number	FTE	number	FTE	number	averaged number per year	averaged FTE
Number of employees with university degrees	25,0	21,350	25,0	20,200	23,0	20,000	23,0	19,650	**96,0**	**24,0**	**20,300**
Number of PhD students	10,0	7,910	12,0	9,980	9,0	7,770	9,0	6,980	**40,0**	**10,0**	**8,160**
Total number	35,0	29,260	37,0	30,180	32,0	27,770	32,0	26,630	**136,0**	**34,0**	**28,460**

1.5.2. Institute units/departments and their FTE employees with university degrees engaged in research and development

Research staff	2012		2013		2014		2015		average	
	No.	FTE	No.	FTE	No.	FTE	No.	FTE	No.	FTE
Institute in whole	25,0	21,350	25,0	20,200	23,0	20,000	23,0	19,650	**24,0**	**20,300**
Unit Bratislava	14,0	13,050	16,0	12,700	15,0	12,900	15,0	12,550	**15,0**	**12,800**
Unit Banská Bystrica	11,0	8,300	9,0	7,500	8,0	7,100	8,0	7,100	**9,0**	**7,500**

1.6. Basic information on the funding of the institute

Institutional salary budget and others salary budget

Salary budget	2012	2013	2014	2015	average
Institutional Salary budget *[thousands of EUR]*	398,099	397,427	398,256	431,620	**406,351**
Other Salary budget *[thousands of EUR]*	30,596	41,779	52,977	55,498	**45,213**

1.7. Mission Statement of the Institute as presented in the Foundation Charter

a. The Institute carries out and develops basic research on mineralogy, petrology, geochemistry, geochronology, tectonics, palaeoclimatology, palaeogeography, palaeontology, sedimentology, sequence stratigraphy, evolutionary biology, environmental geochemistry and raw materials. Scientific activity is oriented towards comprehensive research on geological structures, their material composition, geodynamic evolution and dynamic of ecosystems of the Earth. The research is bound not only to the territory of the Slovak Republic.

b. The research is organized in the framework of the national funding sources and international cooperation. It is interdisciplinary research on the edge of fields of geology, chemistry, physics, biology and climatology.

c. The institute develops geoscience disciplines by solving research grants and tasks. It takes part in international scientific projects and collaborates with Earth science institutions abroad. It participates in the transfer of scientific information into practice. By scientific popularizing and educational activities it contributes to the growth of knowledge and cultural level of Slovakia's population.

d. Institute provides PhD study within the framework of valid Slovak legislation.

e. Institute is publisher of international scientific periodical Geologica Carpathica indexed in the Web of Science.

1.8. Summary of R&D activity pursued by the institute during the assessment period in both national and international contexts, (recommended 5 pages, max. 10 pages)

The research activities of the Geological Institute have been directed towards the fields of (1) petrology and mineralogy (2) palaeobiology and sedimentology and (3) metallogeny and environmental geochemistry. Most of the Institute's projects have international dimensions and are carried out in collaboration with foreign colleagues mainly from countries of the European Union, Norway, Ukraine, Russia, USA, Japan and China. Most of the research results are published in high ranked journals, including Science.

(1) Petrology and mineralogy

Granitic rocks

Granitoids have been studied from various genetic aspects in various places around the Europe. For the Institute's granite group the most important aspects are the interactions among accessory and rock-forming minerals and their bearing on the petrological and age evolution of granitoids. Among accessories, the groups of allanite – monazite – apatite (Broska et al. 2012, 2013), magnetite – ilmenite – titanite (Broska & Petrík 2014), and aluminophosphates – topaz – apatite (Petrík et al. 2014) were the most studied. The assemblages were treated along with their rock-forming counterparts, biotite, hornblende, muscovite and Li-micas. (1) Breakdown of monazite, a widespread phenomenon (for the first time described in the Western Carpathians and Eastern Alps) was studied in detail from various granite types (Ondrejka et al. 2012, Uher et al. 2015). Several types of secondary coronas were identified and attributed to both Permian and Alpine overprints. (2) Biotite in association with Fe-Ti oxides provides important information on late- to post-magmatic stages of I-type granitoid evolution (Broska & Petrík, 2012, 2015). These minerals indicate that their parental rocks experienced an oxidation event whereby they changed their composition and proportions: biotite lost Fe to magnetite and Ti to titanite, thus forming typical properties of the I-type granitoid suite, such as high magnetic susceptibility. (3) In addition to granites, migmatites were also studied (Čík & Petrík 2014) where retrogression and Alpine overprint were calculated using the mineral associations involving margarite and pumpellyite. (4) Specialized Permian granites from the Gemeric unit represent another family of granitoids, influenced by high contents of volatiles (F, B, H_2O) and highly increased P, Rb, Li concentrations. A model of their evolution (Breiter et al. 2015) involves differentiation into three levels, postmagmatic retrogression and a strong Alpine reworking. Their minerals record intensive low temperature overprint which caused a strong oxidation of micas and formation of low temperature aluminophosphates (Petrík et al. 2014). The results based mostly on petrological and mineralogical aspects of the studied granitoids were used for interpretation of some tectonic features and age data obtained from I-type granitoids. (5) The monazite dating from tonalites and vein leucogranites from the Tribeč Mts. enabled identification of Variscan thrusting of these rocks at ca. 340 Ma (Broska & Petrík 2015). (6) However, the main I-type granite magmatism in the Western Carpathians was older starting as early as 365 Ma ago as determined by single zircon dating (Broska et al. 2013). The authors presented a model of Variscan magmatism emphasizing that the ages are among the oldest from Variscan granitoids in Europe. The ages were interpreted as indicating an early subduction of the Palaeotethys below an assemblage of Gondwana-derived fragments (eastern continuation of the Galatian terrane). They probably intruded in a magmatic arc and were preceded by diorite magma, which was partly incorporated into the granite in the form of enclaves. The scenario is in accord with the arc geochemical signature typical of all Tatric and Veporic Variscan granitoids.

Volcanic rocks

Volcanological research has been performed in Upper Miocene-Pleistocene intra-plate volcanic structures in the northern part of the Pannonian Basin. Hurai et al. (2013a) applied for the first time the combined U/Pb and (U-Th)/He geochronometry to direct dating of maars and pyroclastic deposits. They showed that some presumably Quaternary maar structures actually originated during the Pliocene. The U-Pb method has been employed to dating the fluvial deposits of the Hajnáčka maar — a world-famous locality for mammal fauna (Hurai et al. 2012). The age of the maar has been determined together with that of the subsequent volcanic eruption that killed the mammal fauna some 3 Ma years ago. Hurai et al. (2013b) described the world's second occurrence of magmatic aragonite from the Hajnáčka diatreme. They explained its crystallization as a consequence of overpressure in the basaltic magma chamber formed along the mantle-crust boundary.

K/Ar and Rb/Sr dating carried out on rocks of the Štiavnica stratovolcano hosting a world-class epithemal mineralization attested its shorter lifespan than previously assumed. Evolution of the stratovolcano took place in five stages during the interval 15.0 – 11.4 Ma, with emplacement of a subvolcanic intrusive complex and caldera collapse between 13.5 and 12.7 Ma. The final stage of a resurgent horst uplift and rhyolite activity took place in the interval 12.2 – 11.4 Ma. Epithermal mineralization was contemporaneous with this stage continued till 10.7 Ma (Chernyshev et al.,

2013). Palaeovolcanic reconstruction of rhyolite volcanic formation in central and eastern Slovakia revealed their complex evolution and previously unrecognized monogenetic type of individual volcanoes, including an early stage of phreatomagmatic explosive eruptions (Lexa & Pošteková, 2012, Lexa et al., 2014, 2015). Results of this kind are important in volcanic risk evaluation of active volcanoes. A comprehensive investigation of the iconic Devil's Tower phonolite monolith in Wyoming, USA and associated pyroclastic rocks, including thermal and analogue modelling, revealed that the monolith is probably not an intrusion as generally assumed, but rather a low lava dome emplaced into a broad phreatomagmatic crater at the top of a maar-diatreme volcano (Závada et al., 2015).

Metamorphic processes: High-pressure and ultrahigh-pressure metamorphism

The research was focused on phase transformations of high-pressure and ultrahigh-pressure rocks during subduction and exhumation of Earth's continental lithosphere. The investigated rocks were mantle-derived garnet peridotites, eclogites and their host crustal rocks (gneiss, migmatite, marble). The working areas included the Eastern Alps (Pohorje, Slovenia), Scandinavian Caledonides (Tromsø and Seve nappes in Norway and Sweden), Rhodope (southern Bulgaria, northern Greece) and crystalline complexes of the Bohemian Massif and the Western Carpathians. These served as case studies for the tectonometamorphic evolution in the collisional orogens of different ages. Major objectives of the research included: (1) Identification of mineral assemblages stable during distinct stages of metamorphic evolution, especially at (ultra) high pressure and evaluation of their composition. (2) Determination of thermodynamic (P-T-x) parameters based on phase equilibria modelling and geothermobarometric calculations. (3) Reconstruction of the P-T-t evolution and geodynamic interpretation of metamorphism and crust-mantle relationships in the continental subduction/collision zones.

In the investigated areas - Tromsø Nappe, Norway (Janák et al. 2013), Seve Nappe, Sweden (Majka et al., 2014), Pohorje, Slovenia (Janák et al. 2015) - we discovered metamorphic diamond and moissanite (Janák et al., 2015). Diamond and moissanite (natural silicon carbide) were identified in metamorphosed sediments (paragneisses) as single or polyphase inclusions with CO_2 and CH_4 in garnet. To our knowledge, this is the first record of moissanite along with diamond as fluid-inclusion daughter minerals in crustal metamorphic rocks. Our results show that diamond and moissanite precipitated from a supercritical fluid in the C-O-H-Si system, under highly reducing, ultrahigh-pressure conditions (≥3.5 GPa; 800-850 ℃). These can be expected in dept hs exceeding 100 km during subduction of continental crust into the upper mantle. The source of carbon for diamond and moissanite could be biogenic C from subducted sediments. Our investigations are in line with experimental results on the origin of diamond and moissanite in ultrahigh-pressure rocks.

Following the first evidence of ultrahigh-pressure metamorphism in Pohorje Mts. (Janák et al. 2004) we extended our research on eclogites, documenting their P-T conditions of 3.5-4 GPa and 750-900 ℃ (Vrabec et al. 2013), rare chromium-rich minerals- kyanite, Mg-staurolite and corundum (Janák et al. 2015), and water-bearing omphacite (Skogby et al. 2016). Chromium contents in kyanite (17% Cr_2O_3) and staurolite (15% Cr_2O_3) are the highest known in these minerals. UHP metamorphism in Pohorje and the Eastern Alps resulted from intra-continental subduction during the Late Cretaceous (ca. 95 Ma), as documented by geochronological dating.

In the Scandinavian Caledonides our research has been carried out in the northern Norway (Tromsø nappe) and central Sweden (Seve Nappe Complex, SNC), resulting in discovery of diamond in gneisses from Tromsø (Janák et al., 2013) and UHP metamorphism of eclogite in the Seve Nappe (Janák et al. 2013). This was followed by first finding of diamond in Sweden, in the Snäsahogarna Mts. (Majka et al., 2014). We proposed that the diamond-bearing rocks were subducted in an arc-continent collision setting, at ca. 450 Ma, when the Baltic margin collided with the forearc block causing subduction of the SNC rocks to a depth of >100 km and their exhumation was facilitated by local pressure reduction resulting from extraction of the forearc lithospheric block (Majka et al., 2014).

All the results as summarized above are important for understanding of global geological processes in the collisional orogenic zones. UHP metamorphism records a very deep subduction (>100 km) of continental crust into the upper mantle; the subduction can be intra-continental like in the Eastern Alps, witnessed by formation of diamond and moissanite. Re-cycling of carbon and other elements is facilitated by fluids derived from the subducting slab. UHP rocks can be exhumed due to extraction of the overlying lithosphere that enables a rapid uplift without a necessity of erosion as in the Eastern Alps or Scandinavian Caledonides.

(2) Palaeobiology and sedimentology

Mesozoic and Cenozoic biotic events of global significance

Time intervals that capture important environmental, climatic and biotic events, including mass extinctions of global and regional significance, and ocean anoxic events, are of major importance in understanding the dynamic of climate, global carbon cycle, sea-level history and the dynamic of ecosystems. Therefore, our research focused on the stratigraphy, sedimentology, geochemistry and palaeoecology of Mesozoic and Cenozoic formations that preserved stratigraphic records of the end-Triassic and end-Cretaceous extinctions, Palaeocene-Eocene thermal maximum, and other events.

Triassic-Lower Cretaceous.

Latest Triassic environmental changes investigated by an integrated study of sedimentology, cyclostratigraphy, palaeoecology, mineralogy, geochemistry, and rock magnetism (Tatra Mountains; Michalik et al. 2013) showed marked environmental and ecosystem variability in a marine carbonate ramp setting and a climatic control on depositional environments during the time interval that precedes the global end-Triassic mass extinction (Lintnerová et al. 2013). Šimo and Tomašových (2013) found that the trace-fossil assemblages preserved in the Lower Jurassic spotty marls and limestones are indicators of hypoxic conditions because shallow-tier trace fossils are significantly enriched in total organic carbon, explaining the rarity of carbonate producers in such facies.

Environmental events and perturbations occurring during the Cretaceous were assessed in several studies. Depositional conditions during the Early Cretaceous shifted from the deposition of planktogenic hemipelagic limestones, starting during the earliest Valanginian and terminating during the Aptian, with no signs of the late Valanginian anoxic oceanic event (Michalik et al. 2012) but with the presence of significant carbon isotope anomaly in Upper Valanginian limestones. The carbonate platform covered elevated parts in the area until the Late Aptian. The growth of the carbonate platform terminated and collapsed during the Middle Albian. High-resolution stratigraphic analyses in the Dolomites (Alps) at the Puez section allowed (1) new geochronological dating of stratigraphic stages ranging from the Valanginian up to the Cenomanian, (2) delineation of anoxic events (Weissert, Faraoni, Jacob, and Breistroffer events), and (3) definition of magnetostratigraphic zones and isotope anomalies (Lukeneder, Soták et al. 2016).

Upper Cretaceous-Cenozoic.

Indicators of environmental stress in the Upper Cretaceous and Palaeogene strata of the Western Carpathians allowed us to detect recoveries of destabilized Palaeocene ecosystems, and their changes during the Palaeocene-Eocene thermal maximum, during the Mid-Eocene climatic optimum, and during the cooling at the Eocene/Oligocene boundary (Ozdínová & Soták 2015). Sedimentological research on Palaeogene depositional systems revealed the effects of relative sea level changes and climatic changes during the Late Eocene in the Orava Basin (Central Western Carpathians), and suggested the presence of retrograde delta development, followed by continuous deepening of the depositional environment during the late Priabonian/early Rupelian (Starek et al. 2012). Starek et al. (2013) documented the presence of large-volume gravity flow deposits in the Central Carpathian Palaeogene Basin and provided evidence that they reflect hyperpycnal river discharge in deep-sea fans, and Šimo & Starek (2015) found that unusual sand spherules preserved in the Eocene intertidal to subtidal sandstones represent crustacean feeding pellets. They represent the oldest findings of feeding pellets of crustaceans. Šimo & Starek (2015) found an unusual record of ghost shrimps in the Late Miocene brackish lake environments of the Vienna Basin.

Plašienka & Soták (2015) presented a new interpretation of the synorogenic sedimentary record of the Pieniny Klippen Belt and neighbouring zones of the Western Carpathians, which developed during the meso-Alpidic (Coniacian–Eocene) tectonic epoch, as being related to various environments of the foreland basin system consisting of the trench-foredeep and wedge-top depositional areas. They suggested that the peripheral trench-foredeep depozones migrated from the South Penninic-Vahic oceanic realm towards the Oravic continental fragment in an intra-Penninic position, where the synorogenic deposits were laid down with coarsening- and thickening-upward trends before being overthrust by the propagating orogenic wedge tip. The development of wedge-top, piggyback basins (Gosau Supergroup) was controlled by the dynamics of the

underlying wedge, composed of frontal elements of the Fatric and Hronic cover nappe systems of the Central Western Carpathians (Austroalpine units).
Our researchers also contributed to the synthesis of basin and palaeogeographic evolution of the Western Carpathians and Northern Pannonian Domain during the Cenozoic (Kovac, Sotak et al. 2016), illustrated by a series of palinspastic and palaeotopographic maps. Analyses of the tectonic history of Late Cretaceous and Palaeogene basins in the Western Carpathians allowed us to reconstruct the palaeogeographic configuration of these basins and their evolution in the Alpine-Carpathian junction area, providing a new view on the distribution of depositional zones and depocenters, on connectivity between the Western Carpathian basins with the Dinarid basins and the Magura Ocean.

Evolutionary palaeobiology, macroevolution and biogeography of Cenozoic ecosystems

Large-scale distribution patterns of marine invertebrates at broad spatial and temporal scales and their diversity gradients provide ideal opportunities for understanding the effects of environmental factors on their diversification rates. We primarily worked with biogeography, macroevolution and macroeology of Cenozoic molluscan and ostracod assemblages.

Ostracods.
Pipik et al. (2012) analysed ostracod assemblages in the Turiec Basin (TB, Western Carpathians) during the Late Miocene, together with macrofaunal assemblages and Sr-isotope ratios. After the closure of the connection with the Central Paratethys, the Turiec Basin became an isolated and a relatively long-lived freshwater lake (exceeding 1 Ma), with five ecological zones inhabited by distinct ostracod communities. Their evolution was affected primarily by the bathymetrical differentiation of the lacustrine environment and ecological and bathymetrical segregation of the species. Taxonomic comparison of the faunas of the Turiec Basin and the freshwater to brackish Neogene basins of Europe demonstrates the endemic character of the TB ostracod fauna (Neubauer et al., 2015; Ognjanova-Rumenova & Pipík, 2015). On the basis of palaeoecological analyses of 52 ostracod species, Seko et al. (2012), identified a shallowing-upward trend, temporal changes in sedimentation rate and episodic changes in water column stratification in a Lower Badenian section (Židlochovice) in the Carpathian Foredeep (Doláková et al., 2014), and hypothesized that the deepest part of the Carpathian Foredeep was probably situated in this part of the Czech Republic due to a high proportion of deep-water ostracod species in this section. Seko et al. (2015) comprehensively assessed temporal and biogeographic distribution of the marine genus Heliocythere of which the biogeographical trajectory is strongly related to opening and closure of the sea-way connections. It originated during the Oligocene, attained a relatively broad geographic range during the Serravalian, and diversified and spread through the entire Mediterranean area and extended its biogeographic range to the eastern Atlantic Ocean during the Late Miocene. It went extinct during the Late Miocene or Early Pliocene.

Molluscs.
Tomašových et al. (2014, Proceedings of the Royal Society B) tested whether onshore-offshore gradients in long-term turnover of macrobenthic communities during the Cenozoic can be extrapolated from gradients in short-term turnover, using molluscan metacommunities from the Northeastern Atlantic Province. They found that temporal turnover of such metacommunities does not significantly decline with depth over short durations (less than 5 Ma), but significantly declines with depth between the Eocene and Plio-Pleistocene (~50 Ma). Onshore-offshore decline in turnover thus emerges only over long temporal durations. Tomašových et al. (2015, Global Ecology and Biogeography) modelled the consequences of the biogeographic scenario where species living at latitudes that have greater annual temperature variations are expected to achieve broader geographic ranges than species living at lower latitudes. Such a scenario generates a positive relationship between range size and latitude (Rapoport's rule). They improved this scenario by taking into account the greater latitudinal extent of tropical temperatures relative to those at higher latitudes, and found that models incorporating temperature-limited range expansion along realistic thermal gradients predict an inverse relationship between range size and latitude, in opposition to Rapoport's rule, and that the distribution patterns of marine bivalves matched this prediction. The poleward trend in latitudinal range size is thus primarily determined by the nonlinearity of the latitudinal gradient of temperature minima and maxima. Latitudinal gradients in clade expansion and in body size of benthic invertebrates were further evaluated by Jablonski et

al. (2013, Proceedings of the National Academy of Sciences USA) and Berke et al. (2013, Global Ecology and Biogeography). Tomašových et al. (2016, Proceedings of the Royal Society B) attempted to resolve the contrasting biogeographical patterns between marine and terrestrial systems at global scales because marine and terrestrial clades show similar latitudinal gradients in species richness, but opposite gradients in range size (on land, ranges are the smallest in the tropics, whereas in the sea, ranges are the largest in the tropics). Therefore, richness gradients in marine and terrestrial systems do not arise from a shared latitudinal arrangement of species range sizes. They found that gradients in range size are concordant at the level of genera, suggesting that within-genus species diversification thus promotes genus expansion to novel latitudes.

Taphonomy and conservation palaeobiology of fossil assemblages

Age-frequency distributions of dead skeletal material on the landscape or seabed - information on the time that has elapsed since the death of individuals - provide unique decadal, centennial and millennial-scale perspectives on the history of production during the Holocene and Anthropocene, as well as on the taphonomic processes that lead to skeletal disintegration and burial.
Kidwell & Tomašových (2013; Annual Reviews of Ecology, Evolution and Systematics) summarized the state of the art in the use of Holocene subfossil assemblages in conservation palaeobiology. Meta-analyses, dynamic modelling, and individual case studies, particularly of mollusks and mammals, revealed that subfossil assemblages differ from living assemblages, primarily because they are temporally coarse, time-averaged samples, contrary to concerns that taphonomic bias dominates. Tomašových et al. (2014; Geology) used an extensive shell age-dating program on the Southern California (USA) shelf to model the dynamics of shell loss in the surface mixed layer and to quantify the rates of carbonate disintegration for the first time. They found that bivalve shells experience an initially high disintegration rate with ~ decadal half-lives) but shift abruptly, within the first ~500 yr postmortem, to ~ millennial half-lives due to burial and/or diagenetic stabilization. Our two-phase model of shell loss shows how shell age-frequency distributions can yield rigorous and realistic estimates of carbonate recycling on geological time scales. To improve inferences in conservation palaeobiology and historical ecology, Tomašových et al. (2016, Palaeobiology) evaluated the joint effects of temporally-variable production and skeletal loss on postmortem age-frequency distributions (AFDs) to determine how to detect fluctuations in production over the recent past from AFDs. They showed that, relative to the true timing of past production pulses, the modes of AFDs will be shifted to younger age cohorts, causing the true age of past pulses to be underestimated.

Systematics, phylogeny, and functional morphology

Several researchers were working on the systematics, functional morphology and phylogeny of several invertebrate and vertebrate clades, mainly vertebrates and insects, to better understand the natural history of clades that underwent adaptive radiations.

Vertebrates.
The research on reptiles revealed the first modern squamates in the Early Miocene of Europe on the basis of a large number of specimens from Wiesbaden-Amöneburg in western Germany (Čerňanský 2015, Journal of Systematic Palaeontology). A temporary return to a paratropical humid climate in the Early Miocene, after the relatively cool and dry Oligocene to Europe, was associated with origination or immigration of new species, possibly also associated with the collision of Eurasia with Africa. Comparative anatomy of the atlas-axis complex in all chameleonid genera revealed new phylogenetic relations in chameleonids (Anatomical Record 2014). Morphological aspects of Cenozoic squamate reptiles were described by Čerňanský in a series of papers, including findings from Germany (Palaeontology 2013), France (Journal of Vertebrate Palaeontology, 2015), New South Wales (Alcheringia, 2015), Czech Republic (Geodiversitas 2012). Kundrát, Soták & Ahlberg (2015) discovered the oldest bird remains in the Palaeogene formations of the Western Carpathians, assigning the finding to the small birds of the clade Upupiformes.

Insects.
In a series of papers, fossil cockroaches were described from the Late Permian, from the Middle Jurassic of China (Liang et al. 2012), from the Palaeocene of the Russian Far East (Vršanský et al. 2013, Zootaxa), and the earliest termite of the extant genus Mastotermes were described from the

Jurassic/Cretaceous (J/K) transitional beds of Transbaikalian Russia, representing the earliest eusocial organisms (Vršanský & Aristov, 2014, European Journal of Entomology). Vršanský et al. (2012, Insect Science) found a cockroach genus that shares several autapomorphies within the advanced and highly derived living cockroach genus. This genus has extant occurrence in the Caribbean and South America and thus represents important evidence for the occurrence of derived living genera of cockroaches that are ca 50 Ma old. Vršanský et al. (2014, Annals of the Entomological Society of America) described cockroaches of the genus Ectobius from the Lower Eocene Green River Formation. This genus later disappeared from North America, but was re-introduced to North America 49 million years later by a cool-adapted Ectobius lapponicus. Vršanský et al. (2012) showed that photo-characteristics of three Recent cockroach species are nearly identical with those of toxic luminescent click beetles, suggesting that cockroached mimic the beetles.

(3) Metallogeny and environmental geochemistry

The Neogene Central Slovakia Volcanic Field contains various Au deposits, hosted by central zones of large andesite stratovolcanoes. Fluids involved in mineralization have been studied at three different types of deposit, mostly by fluid inclusion and stable isotope techniques. The intermediate sulphidation-style Au–Ag epithermal mineralization on subhorizontal veins related to early stage of the Štiavnica stratovolcano caldera collapse shows fluids of low salinity that underwent extensive boiling at 280–330 °C on transition from suprahydrostatic towards hydrodynamic conditions at shallow depths (ca. 550 m) from fluids of mixed magmatic and meteoric origin. The Kremnica system of low sulphidation-style Au–Ag veins contemporaneous with rhyolite magmatism and situated on resurgent horst faults shows fluids of low salinity, predominantly of meteoric origin. A gradual decrease in temperature along the system (c. 270–140 °C) is related to a decrease in erosion level from ca. 500 to ca. 50 m (Koděra et al., 2014a). The recently discovered Biely Vrch deposit in the Western Carpathian magmatic arc is the most extreme example of a porphyry gold deposit, being practically free of copper, molybdenum or any other sulfide minerals. Microanalytical data on fluid inclusions in quartz veinlets show that this deposit formed from nearly anhydrous Fe-K-Na-Cl salt melts containing ~10 ppm Au, coexisting with hydrous vapor of very low density. This exceptional fluid evolution required an Fe-rich dioritic source magma that was emplaced at shallow subvolcanic depth (<3.5 km), directly exsolving a hypersaline liquid and magmatic vapor at high temperature (~850 °C). During ascent to the level of the porphyry intrusion (0.5–1 km), fluid expansion at high temperature but low pressure led to halite precipitation and further water loss to the vapor, generating an increasingly Fe-K-rich salt melt that transported high concentrations of Au but negligible Cu into the fractured porphyry stock (Koděra et al., 2014a,b). Based on mineral thermobarometry the porphyry system evolved in the temperature interval 850 to < 380 °C (Koděra et al., 2013). An interaction of salt melts with host porphyry produced a unique association of Cl and F rich secondary minerals including new members of the mica and amphibole groups (Lexa et al., 2014). These results extend knowledge on porphyry Au deposits world-wide and are directly applicable to their exploration.

Research activity concentrated also on other Tertiary sub-volcanic base-metal and Cu-porphyry deposits of Carpathians and Dinarides. Apopei et al. (2014) provided new data from optical microscopy, electron probe microanalysis and Raman spectroscopy on rare Au-Ag and Ag tellurides - hessite and stützite, from Metaliferi Mountains of Romania. They documented their primary origin and crystallization during late stages of mineral formation of the famous Coranda-Hondol deposit. Uher et al. (2015) identified the rare Zr-rich garnet – kerimasite, from Ca-Mg skarns developed along the exocontact of a granodiorite intrusion in the Cu-Au deposit of Vysoká-Zlatno in the Stiavnica stratovolcano. They documented substitution mechanisms and accompanying changes in physical properties. Jeleň et al. (2012) provided mineralogical characteristics of rare bismuth sulfosalts – cuprobismuthite, pavonite, and aikinite, from the only active ore mine in Slovakia – the Rozália Mine in Hodruša-Hámre of the Štiavnica Stratovolcano. Borojević Šoštarić et al. (2013) provided genetic model of an epithermal Pb-Zn-Ag deposit Crnac in Kosovo based on isotope, fluid inclusion and radiometric data. They defined several mineralization stages and showed that mineral deposition was initiated by the neutralization of primary acidic magmatic fluid by water-rock interactions that caused extensive propylitization and sericitization.

Additional effort has been devoted to elucidate origin of siderite-polymetallic deposits in the Variscan basement of Western Carpathians. Hurai et al. (2015b) determined U-Pb-Th isotopes in

zircon and monazite from albitite metasomatites of a siderite deposit in southern Slovakia, and corroborated the previous model of formation of siderite veins in arcuate tectonic front developed as a response to thrusting of nappe units during an Early Cretaceous compression.
Research in the field of environmental mineralogy has been targeted on mineral equilibria, assemblages, properties, and risk assessment of dumps from historical Cu-deposits of Slovakia (Špania Dolina, Ľubietová). Thermodynamic properties and phase equilibria among natural and synthetic secondary Cu minerals have been studied. These are essential for the assessment of stability limits of the phases precipitated in oxidation zones of copper deposits. Kharbish et al. (2014) characterized rare Cu-phosphate minerals - cornetite, libethenite, pseudomalachite, reichenbachite and ludjibaite. They employed the Raman spectroscopic method to reveal differences in spectral characteristics of individual minerals induced by their structural properties, such as bond lengths and the reduction of PO_4 symmetry. Andráš et al. (2012), (2013) and Franková et al. (2012) performed geochemical study of dump materials, and characterized potential risks that may occur in future due to leaching of heavy metals by acid mine drainage waters.

Heat flow and Fluid migration

Milovský et al. (2012) studied textures, fluid inclusions and stable isotopes in tectonic breccias from the base of the Muráň nappe (Western Carpathians). They concluded that the Alpine nappe movement has been accompanied by fluid overpressure, whereas high-salinity brines may have served as lubricant medium facilitating the movement along the thrust plane. Slobodník et al. (2012) studied fluid flow and migration in the Prague Synform of the Barrandian Basin, Czech Republic, using fluid inclusion and stable isotope data. They showed that the migration of various types of hydrocarbon-bearing aqueous fluids has been confined to specific lithologies. Hurai et al. (2015a, Elsevier) published world class monograph devoted to research and interpretation of fluid inclusion, spectrometric, stable isotope and thermodynamic data, with working examples based on long-lasting experience with the geofluid research in Slovakia. Problems were associated also with the origin and migration paths of ore-forming fluids in the Thuringian Basin, Germany. They showed that low temperature basinal brines mobilized Fe and Mn, and these elements were redeposited as siderite-ankerite veinlets within carbonate rocks, or hematite+Mn-oxide ores in oxidising environment of Permian volcanoclastic rocks. A study of caves north of Banská Štiavnica, using stable isotope data and fluid inclusions, revealed their hydrothermal origin due to dissolution of limestones by hot hydrothermal fluids coincidental with subvolcanic magmatic activity in the Štiavnica stratovolcano.

2. Partial indicators of main activities:

2.1. Research output

2.1.1. Principal types of research output of the institute: basic research/applied research, international/regional (ratios in percentage)

basic/applied research 80/20
international/regional 100/0

Comments: The research at the former Geological Institute Slovak Academy of Sciences and recently Earth Science Institute SAS is defined clearly as basic and international, even in the cases when the studied samples have been taken from localities in the territory of Slovakia. By virtue of our main object of research, the Earth's crust, our research publications have always some international significance and implications. The exception is popularization, which is not really a research activity. In this moment our last applied research activity was a contract with Nafta a.s. (direct industrial partnership) and obtained results offer also good material for publications. Therefore, our estimation of applied activity of the institution is rather low, ca. 20 %.

2.1.2 List of selected publications documenting the most important results of basic research. The total number of publications listed for the assessment period should not exceed the average number of employees with university degrees engaged in research projects. The principal research outputs (max. 5, including Digital Object Identifier - DOI) should be underlined

1. ČERŇANSKÝ A.: *The oldest know European Neogene girdled lizard fauna (Squamata, Cordylidae), with comments on Early Miocene immigration of African taxa*. In Geodiversitas, 2012, vol. 34, no. 4, p. 837-848. (1.266 - IF2011). (2012 - Current Contents). ISSN 1280-9659.
2. JANÁK M., KROGH RAVNA E. J. & KULLERUD K.: *Constraining peak P-T conditions in UHP eclogites: calculated phase equilibria in kyanite- and phengite-bearing eclogite of the Tromsø Nappe, Norway.* In Journal of Metamorphic Geology, 2012, vol. 30, p. 377-396. (2.990 - IF2011). (2012 - Current Contents). ISSN 0263-4929. doi:10.1111/j.1525-1314.2011.00971.
3. MILOVSKÝ R., VAN DEN KERKHOF A., HOEFS J, HURAI V. & PROCHASKA W.: *Cathodoluminescence, fluid inclusion and stable C-O isotope study of tectonic breccias from thrusting plane of a thin-skinned calcareous nappe.* In International Journal of Earth Sciences, 2012, vol. 101, no. 2, p. 535-554. (2.342 - IF2011). (2012 - Current Contents). ISSN 1437-3254. doi:10.1007/s00531011-0685-8.
4. PIPÍK R., BODERGAT A.M., BRIOT D., KOVÁČ M., KRÁĽ J. & ZIELINSKI G.: *Physical and biological properties of the late Miocene, long-lived Turiec Basin, Western Carpathians (Slovakia) and its paleobiotopes.* In Journal of Paleolimnology, 2012, vol. 47, p. 233-249. (1.898 - IF2011). (2012 - Current Contents). ISSN 0921-2728.
5. STAREK D., SLIVA Ľ. & VOJTKO R.: *Eustatic and tectonic control on late Eocene fan delta development (Orava Basin, Central Western Carpathians).* In Geological Quarterly, 2012, vol. 56, no. 1, p. 67-84. (0.844 - IF2011). (2012 - Current Contents). ISSN 1641-7291.
6. VRŠANSKY P., CHORVÁT D., FRITZSCHE I., HAIN M. & ŠEVČÍK R.: *Light-mimicking cockroaches indicate Tertiary origin of recent terrestrial luminescence.* In Naturwissenschaften (The Science of Nature), 2012, vol. 99, no. 9, p. 739-749. (2.278 - IF2011). (2012 - Current Contents). ISSN 0028-1042
7. HURAI V., HURAIOVÁ M., MILOVSKÝ R., LUPTÁKOVÁ J. & KONEČNÝ P.: *High-pressure aragonite phenocrysts in carbonatite and carbonated syenite xenoliths within an alkali bas*alt. American Mineralogist, 2013, vol. 98, p. 1074-1077. (VEGA 2/0069/13)
8. ANDRÁŠ P., DIRNER V., KHARBISH S. & KRNÁČ J.: *Characteristics of heavy metal distribution at spoil dump-fields of Cu-deposit Ľubietová (Slovakia).* In Carpathian Journal of Earth and Environmental Sciences, 2013, vol. 8, no. 3, p. 87-96. (1.495 - IF2012). ISSN 1842-4090.

9. ČERŇANSKÝ A. & AUGÉ M.L.: *New species of the genus Plesiolacerta (Squamata: Lacertidae) from the Upper Oligocene (MP28) of southern Germany and a revision of the type species Plesiolacerta Lydekkeri.* In Palaeontology, 2013, vol.56, part 1, p. 79-94. (1.652 - IF2012). (2013 - Current Contents). ISSN 0031-0239.
10. BROSKA I., PETRÍK I., SHLEVIN Y.B., MAJKA J. & BEZÁK V.: *Devonian/Mississippian I-type granitoids in the Western Carpathians: A subduction-related hybrid magmatism.* In Lithos, 2013, vol. 162-163, no. 1, p. 27-36. (3.779 - IF2012). (2013 - Current Contents). ISSN 0024-4937.
11. JANÁK M., VAN ROERMUND H.L.M., MAJKA J. & GEE D.G.: *UHP metamorphism recorded by kyanite-bearing eclogites from the Seve Nappe Complex of northern Jämtland, Swedich Caledonides.* In Gondwana Research, 2013, vol. 23, p. 865-879. (7.396 - IF2012). (2013 - Current Contents). ISSN 1342-937X
12. JANÁK M., KROGH RAVNA E.J., KULLERUD K., YOSHIDA K., MILOVSKÝ R. & HIRAJIMA T.: *Discovery of diamond in the Tromsø Nappe, Scandinavian Caledonides (N. Norway).* In Journal of Metamorphic Geology, 2013, vol. 31, p. 691-703. (3.400 - IF2012). (2013 - Current Contents). ISSN 0263-4929. (APVV-0080-11) . doi:10.1111/jmg.12040
13. MICHALÍK J., LINTNEROVÁ O., WÓJCIK-TABOL P., GAŹDZICKI A., GRABOWSKI J., GOLEJ M., ŠIMO V. & ZAHRADNIKOVÁ B.: *Paleoenvironments during the Rhaetian transgression and the colonization history of marine biota in the Fatric Unit (Western Carpathians).* In Geologica Carpathica, 2013, vol. 64, no. 1, p. 39-62. (1.143 - IF2012). (2013 - Current Contents). ISSN 1335-0552 (VEGA 2/0065/12).
14. STAREK D., SOTÁK J., JABLONSKÝ J. & MARSCHALKO R.: *Large-volume gravity flow deposits in the Central Carpathian Paleogene Basin (Orava region, Slovakia): evidence for hyperpycnal river discharge in deep-sea fans.* In Geologica Carpathica, 2013, vol. 64, no. 4, p. 305-326. (1.143 - IF2012). (2013 - Current Contents). ISSN 1335-0552.

15. BARNA P.: *Low diversity cockroach assemblage from Chernovskie Kopi inRussia confirms wing deformities in insects at the Jurassic/Cretaceous boundary.* InBiologia : journal of the Slovak Academy of Sciences, 2014, vol. 69, no. 5, p. 651-675. (0.696 - IF2013). (2014 - Current Contents). ISSN 0006-3088.
16. BROSKA I., RAVNA E.J.K., VOJTKO P., JANÁK M., KONEČNÝ P., PENTRÁK M., BAČÍK P., LUPTÁKOVÁ J. & KULLERUD K.: *Oriented inclusions in apatite in a post-UHP fluid-mediated regime (Tromsø Nappe, Norway).* In European Journal of Mineralogy, 2014, vol. 26, p. 623-634. (1.506 - IF2013). (2014 - Current Contents). ISSN 0935-1221.
17. KHARBISH S., ANDRÁŠ P., LUPTÁKOVÁ J. & MILOVSKÁ S.: *Raman spectra of oriented and non-oriented Cu hydroxy-phosphate minerals: Libethenite, cornetite, pseudomalachite, reichenbachite and ludjibaite.* In Spectrochimica Acta Part A - Molecular and Biomolecular Spectroscopy, 2014, vol. 130, p. 152-163. (2.129 - IF2013). (2014 - Current Contents). ISSN 1386-1425.
18. OZDÍNOVÁ S. & SOTÁK J.: *Oligocene-Early Miocene planktonic microbiostratigraphy and paleoenvironments of the South Slovakian Basin (Lučenec Depression).* In Geologica Carpathica, 2014, vol. 65, no. 6, p. 451-470. (0.835 - IF2013). (2014 - Current Contents). ISSN 1335-0552.
19. PETRÍK I., ČÍK Š., MIGLIERINI M., VACULOVIČ T., DIANIŠKA I. & OZDÍN D.: *Alpine oxidation of lithium micas in Permian S-type granites (Gemericunit, Western Carpathians, Slovakia).* In Mineralogical Magazine, 2014, vol. 78, no. 3, p. 507-533. (1.898 - IF2013). (2014 - Current Contents). ISSN 0026-461X.
20. TOMAŠOVÝCH A., KIDWELL S.M., FOYGEL BARBER R. & KAUFMAN D. S.: *Long-term accumulation of carbonate shells reflects a 100-fold drop in loss rate.* In Geology, 2014, vol. 42, p. 819-822. (4.638 - IF2013). (2014 - Current Contents). ISSN 0091-7613. doi:10.1130/G35694.1

21. HURAI V., HURAIOVÁ M., SLOBODNÍK M. & THOMAS R.: Geofluids : *Developments in Microthermometry, Spectroscopy, Thermodynamics, and Stable Isotopes.* 1. vyd. Amsterdam : Elsevier, 2015. ISBN 978-0-12-803241-1.

22. JANÁK M., FROITZHEIM N., YOSHIDA K., SASINKOVÁ V., NOSKO M., KOBAYASHI T., HIRAJIMA T. & VRABEC M.: *Diamond in metasedimentary crustal rocks from Pohorje, Eastern Alps: a window to deep continental subduction.* In Journal of Metamorphic Geology, 2015, vol. 33, p. 495-512. (4.147 - IF2014). (2015 - Current Contents). ISSN 0263-4929.
23. TOMAŠOVÝCH A., JABLONSKI D., BERKE S.K., KRUG A.Z. & VALENTINE J.W.: *Nonlinear thermal gradients shape broad- scale patterns in geographic range size and can reverse Rapoport´s rule.* In Global Ecology and Biogeography, 2015, vol. 24, no. 2, p. 157-167. (6.531 - IF2014). (2015 - Current Contents).
24. STAREK D. & ŠIMO V.: *Sand spherules interpreted as crustacean feeding pellets from an Eocene shore environment (Western Carpathians - Slovakia).* In Palaeogeography, Palaeoclimatology, Palaeoecology, 2015, vol. 438, p. 364-378. (2.339 - IF2014). (2015 - Current Contents). ISSN 0031-0182.
25. VĎAČNÝ M. & BAČÍK P.: *Provenance of the Permian Malužiná Formation sandstones (Malé Karpaty Mountains, Western Carpathians): evidence of garnet and tourmaline mineral chemistry.* In Geologica Carpathica, 2015, vol. 66, no. 2, p. 83-97. (0.761 - IF2014). (2015 - Current Contents). ISSN 1335-0552.
26. VOZÁR J., SPIŠIAK J., VOZÁROVÁ A., BAZARNIK J. & KRÁĽ J.: *Geochemistry and Sr, Nd isotopic composition of the Hronic Upper Paleozoic basic rocks (Western Carpathians, Slovakia).* In Geologica Carpathica, 2015, vol. 66, no. 1, p. 3-17. (0.761 - IF2014). (2015 - Current Contents). ISSN 1335-0552.

2.1.3 List of monographs/books published abroad

1. HURAI V., HURAIOVÁ M., SLOBODNÍK M. & THOMAS R.: *Geofluids : Developments in Microthermometry, Spectroscopy, Thermodynamics, and Stable Isotopes*. 1. vyd. Amsterdam : Elsevier, 2015. ISBN 978-0-12-803241-1.
2. ŠKOĽNIK E.L., ŽEGALLO E.A., BATURIN G.N., BOGATYREV B.A., HÁBER M., GERASIMENKO L.M., GOLOVIN D.I., EGANOV E.A., JELEŇ S., LEJMIŇ I., KOVALENKER V.A., KRUGĽAKOV V.V., KULEŠOV V.N., MAČABELI G.A., MEĽNIKOV M.E., NOVIKOV V.M., ORLEANSKIJ V.K., PACHNEVIČ A.V., SLUKIN A.D., ŠARKOV A.A. & JUBKO V.M.: *Issledovanie margancevoj i železomargancevoj mineralizaciji v raznych prirodnych obstanovkach metodami skanirujuščej elektronnoj mikroskopiji*. 1. vyd. Moskva : SAMPoligrafist, 2012. 472 s. ISBN 978-5-94101-250-0.

2.1.4. List of monographs/books published in Slovakia

1. BROSKA I., PETRÍK I. & UHER P.: *Akcesorické minerály granitických hornín Západných Karpát* [Acessory minerals of the Carpathian granitic rocks]. 1. vyd. Bratislava : Veda, 2012. 235 s. ISBN 978-80-224-1255-1.
2. MICHALÍK J., VAŠÍČEK Z., BOOROVÁ D., GOLEJ M., HALÁSOVÁ E., HORT P., LEDVÁK P., LINTNEROVÁ O., MĚCHOVÁ L., ŠIMO V., ŠIMONOVÁ V., REHÁKOVÁ D., SCHLŐGL J., SKUPIEN P., SMREČKOVÁ M., SOTÁK J. & ZAHRADNIKOVÁ B.: *Vrch Butkov: kamenný archív histórie slovenských vrchov a druhohorného morského života : a stone archive of Slovakian mountains and of the Mesozoic sea life history*. 1. vyd. Bratislava : Slovak Academy of Sciences, Geological Institute : Veda Editorial house, 2013. 164 s. ISBN 978-80-224-1287-2.
3. VOZÁR J., EBNER F., VOZÁROVÁ A., HAAS J., KOVÁCS S., SUDAR M., BIELIK M. & PÉRÓ C.: *Variscan and Alpine terranes of the Circum-Pannonian region*. Second Edition (Available only as DVD version). Bratislava : Geological Institute of SAS Bratislava : Comenius University, Faculty of Natural Sciences, Bratislava, 2014.

2.1.5. List of other scientific outputs specifically important for the institute, max. 10 items

1. ANDRÁŠ P., NAGYOVÁ I., SAMEŠOVÁ D. & MELICHOVÁ Z.: *Study of environmental risks at an old spoil dump field.* In Polish Journal of Environmental Studies, 2012, vol. 21, no. 6, p. 11-20. (0.508 - IF2011). (2012 - Current Contents). ISSN 1230-1485.
2. HURAI V., PAQUETTE J.-L., HURAIOVÁ M. & SABOL M.: *U-Pb geochronology of zircons from fossiliferous sediments of the Hajnáčka I maar (Slovakia) - type locality of the MN16a biostratigraphic subzone.* In Geological magazine, 2012, vol. 149, no. 6, p. 989-1000. (1.764 - IF2011). (2012 - Current Contents). ISSN 0016-7568
3. HURAI V., PAQUETTE J.-L., LEXA O., KONEČNÝ P. & DIANIŠKA I.: *U-Pb-Th geochronology of monazite and zircon in albitite metasomatites of the Rožňava-Nadabula ore field (Western Carpathians, Slovakia): implications for the origin of hydrothermal polymetallic siderite veins.* In Mineralogy and Petrology, 2015, vol. 109, p. 519-530. (1.349 - IF2014). (2015 - Current Contents). ISSN 0930-0708.
4. KIDWELL S.M. & TOMAŠOVÝCH A.: *Implications of Death Assemblages for Ecology and Conservation Biology.* In Annual Review of Ecology Evolution and Systematics, 2013, vol. 44, p. 539-563. (10.375 - IF2012). ISSN 1543-592X.
5. KODĚRA P., HEINRICH Ch.A., WÄLLE M. & LEXA J.: *Magmatic salt melt and vapor: Extreme fluids forming porphyry gold deposits in shallow subvolcanic settings*. In Geology, 2014, vol. 42, n. 6, p. 495-498. (4.638 - IF2013).
6. MICHALÍK J., LINTNEROVÁ O., WÓJCIK-TABOL P., GAŹDZICKI A., GRABOWSKI J., GOLEJ M., ŠIMO V. & ZAHRADNIKOVÁ B.: *Paleoenvironments during the Rhaetian transgression and the colonization history of marine biota in the Fatric Unit (Western Carpathians).* In Geologica Carpathica, 2013, vol. 64, no. 1, p. 39-62. (1.143 - IF2012). (2013 - Current Contents). ISSN 1335-0552.
7. STAREK D., SOTÁK J., JABLONSKÝ J. & MARSCHALKO R.: *Large-volume gravity flow deposits in the Central Carpathian Paleogene Basin (Orava region, Slovakia): evidence for hyperpycnal river discharge in deep-sea fans.* In Geologica Carpathica, 2013, vol. 64, no. 4, p. 305-326. (1.143 - IF2012). (2013 - Current Contents). ISSN 1335-0552
8. ŠIMO V. & TOMAŠOVÝCH A.: *Trace-fossil assemblages with a new ichnogenus in "spotted" (Fleckenmergel-Fleckenkalk) deposits: a signature of oxygen-limited benthic comm*unities. In Geologica Carpathica, 2013, vol. 64, no. 5, p. 355-374. (1.143 - IF2012). (2013 - Current Contents). ISSN 1335-0552.
9. TOMAŠOVÝCH A., DOMINICI S., ZUSCHIN M. & MERLE D.: *Onshore-offshore gradient in metacommunity turnover emerges only over macroevolutionary time-scales.* In Proceedings of Royal Society : B - Biological Sciences, 2014, vol. 281, dOI 10.1098/rspb.2014.1533. (5.292 - IF2013). (2014 - Current Contents).
10. UHER P., JANÁK M., KONEČNÝ P. & VRABEC M.: *Rare-element granitic pegmatite of Miocene age emplaced in UHP rocks from Visole, Pohorje Mountains (Eastern Alps, Slovenia): accessory minerals, monazite and uraninite chemical dating.* In Geologica Carpathica, 2014, vol. 65, no. 2, p. 131-146. (0.835 - IF2013). (2014 - Current Contents). ISSN 1335-0552.

2.1.6. List of patents, patent applications, and other intellectual property rights registered abroad, incl. revenues

2.1.7. List of patents, patent applications, and other intellectual property rights registered in Slovakia, incl. revenues

no patents

2.1.8. Table of research outputs (as in annual reports).

Papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) have to be listed separately.

Scientific publications	2012			2013			2014			2015			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
Scientific monographs and monographic studies in journals and proceedings published abroad *(AAA, ABA)*	1,0	0,034	0,003	0,0	0,000	0,000	0,0	0,000	0,000	1,0	0,038	0,002	**2,0**	**0,5**	**0,018**	**0,001**
Scientific monographs and monographic studies in journals and proceedings published in Slovakia *(AAB, ABB)*	1,0	0,034	0,003	1,0	0,033	0,003	1,0	0,036	0,003	0,0	0,000	0,000	**3,0**	**0,8**	**0,026**	**0,002**
Chapters in scientific monographs published abroad *(ABC)*	0,0	0,000	0,000	7,0	0,232	0,018	9,0	0,324	0,023	0,0	0,000	0,000	**16,0**	**4,0**	**0,141**	**0,010**
Chapters in scientific monographs published in Slovakia *(ABD)*	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	**0,0**	**0,0**	**0,000**	**0,000**
Scientific papers published in journals registered in Current Contents Connect *(ADCA, ADCB, ADDA, ADDB)*	26,0	0,889	0,065	25,0	0,828	0,063	22,0	0,792	0,055	25,0	0,939	0,058	**98,0**	**24,5**	**0,861**	**0,060**
Scientific papers published in journals registered in Web of Science Core Collection and SCOPUS *(ADMA, ADMB, ADNA, ADNB)*	4,0	0,137	0,010	9,0	0,298	0,023	4,0	0,144	0,010	9,0	0,338	0,021	**26,0**	**6,5**	**0,228**	**0,016**
Scientific papers published in other foreign journals (not listed above) *(ADEA, ADEB)*	0,0	0,000	0,000	3,0	0,099	0,008	1,0	0,036	0,003	3,0	0,113	0,007	**7,0**	**1,8**	**0,061**	**0,004**
Scientific papers published in other domestic journals (not listed above) *(ADFA, ADFB)*	15,0	0,513	0,038	2,0	0,066	0,005	3,0	0,108	0,008	1,0	0,038	0,002	**21,0**	**5,3**	**0,184**	**0,013**
Scientific papers published in foreign peer-reviewed proceedings *(AEC, AECA)*	2,0	0,068	0,005	10,0	0,331	0,025	0,0	0,000	0,000	0,0	0,000	0,000	**12,0**	**3,0**	**0,105**	**0,007**
Scientific papers published in domestic peer-reviewed proceedings *(AED, AEDA)*	12,0	0,410	0,030	23,0	0,762	0,058	13,0	0,468	0,033	1,0	0,038	0,002	**49,0**	**12,3**	**0,430**	**0,030**
Published papers (full text) from foreign and international scientific conferences *(AFA, AFC, AFBA, AFDA)*	2,0	0,068	0,005	5,0	0,166	0,013	11,0	0,396	0,028	1,0	0,038	0,002	**19,0**	**4,8**	**0,167**	**0,012**
Published papers (full text) from domestic scientific conferences *(AFB, AFD, AFBB, AFDB)*	4,0	0,137	0,010	4,0	0,133	0,010	0,0	0,000	0,000	8,0	0,300	0,019	**16,0**	**4,0**	**0,141**	**0,010**

- **Supplementary information and/or comments on the scientific outputs of the institute.**

We trend towards publishing high-quality research output that is of a broad interest to the international community and can be published, in highly ranked journals. This strategy is a result of the overall atmosphere at the institution where we put emphasis on quality rather than on quantity of outputs. High-quality publications inevitably improve the international reputation of our researchers. The effort of researchers to produce the high-quality publications partly follows from the annual assessment of our research. This assessment also affects personal financial evaluation of individual researchers.

The rules for evaluation of individuals are strictly applied. Moreover, our scientific board selects the most significant publications on a yearly basis, primarily targeting publications where the first author is from our institution. These publications are shown in chapter 2.1.2. as the most important results of basic research. The pressure on the quality of scientific outputs also results in a relatively high number of ISI citations (when compared within the geosciences). Chapter 2.1.5 contains the publications selected by our scientific board as important contributions towards international cooperation.

2.2. Responses to the research outputs (citations, etc.)

2.2.1. Table with citations per annum.

Citations of papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) have to be listed separately.

Citations, reviews	2011		2012		2013		2014		total		
	number	No. / FTE	number	No. / FTE	number	No. / FTE	number	No. / FTE	number	averaged number per year	av. No. / FTE
Citations in Web of Science Core Collection (1.1, 2.1)	360,0	14,030	409,0	13,552	394,0	14,188	399,0	14,983	**1562,0**	**390,5**	**13,721**
Citations in SCOPUS (1.2, 2.2) if not listed above	24,0	0,930	37,0	1,226	28,0	1,008	70,0	2,629	**159,0**	**39,8**	**1,397**
Citations in other citation indexes and databases (not listed above) (3.2,4.2,9,10)	0,0	0,000	0,0	0,000	1,0	0,036	0,0	0,000	**1,0**	**0,3**	**0,009**
Other citations (not listed above) (3, 4, 3.1, 4.1)	83,0	3,230	334,0	11,067	35,0	1,260	32,0	1,202	**484,0**	**121,0**	**4,252**
Reviews (5,6)	0,0	0,000	0,0	0,000	0,0	0,000	0,0	0,000	**0,0**	**0,0**	**0,000**

2.2.2. List of 10 most-cited publications, with number of citations, in the assessment period (2011 – 2014).

1. Alroy J., Aberhan M., Bottjer D.J., Foote M., Fürsich F.T., Harries P.J., Hendy A.J., Holland S.M., Ivany L.C., Kiessling W. Kosnik M.A., Marshall C.R., McGowan A.J., Miller A.I., Olszewski T.D., Patzkowsky M.E., Peters S.E., Vilier L., Wagner P.J., Bonuso N., Borkow P.S., Brenneis B., Clapham M.E., Fall L.M., Ferguson C.A., Hanson V.L., Krug A.Z., Layou K.M., Leckey E.H., Nurnberg S., Powers C.M., Sessa J.A., Simpson C. & Tomašových, A. Vissagi C.C., 2008. Phanerozoic trends in the global diversity of marine invertebrates. *Science*, *321*(5885), pp.97-100. (26.372 - IF2007).
   122 citations
2. Petrík I., Broska I. Lipka J. & Siman, P. 1995. Granitoid allanite-(Ce): substitution relations, redox conditions and REE distributions (on an example of I-type granitoids, Western Carpathians, Slovakia). *Geologica Carpathica*, *46*, pp.79-94.
   21 citations
3. Tomašových A. & Kidwell S.M., 2009. Fidelity of variation in species composition and diversity partitioning by death assemblages: time-averaging transfers diversity from beta to alpha levels. *Paleobiology*, *35*(01), pp.94-118. (2.800 - IF2008).
   19 citations
4. Broska I., Williams C.T., Janák M. & Nagy G., 2005. Alteration and breakdown of xenotime-(Y) and monazite-(Ce) in granitic rocks of the Western Carpathians, Slovakia. *Lithos*, *82*(1), pp.71-83. (2.567 - IF2004).
   16 citations
5. Tomašových A. & Kidwell S.M., 2010. Predicting the effects of increasing temporal scale on species composition, diversity, and rank-abundance distributions. *Paleobiology*, *36*(04), pp.672-695. (2.985 - IF2009).
   16 citations
6. Soták J., 2010. Paleoenvironmental changes across the Eocene-Oligocene boundary: insights from the Central-Carpathian Paleogene Basin. *Geologica Carpathica*, *61*(5), pp.393-418. (0.963 - IF2009).
   13 citations
7. Petrík I. & Konečný P., 2009. Metasomatic replacement of inherited metamorphic monazite in a biotite-garnet granite from the Nízke Tatry Mountains, Western Carpathians, Slovakia: Chemical dating and evidence for disequilibrium melting. *American Mineralogist*, *94*(7), pp.957-974. (1.962 - IF2008).
   13 citations
8. Michalík J., Soták J., Lintnerová O., Halásová E., Bąk M., Skupien P. & Boorová D., 2008. The stratigraphic and paleoenvironmental setting of Aptian OAE black shale deposits in the Pieniny Klippen Belt, Slovak Western Carpathians. *Cretaceous Research*, *29*, 871-892. (1.045 - IF2007).
   12 citations
9. Janák M., Froitzheim N., Lupták B., Vrabec M. & Ravna E.J.K., 2004. First evidence for ultrahigh-pressure metamorphism of eclogites in Pohorje, Slovenia: Tracing deep continental subduction in the Eastern Alps. *Tectonics*, *23*(5). (2.308 - IF2003).
   11 citations
10. Broska I., Harlov D., Tropper P. & Siman P., 2007. Formation of magmatic titanite and titanite–ilmenite phase relations during granite alteration in the Tribeč Mountains, Western Carpathians, Slovakia. Lithos, 95(1), pp.58-71. (2.203 - IF2006).
    11 citations

2.2.3. List of most-cited authors from the Institute (at most 10 % of the research employees with university degree engaged in research projects) and their number of citations in the assessment period (2011– 2014).

1. TOMÁŠOVÝCH A. - Number of citations: 343
2. BROSKA I. – Number of citations: 247
3. SOTÁK J. - Number of citations: 182
4. JANÁK M. - Number of citations: 179
5. MICHALÍK J. - Number of citations: 171
6. VRŠANSKÝ P. - Number of citations: 169

- **Supplementary information and/or comments on responses to the scientific output of the institute.**

We note that the List of ten most cited publications between 2011-2014 includes only those publications that have recently employed researchers in the list of authors. Many of our former researchers show a high citation output but this is not shown. One such example of 51 citations within 4 years: CSONTOS, L. - NAGYMAROSY, András - HORVÁTH, Ferenc - KOVÁČ, Michal. Tertiary evolution of the Intra-Carpathian area: a model. In Tectonophysics, 1992, vol. 208, no. 1-3, p. 221-241. ISSN 0040-1951

2.3. Research status of the institute in international and national contexts

- **International/European position of the institute**

2.3.1. List of the most important research activities demonstrating the international relevance of the research performed by the institute, incl. major projects (details of projects should be supplied under Indicator 2.4). Max. 10 items.

The research activities of the Geological Institute SAS involving international cooperation are very variable. They include various projects with international cooperation, organization of international conferences, and participation in wide UNESCO international geological correlation projects projects (IGCP). Some of such activities and publications include the following:

The establishment of the Energy Geoscience Laboratory at the Geological Institute SAS, as joint work place of our institution and the Energy Geoscience Institute at Utah University (Salt Lake City) manifests the international character of institutional activities. Projects from the east Atlantic coast line or from the area of the Black Sea have been carried out also through our institute by many co-workers and students.

J. Michalík is a chairman of the IGCP National committee of the UNESCO Commission, Ministry of Foreign Affairs of the Slovak republic. Moreover, J. Michalik is a voting member in the Triassic and Cretaceous sub-commissions of the International Commission on Stratigraphy ICS. A. Tomašových is a voting member in the Triassic sub-commission of the International Commission on Stratigraphy ICS.

M. Janák represents Slovakia in the international committee on UHP metamorphism led by prof. L. Dobrzhinetskaya (USA). M. Janák has been asked to participate and subsequently collaborated on the study of UHP metamorphism in the Caledonides through collaboration with prof. Erling Krogh Ravna (University Tromsø) and prof. D. Gee and J Majka (Uppsala University).

A. Tomašových spent several months at the University of Chicago, working on a National Science Foundation project devoted to the palaeoecology and taphonomy of mollusks on the global scale. He was a co-convener of paleobiological sessions at the European Geoscience Symposium in Vienna over the last years.

Researchers of the Geological Institute SAS were asked for reviews of dozens of manuscripts of articles proposed for publication in high ranked scientific journals such as American Mineralogists, Canadian Mineralogist, Lithos, Mineralogy and Petrology, Mineralogical Magazine, International Journal of Geology, Sedimentology, Cretaceous research, Jahrbuch für Paläontologie, Acta Geologica Polonica, Journal of Geosciences, Gondwana research, Tectonophysics etc.

Publishing of the scientific journal Geologica Carpathica in cooperation with the Geological Institute of the Czech Academy of Science and the Polish Geological Survey is another expression of the institute's position in the international framework.

In following, some selected outputs based on wide cooperation (not supported by the Slovak funding agencies) and projects solved at the Institution will be shown. The discovery of diamond in the Seve nappe (Sweden) by a team headed by J. Majka was awarded by the Swedish Academy of Sciences in 2016. Jeleň S. described unique Bi minerals with the Russian, Czech and Romanian experts. Orvošová M. with German experts described for the first time cryogenic carbonates in the Slovak caves on our analytical Instruments – important for the understanding of recent climate changes. Čerňanský A. collaborated on the palaeobiology and biogeography of Cenozoic squamate reptiles during the Humboldt Fellowship in Berlin.

1. ČERŇANSKÝ A., RAGE J.-C. & KLEMBARA J.: *The Early Miocene squamates of Amöneburg (Germany): the first stages of modern squamates in Europe.* In Journal of Systematic Palaeontology, 2015, vol. 13, no. 2, p. 97-128. (3.727 - IF2014). (2015 - Current Contents). ISSN 1477-2019.
2. JELEŇ S., PRŠEK J., KOVALENKER V., TOPA D., SEJKORA J., OZDÍN D. & ŠTEVKO M.: *Bismuth sulphosalts of the cuprobismuthite, pavonite and aikinite series from the Rozália Mine, Hodruša-Hámre, Slovakia.* In Canadian Mineralogist, 2012, vol. 50, p. 325-340. (1.115 - IF2011). (2012 - Current Contents). ISSN 0008-4476.
3. MAJKA J., ROSÉN A., JANÁK M., FROITZHEIM N., KLONOWSKA I., MANECKI M., SASINKOVÁ V. & YOSHIDA K.: *Microdiamond discovered in the Seve Nappe (Scandinavian Caledonides) and its exhumation by the "vacuum-cleaner" mechanism*. In Geology, 2014, vol. 42, p. 1107-1110. (4.638 - IF2013). (2014 - Current Contents). ISSN 0091-7613.
4. ORVOŠOVÁ M., DEININGER M. & MILOVSKÝ R.: *Permafrost occurrence during the Last Permafrost Maximum in the Western Carpathian Mountains of Slovakia as inferred from cryogenic cave carbonate.* In Boreas, 2014, vol. 43, no. 3, p. 750-758. (2.383 - IF2013). (2014 - Current Contents).
5. TOMAŠOVÝCH A., DOMINICI S., ZUSCHIN M. & MERLE D.: *Onshore-offshore gradient in metacommunity turnover emerges only over macroevolutionary time-scales*. In Proceedings of Royal Society : B - Biological Sciences, 2014, vol. 281, dOI 10.1098/rspb.2014.1533. (5.292 - IF2013). (2014 - Current Contents). ISSN 0962-8452.
6. TOMAŠOVÝCH A., JABLONSKI D., BERKE S.K., KRUG A.Z. & VALENTINE J.W.: *Nonlinear thermal gradients shape broad- scale patterns in geographic range size and can reverse Rapoport´s rule.* In Global Ecology and Biogeography, 2015, vol. 24, no. 2, p. 157-167. (6.531 - IF2014). (2015 - Current Contents). ISSN 1466-822X.
7. JABLONSKI D., BELANGER C.L., BERKE S.K., HUANG S., KRUG A.Z., ROY K., TOMAŠOVÝCH A. & VALENTINE J.W.: *Out of the tropics, but how? Fossils, bridge species, and thermal ranges in the dynamics of the marine latitudinal diversity gradient.* In Proceedings of the National Academy of Sciences of the United States of America, 2013, vol. 110, p. 10487-10494. (9.737 - IF2012). (2013 - Current Contents).

2.3.2. List of international conferences (co)organised by the institute.

1. GEEWEC 2013 – Geological evolution of the Western Carpathians: new ideas in frame of inter-regional correlations, Smolenice, 16.10.-19.10.2013, SR, 80 participants
2. Workshop on Ichnotaxonomy, Smolenice, 09.06.-13.06.2014, SR, 50 participants
3. 15th Czech-Slovak-Polish Palaeontological Conference, Banská Bystrica, 15.10.-18.10.2014, SR, 75 participans
4. ESSE WECA Environmental, Structural and Stratigraphical Evolution of the Western Carpathians, Smolenice, 5.11.-7.11.2014, SR, 80 participants
5. Petros 2015, Bratislava, Natural Faculty of Science Comenius University UK, 1.06.-3.06.2015, SR

2.3.3. List of edited proceedings from international scientific conferences.

none

2.3.4. List of journals edited/published by the institute:

2.3.4.1. WOS (IF of journals in each year of the assessment period)

2.3.4.2. SCOPUS

2.3.4.3. other databases

2.3.4.4. not included in databases

Geological Institute is publisher of international geological journal Geologica Carpathica, which is official journal of Carpathian-Balkan Geological Association established in 1923.

2012 – Vol 63, no 1-6, IF=1.143

2013 – Vol. 64, no 1-6, IF=0.835

2014 – Vol. 65, no 1-6, IF=0.761

2015 – Vol. 66, no 1-6, IF=1.523

- **National position of the institute**

2.3.5. List of selected projects of national importance

1. APVV-0644-10 **Assessing taphonomic and geochemical approaches in evaluating spatial and temporal turnover of marine invertebrate paleocommunities** – TOMAŠOVÝCH A. (01.05.2011-31.10.2014), 94 768,-€, (34 months)
2. APVV-0080-11 **(Ultra)high pressure metamorphism and phase transformations during subduction and exhumation of continental lithosphere in collisional orogenic zones** – JANÁK M. (01.07.2012-31.12.2015), 166 526,-€ (42 months)
3. APVV-0436-12 **Evolutionary patterns as indicated by panarthropods** – VRŠANSKÝ P. (01.10.2013-30.09.2017), 55 533,-€, (27 months)
4. APVV-14-0278 **Stability of accessory minerals and the mobility of rare lithophile elements and C in the rocks of collisional orogenic zones: prograde and retrograde transformations** – PETRÍK I. (01.07.2015-30.06.2019), 11 841,-€ (6 months)
5. APVV-14-0118 **Regional stratotypes for genetic, earthtime and paleoenvironmental properties of the Western Carpathian sedimentary basins** - SOTÁK J. (01.07.2015-30.06.2019), 16 336,-€, (6 months)

2.3.6. Projects of the Slovak Research and Development Agency (APVV)

1. APVV- 0663-10 **Contamination of mining country by toxic elements at selected Cu-deposits and possibilities of its remediation** (UMB Banská Bystrica – project leader) – JELEŇ S. (01.05.2011-31.10.2014),
2. APVV-0537-10 **Au-porphyry systems deposit models in the Central Slovakia Neogene Volcanic Field and environmental aspects of their exploitation** (PriF UK Bratislava– project leader) – LEXA J. (01.05.2011-31.10.2014),
3. APVV-0081-10 **Meta-ultramafics, indicator of mechanisms of crust-mantle interaction, recyclation and exhumation in an orogenic wedge (W. Carpathians and eastern Alpine margin)** (PriF UK Bratislava– project leader) – SIMAN P. (01.05.2011-31.10.2014),
4. APVV-0644-10 **Assessing taphonomic and geochemical approaches in evaluating spatial and temporal turnover of marine invertebrate paleocommunities** – TOMAŠOVÝCH A. (01.05.2011-31.10.2014),
5. APVV-0080-11 **(Ultra)high pressure metamorphism and phase transformations during subduction and exhumation of continental lithosphere in collisional orogenic zones** – JANÁK M. (01.07.2012-31.12.2015),
6. APVV-0339-12 **Perlite genesis and inovative approaches to its exploitation and processing** (PriF UK Bratislava– project leader) – LEXA J. (01.10.2013-30.9.2017),
7. APVV-0436-12 **Evolutionary patterns as indicated by panarthropods** – VRŠANSKÝ P. (01.10.2013-30.09.2017),

8. APVV-14-0278 **Stability of accessory minerals and the mobility of rare lithophile elements and C in the rocks of collisional orogenic zones: prograde and retrograde transformations** – PETRÍK I. (01.07.2015-30.06.2019),
9. APVV-14-0118 **Regional stratotypes for genetic, earthtime and paleoenvironmental properties of the Western Carpathian sedimentary basins** - SOTÁK J. (01.07.2015-30.06.2019),

2.3.7. Projects of the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA)

1. GA-2/0125/09 **Origin of eusociality: cockroach-termite transition** – VRŠANSKÝ P. (01.2009 - 12.2012)
2. GA-2/0060/10 **Oxidation-reduction conditions and water content in granitoid magmas: the use of biotite and Fe-Ti oxides as petrological indicators** – PETRÍK I. (01.2010-12.2012)
3. GA-1/0388/10 **TECTOGEN - Tectonosedimentary breccias as tracer of the tectonic events in sedimentary record of the Mesozoic and Paleogene successions of the Western Carpathians** – SOTÁK J. (01.2010 - 12.2012)
4. GA–2/0065/11 **Comparison of the contamination as a consequence of mining activity at Cu-deposits in the surrounding of Banska Bystrica** – ANDRÁŠ P. (01.2011 - 12.2013)
5. GA-2/0068/11 **Assessment of taphonomic and geochemical methods in evaluating the stability of marine ecosystems during the Jurassic** – TOMÁŠOVÝCH A. (01.2011 - 12.2014)
6. GA-2/0100/11 **Traces of life in Upper Paleozoic sediments from Slovakia and age determination based on isotopic composition (300-250 Ma)** – ŠIMO V. (01.2011 - 12.2013)
7. GA-2/0145/11 **Changes in the assemble of calcareous nannofossils during the great climatic changes** – OZDINOVÁ S. (01.2011 - 12.2013)
8. GA-2/0162/11 **Processes and products of rhyollite volcanism: paleovolcanic reconstruction of the Jastrabá Formation in the Central Slovakia volcanic field** – LEXA J. (01.2011 - 12.2014)
9. GA-1/0744/11 **Lamprophyres in the Western Carpathians: petrology and geochemistry** – SIMAN P. (01.2011 - 12.2013)
10. GA-2/0013/12 **Thermodynamic modelling of metamorphic processes in the collisional orogenic zones** – JANÁK M. (01.2012 - 12.2015)
11. GA-2/0042/12 **Paleoenvironmental record of global system instability in the Late Cretaceous and Paleogene Formations of the Western Carpathians: changes of the physical and life conditions in time of biotic crisis, climatic extremes, impacts and syngenetic volcanisms** – SOTÁK J. (01.2012 - 12.2015)
12. GA-2/0065/12 **Comparison of paleoclimate and paleoceanography of the West Carpathian area at the beginning of Jurassic and Cretaceous periods** – MICHALÍK J. (01.2012 - 12.2015)
13. GA-2/0087/12 **Mineralogical research of specific types of secondary mineral accumulation in selected near-surface underground systems of Slovakia and influence of microbiota on their formation** – JELEŇ S. (01.2012 - 12.2014)
14. GA-1/0560/12 **Mineralogy and genesis of economically important types of gold mineralization in the Central Slovakia Volcanic Field** – LEXA J. (01.2015-12.2018)
15. GA-1/0030/12 **Hypogenous caves in Slovakia: speleogenesis and morphogenetic types** – MILOVSKÝ R. (01.2013 - 12.2015)
16. GA-1/0180/12 **Postglacial evolution of Tatra Mts. environment: multidisciplinary ecological study of subalpine lake** – KYŠKA-PIPÍK R. (01.2012 - 12.2015)
17. GA-2/0069/13 **Stable and radiogenic isotopes in minerals of basalt maars of southern Slovakia – implications for age of volcanism and origin of exotix xenoliths** – HURAI V. (01.2013 - 12.2015)

18. GA-2/0087/13 **Morphology, phylogeny, palaeobiography and palaeoecology of the new finds of squamate reptiles from the Cenozoic localities of Central Europe** – ČERŇANSKÝ A. (01.2013 - 12.2015)
19. GA-2/0159/13 **The role of diorite magma in the initiation of I-type granitoid magmatism – mafic enclaves of the Nízke Tatry Mountains** – PETRÍK I. (01.2013 - 12.2015)
20. GA-2/0012/14 **Cockroaches in amber** – VRŠANSKÝ P. (01.2014 - 12.2017)
21. GA-2/0094/14 **Biostratigraphic and palaeoenvironmental analysis of the Lower to Middle Jurrasic sequences of the selected localities of the Western Carpathians** – OZDINOVÁ S. (01.2014 - 12.2016)
22. GA-2/0017/15 **Integrated sedimentological study of the Paleogene formations of the Central Western Carpathians: a reconstruction of the depositional paleoenvironments in relation to tectogenetic processes, subsidence history of the basin and changing climate regimes** – STAREK D. (01.2015-12.2017)
23. GA-2/0056/15 **Multiproxy analysis of limnic profundal deposits: cyclicity and variability of the environment in Late Miocene of the Central Paratethys** – KYŠKA-PIPÍK R. (01.2015-12.2017)
24. GA-2/0136/15 **Tracing changes in seawater temperature during the end-Triassic mass extinction and during the Early Jurassic in the western Tethys (Western Carpathians and Eastern Alps** – TOMÁŠOVÝCH A. (01.2015-12.2017)
25. GA-2/0138/15 **Evolution of monogentic rhyolite volcanoes** – LEXA J. (01.2015-12.2018)
26. GA-2/0193/15 **Timing, extent and depth of Late Pleistocene epizodic thawing of permafrost inferred from cave paleoclimatic records of Slovakia** – MILOVSKÝ R. (01.2015-12.2017)
27. GA-1/0538/15 **Comparison of country remediation possibilities in surrounding of selected European Cu-deposits** – MILOVSKÁ S. (01.2015-12.2017)
28. GA-1/0650/15 **Geochemistry and geochronology of the dyke rocks from the Western Carpathians** SIMAN P. (01.2015-12.2018)
29. GA-1/0664/15 **A 250 year history of human impacts on a landscape of the Banská Štiavnica mining territory: palaeolimnological reconstruction using biotic and abiotic indicators from lake sediments** – KYŠKA-PIPÍK R. (01.2015 - 12.2017))

2.3.8. Projects of SAS Centres of Excellence

none

2.3.9. National projects supported by EU Structural Funds

1. ITMS 26210120013 **Completion of technical infrastructure for research of geodynamical processes and global changes in Earth‘s history** – BIROŇ A. (23.10.2012-30.04.2015) - project manager. Institute was recipient.
2. ITMS 26220120064 **Centre of excelence for integrated research of the Earth's geosphere** – SOTÁK J. (01.09.2010-28.02.2015) - project manager. Institute was recipient and coordinator (partners: Institute of Geotechnics SAS Košice and Wood Faculty of Technical Zvolen)
3. ITMS 26250120034 **Centers of education of Slovak Academy of Sciences in Banská Bystrica and Smolenice** – KYŠKA-PIPÍK R. (01.06.2010-01.01.2015) – project manager. Institute was recipient.

2.3.10. List of journals (published only in the Slovak language) edited/published by the institute:

2.3.10.1. WOS (IF of journals in each year of the assessment period)
2.3.10.2. SCOPUS
2.3.10.3. Other databases
2.3.10.4. Not included in databases

none

- **Position of individual researchers in an international context**

Broska I.

- editor-in-chief of the international journal Geologica Carpathica (Bratislava)
- member of editorial board of the Journal of Geosciences (Prague, Czech Republic)
- member of editorial board of the journal Mineralogia Krakow, (Poland)
- member of scientific board of Faculty of Natural Sciences of the Masaryk university Brno, (Czech Republic, 2010-2014)
- representative of the Slovakia in the European Mineralogical Union (2005-2014)

Hurai V.

- member of editorial board of the Geologica Carpathica
- member of editorial board of the International Journal of Mineralogy

Janák M.

- member of editorial board of the Geologica Carpathica

Kyška-Pipík R.

- member of editorial board of the Geological Bulletin of Turkey
- member of editorial board of the Open Geosciences (former Central European Journal of Geosciences)

Lexa J.

- member of editorial board of the Geologica Carpathica
- associate editor of editorial board of the Ore Geology Reviews

Michalík J.

- member of editorial board of the Bulletin of Geosciences
- member of editorial board of the Geologica Carpathica
- member of editorial board of the Geological Quaterly
- member of editorial board of the Geoscience e-journals
- member of editorial board of the Iranian Journal of Geosciences
- member of the Editorial Advisory Board Open Paleontology Journal

Petrík I.

- member of editorial board of the Geologica Carpathica

Soták J.

- member of editorial board of the Geologica Carpathica
- member of the Consulting Editor´s Board Geological Quarterly
- member of editorial board of the Paleontology Journal

Tomašových A.

- member of editorial board of the Ameghiniana
- associated editor of editorial board of the Geologica Carpathica
- associate editor of the Palaios
- member of editorial board of the Revista Espanola de Paleontologia

Vozár J.

- member of editorial board of the Annales Geologiques de la Péninsule Balkanique
- member of editorial board of the Geologica Carpathica
- member of editorial board of the Polish Geological Institute Papers

2.3.11. List of invited/keynote presentations at international conferences, as documented by programme or invitation letter

1. Broska I. - Accessory minerals and granite typology of the Western Carpathians. Workshop at Kumaun University, Nainital, India, 8.8.2012
2. Janák M. - Ultrahigh-pressure metamorphism and deep subduction of continental crust. Workshop at Kumaum University, India, 8.8.2012
3. Vršanský P**.** - Insect evolution, Instituto de Geologia, Coyoacán, Mexico
4. Vršanský P. - Yixian cockroaches, Capital Normal University, Beijing, China
5. Broska I., Madarás J.: Scheme of radioactive waste disposal and its possible application in the Slovak Territory. Skalský dvur, 22.4.2014
6. Soták J., Kováč M., Bučová J., Hók J., Králiková S., Pešková I., Plašienka D., Sliva Ľ., & Starek D.: Geodynamics and paleogeography of the Western Carpathian Paleogene. GEEWEC Smolenice, 17. 10. 2013 (keynote talk)
7. Kováč M., Soták J., Fordinál K., Halásová E., Hudáčková N., Joniak P., Kováčová M., Marko F., Márton E., Kyška-Pipík R., Šarinová K., Vojtko R., Šujan M. & Rybár S.: Geodynamics and paleogeography of the Western Carpathian Neogene. GEEWEC Smolenice, 17. 10. 2013 (keynote talk)
8. Michalík J., Soták J. & Lintnerová O.: Paleogeography and paleoclimate at the Triassic/Jurassic and Jurassic/Cretaceous boundaries. GEEWEC Smolenice, 17. 10. 2013 (keynote talk)

Invited presentation at scientific institutions

1. Broska I. - Accessory minerals in granitic rocks of the Western Carpathians. Universitet Uppsala, Sweden, 5.10.2012
2. Jeleň S. – Epithermal Au-Ag polymetalic deposit in Banská Štiavnica (Western Carpathians): geological structure, mineralogy and condition of origin. Lvov University, Dept. Of Mineralogy (Geological faculty, Ivan Frank Lvov National University), 3.10.2012
3. Hurai V. **-** Mineralogy, geochemistry and origin of exotic xenoliths and megacrysts ejected in Pliocene volcanic eruptions in northernmost part of Pannonian basin. Österreichische Mineralogische Gesellschaft, 18.11.2013, 17:45 Uhr, Geozentrum, Hörsaal II, Universität Wien, Austria
4. Kyška-Pipík R. **-** Long lived lakes of the Central Paratethys – hot spot of Miocene biodiversity. Ludwig Maximilians Universität Munich, 25.10.2013

2.3.12. List of researchers who served as members of the organising and/or programme committees

1. Broska I.: Head of organising committee of the international conference Geological evolution of the Western Carpathians: new ideas in frame of inter-regional correlations, (GEEWEEC) Smolenice, 16.10.-19.10.2013
2. Petrík I. - Siman P. Puškelová , Ľ., Michalík, A.Tomašových – GEEWEC 2013 – Geological evolution of the Western Carpathians: new ideas in frame of inter-regional correlations, Smolenice, 16.10.-19.10.2013, SR
3. Šimo V. – Starek D. - Workshop on Ichnotaxonomy, Smolenice, 09.06.-13.06.2014, SR (organising committees)
4. Soták J. - 15th Czech-Slovak-Polish Palaeontological Conference, Banská Bystrica, 15.10.-18.10.2014, SR
5. Broska I. organising committee of the conference Environmental, Structural and Stratigraphical Evolution of the Western Carpathians (ESSE WECA), Smolenice, 5.11.-7.11.2014, SR
6. Petrík I. - Petros 2015, Bratislava, PriF UK, 1.06.-3.06.2015, SR (organising committees)
7. Tomašových A. - convener for SSP4.6: Conservation & Stratigraphic Palaeobiology: Deep-time to Recent, European Geoscience Union Assembly, Vienna, 14.4. 2015

8. Tomašových A. – chair of the session Ecological fidelity and resolution of the fossil record across broad spatial and temporal scales, Northern American Paleontological Convention, Gainesville, 15-18. 2. 2014

- **Position of individual researchers in a national context**

Broska I.

- editorial board of the journal Mineralia Slovaca (member)
- scientific board of Natural Faculty of Comenius University (member)
- scientific board of Slovak National Museum (member)
- Agency for the Promotion of Research and development (member of committee for Earth and environmental sciences)
- Slovak Geological Board advisory committee of Ministry of environment - (member)
- Scientific College for Earth and Space sciences (member)
- Slovak Geological Society (member)
- Slovak Mineralogical Society (member of committee 2012-2015)

Janák M.

- Slovak Geological Society (member)

Jeleň S.

- Slovak association of economic geologist (member)
- Slovak Geological Society (member)

Kyška-Pipík R.

- Slovak Geological society (chairperson of regional branch)
- Slovak limnological society (member)

Lexa J.

- Slovak Geological Society (honourable member)

Luptáková J.

- Slovak association of economic geologist (member)
- Slovak Geological Society (member)
- Slovak Mineralogical Society (member)

Madarás J.

- Slovak Geological Society (member)

Michalík J.

- editorial board of the journal Mineralia Slovaca (member)
- Slovak Geological Society (chairperson of Paleontological branch)
- Scientific College for the Earth and Space sciences (member)
- editorial board of Slovak Academy of Sciences (memebr)
- Programme Board of the Centre of excelences (member)

Milovská S.

- Slovak Geological Society (member
- Slovak Mineralogical Society (member)

Milovský R

- Slovak Geological Society (member)
- Slovak Mineralogical Society (member)

Ozdinová S.

- Slovak Geological Society (scientific secretary)

Petrík I.

- Slovak Geological Society (member)

Puškelová Ľ.

- Slovak Geological Society (member)

Siman P.

- Presidium of Slovak Academy of Sciences, vice-chairperson of the 1. section
- Scientific board of the Slovak Academy of Sciences (member)
- Scientific board of Matej Bell University (member)
- Commission of the SAS on informatic technologies (chairman)
- Commission of the SAS on infrastructure and structural funds (chairman)
- Commission of the SAS on communication and media (member)
- Commission of the SAS on equality of opportunities (member)
- Commission of the SAS on cooperation among scientific societies (member)
- Commission of the SAS for the environmnets (chairman)
- Committee of grant agency VEGA No. 2 on Geosciences, Space and environmental sciences (incl. Erath resources) (member)
- Editorial board of the journal Geologické práce - Správy (member)
- Slovak Geological Society (member)
- Slovak Mineralogical Society (member of committee)

Soták J.

- Editorial board of the journal Mineralia Slovaca (member)
- Slovak Geographis Society (member)
- Slovak Geological Society (member

Starek D.

- Slovak Geological Society (member)

Sýkorová M.

- Slovak Geological Society (member)

Šimo V.

- Slovak Geological Society (member)

Tomášových A.

- Slovak Geological Society (member of committee)
- Commission on grant agency VEGA No. 2 on geosciences, space and environmental sciences (including Earth resources) - (member)

Vozár J.

- Slovak Geological Society (member)

Vršanský P.

- Slovak entomological society (member)
- Slovak Geological Society (member)
- Commission of the SAS on evaluation of international propjects (member)

2.3.13. List of invited/keynote presentations at national conferences, as documented by programme or invitation letter

1. Madarás J., Kráľ J. & Siman P.: Rock datings by radiometric methods. 23nd General meeting of Slovak nuclear society, Častá – Papiernička, 17. 5. 2012 (in Slovak).
2. Broska I., Petrík I. & Uher P.: Typomorphism of the accessory minerals. Geochémia 2016., 2.12.2013 Bratislava (in Slovak).
3. Kyška-Pipík R.: Best Practices OPVAV 2007-2013, Hotel Bôrik, Bratislava, 23.-24.11.2015 (in Slovak).
4. Broska I., & Petrik I.: Granitoids in the Tribeč block of Tatric crystalline basement: Their typology and tectonic interpretation. Christmas seminar .2015 (in Slovak).
5. Soták J., Kováč M., Plašienka D. & Vojtko R.: Middle Slovakian fault system a its role in tectogenesus and paleogeography of Paleogene basins of the Western Carpathians: new results from the Horna Nitra and Turiec basins. 14th Christmas seminar of the Slovak Geological Society, Bratislava, 10.12.2015 (in Slovak).
6. Michalík J.: Dinosaurs and climate during the Jurassic and Cretaceous - workshop results of the IGCP 609 and 632 projects in Nanjing and Shenyang, China. 14th Christmas seminar of the

Slovak Geological Society, Bratislava, 10.12.2015 (in Slovak).

7. Kyška-Pipík R. – Lost water paradise or how Turiec look like before 2 - 15 Ma. Matej Bela University, 19.11.2013

2.3.14. List of researchers who served as members of organising and programme committees of national conferences

1. Andráš P.: Sustainability – Environment – Safety 2012, Bratislava, 03.12.2012, SR, (organising committees)
2. Andráš P.: Environmental management and applied research, Banská Bystrica, 17.10.2013 (organising committees)
3. Ozdinová S.: 14th Workshop on actual geological problems of the Western Carpathians – annual meeting, Bratislava, 2015 (organising committees)
4. Ozdinová S.: Open congress of the Czech geological society and Slovak geological society Mikulov, 15.7.-17.7.2015, ČR

- **Supplementary information and/or comments documenting the international and national status of the Institute**

The research at the Institute is internationally appreciated, as can be deduced from the number of published papers in high ranked international journals. The renowned position of our key senior researchers follows from the citations of their publications and is a basis for calls and invitations to review papers in journals and to evaluate international projects, to participate in PhD and habilitation committees, and to be active in organizing committees of international conferences. The international editorial board of our journal Geologica Carpathica consisting of the top experts form different geological branches is also a result of the good reputation of our institution in the world. The high-quality infrastructure with qualified staff is also used by researchers from abroad, recently from Poland, Hungary, Romania, Germany, Norway and Sweden. Our offer of technical facilities is also important, for example, in the production of thin sections for researchers in Sweden and Norway.

The national position of the Institution is highlighted by high-quality modern infrastructure, which is used by researchers from Slovak Universities. The popularization activities are very important, especially from the workplace in Banská Bystrica. Many popularization activities, presentation on TV, including the Crystal Wing Prize for Dr. M. Janák, are part of the important outreach to our national position. Moreover, the national position is emphasized by the publication of two course books for the universities (see part 2.5.5). Core scientists from the institution are members of scientific boards of faculties and institutions. They were the members of numerous PhD and habilitation committees, mainly at the Comenius University. Some of them were/are active in the management of the Slovak Geological Society and the Slovak Mineralogical Society.

2.4. Tables of project structure, research grants and other funding resources

- **International projects and funding**

2.4.1. Major projects within the European Research Area and other important project – Framework Programmes of the EU, ERA-NET, European Science Foundation, NATO, COST, INTAS, etc. (here and in items below please specify: type of project, title, grant number, duration, total funding and funding for the institute, responsible person in the institute and his/her status in the project, e.g. coordinator "C", work package leader "W", investigator "I"),

	Project title	Typ / Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute / Responsible person
2012					
2013					
2014					
2015	Brachiopods as sensitive tracers of global marine Environment: Insights from alkaline, alkaline Earth metal, and metalloid trace element ratios and isotope systems	H2020-MSCA-ITN-2014; REA Grant Agreement No. 643084	3	14000 (EU fund) 4000 (SAS fund)	C

2.4.2. Other international projects, incl. total funding and funding for the institute

1. APVV SK-HU-2013-0027 **Comparative study of Miocene rhyolite volcanic formations in Slovakia and Hungary** – LEXA J. (01.01.2015-31.12.2016) – coordinator, 1480,-€
2. MVTS-UNESCO NA - **Global evolutionary patterns and environmental change indicated by the fossil record of cockroaches, termites and mantises** (UNESCO/AMBA framework) – VRŠANSKÝ P. (06.1998-12.2018) – 13 400,-€
3. MVTS-H2020 – **Isotops and ratio of trace elements during mass extincion on the Triassic and Jurassic boundary** (Geomar Germany) – TOMÁŠOVÝCH A. (01.2015-12.2018) – 4 000,-€
4. Project NSF-EAR 1124318 – **Temporal resolution in benthic assemblages: assessing and modeling the roles of burial dynamics, seafloor type, and intrinsic**

factors using (un)natural experiments (USA) – TOMÁŠOVÝCH A. (01.2012-12.2013), – project manager

5. Project JSPS 2012-2013 - **The role of ultramafic rocks on the mechanism of crust-mantle interaction in subduction zone** (Japan) – SIMAN P. (01.01.2012-31.12.2013) – project manager
6. Project RESPIRE NE/K005529/1 - **Responce of global ocean oxygenation to Early Cenozoic climate extremes** (England)– SOTÁK J. (01.01.2013-31.12.2015) – project manager
7. Project National Science Centre of Poland - **Magura Piggy-back Basin at the font of the PKB: lito and biostratigraphy, provenance analysis and paleogeographic interpretations (Western Outer Carpathians, Poland and Slovakia** (Poland) – SOTÁK J. (01.01.2014-31.12.2018) – project manager

2.4.3. Other important, international projects and collaborations without direct funding (max. 10 projects)

1. Project UNESCO/IGCP No. 609 - **Climate-environmental deteriorations during Greenhouse phases: Causes and consequences of short-term Cretaceous sea-level changes** (Austria) – MICHALÍK J. (25.04.2014-31.12.2019) – coordinator for SR
2. Project MAD - **Genetical and time relations between magmatic processes and gold mineralization in porphyry epithermal ore-forming systems in volcanic structures of Central Slovakian neovolcanites** (Russia) – JELEŇ S. (01.01.2012-31.12.2014), 0,-€
3. Project MAD - **Geology and evolution of Au-Ag-Bi-Te-Se of associations of deposits and ore manifestations of Ukraine and Slovakia** (Ukraine) – JELEŇ S. (01.01.2011-31.12.2013), 0,-€
4. Project MAD - **Ostracod-Diatomaceae paleoecologic and isotopic inference model for the fossil freshwater and brackish lakes** – KYŠKA-PIPÍK R. (01.01.2012-31.12.2014), 0,-€
5. Project MAD - **Paleovolcanic reconstruction and evolution of silicic volcanic formations in Carpathian-Pannonian region** (Hungary) – LEXA J. (01.01.2010-31.12.2012), 0,-€
6. Project MAD 32: **Miocene to Recent tectonic activity of Orava-Nowy Targ Basin** (Poland) – STAREK D. (01.01.2007-31.12.2012) - coordinators
7. Project MAD 2 - **Neotectonics of eastern segment of Mur-Orava Basin Fault Zone** (Poland) – STAREK D. (01.08.2013-31.12.2015) - coordinators
8. Project MAD 7 - **Revealing of genetic and age relations between magmatism and epithermal ore formation in volcanic structures of eastern-Slovakian and Western-Ukrainian regions of the neogene** (Ukraine) – JELEŇ S. (25.09.2014-31.12.2016) - coordinators
9. Project MAD - **Distribution patterns of diatoms and ostracods in the Slovakian and Bulgarian Neogene lake systems** (Bulgaria) – KYŠKA-PIPÍK R. (01.01.2015-31.12.2017) - coordinators
10. Project LS-2288 - **Fossil subcellular structures in giant sperm cells of Miocene ostracods: expanding the record to specimens preserved in amber** (Germany) – KYŠKA-PIPÍK R. (03.04.2014-23.06.2015) – project manager
11. Project CBEP - **Climate and biota of the Early Paleogene** – SOTÁK J. (01/2011-12/2013)

- **National projects and their funding**

2.4.4. Projects supported by the Slovak Research and Development Agency (APVV)

Role of the Institute e.g. coordinator “C”, investigator “I”.

	Project title	Typ / Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute / Responsible person
Continue	Contamination of mining country by toxic elements at selected Cu-deposits and possibilities of its remediation	APVV-0663-10	34	34160	I
	Au-porphyry systems deposit models in the Central Slovakia Neogene Volcanic Field and environmental aspects of their exploitation	APVV-0537-10	34	47611	I
	Meta-ultramafics, indicator of mechanisms of crust-mantle interaction, recyclation and exhumation in an orogenic wedge (W. Carpathians and eastern Alpine margin)	APVV-0081-10	34	41927	I
	Assessing taphonomic and geochemical approaches in evaluating spatial and temporal turnover of marine invertebrate paleocommunities	APVV-0644-10	34	91768	C
Start 2012	(Ultra)high pressure metamorphism and phase transformations during subduction and exhumation of continental lithosphere in collisional orogenic zones	APVV-0080-11	42	166526	C
Start 2013	Perlite genesis and inovative approaches to its exploitation and processing	APVV-0339-12	27	13222	I
	Evolutionary patterns as indicated by panarthropods	APVV-0436-12	27	55533	C
2014					
Start 2015	Stability of accessory minerals and the mobility of rare lithophile elements and C in the rocks of collisional orogenic zones: prograde and retrograde transformations	APVV-14-0278	6	11841	C
	Regional stratotypes for genetic, earthtime and paleoenvironmental properties of the Western Carpathian sedimentary basins	APVV-14-0118	6	16336	C
	Comparative study of Miocene rhyolite volcanic formations in Slovakia and Hungary	SK-HU-2013-002	12	1480	C

2.4.5. Projects supported by the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA) for each year, and their funding

VEGA	2012	2013	2014	2015
Number	13	15	13	16
Funding in the year (EUR)	50561	65509	70212	68541

[1]

[1] Excluding projects for the popularisation of science

- **Summary of funding from external resources**

2.4.6. List of projects supported by EU Structural Funds

2.4.7. Summary of external resources of the EU Structural Funds (ERDF/ESF)

Role of the Institute in the project, e.g. coordinator "C", work package leader "W", investigator "I".

Year	Project title	Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute
Continue	Centers of education of Slovak Academy of Sciences in Banská Bystrica and Smolenice	**ITMS 26250120034**	36	5256988,22	C
	Centre of excelence for integrated research of the Earth's geosphere	**ITMS 26220120064**	38	2533002,02	C
Start 2012	Completion of technical infrastructure for research of geodynamical processes and global changes in Earth's history	**ITMS 26210120013**	31	2992651,75	C
2013					
2014					
2015					

External resources	2012	2013	2014	2015	total	average
External resources (milions of EUR)	1,980	1,800	6,450	2,380	**12,610**	**3,153**
External resources transfered to coooperating research institute (milions of EUR)	0,120	0,210	0,080	0,030	**0,440**	**0,110**

- **Supplementary information and/or comments on research projects and funding sources**

First the most important funding sources for the research were obtained from the Slovak Research and Development Agency (APVV). The researchers supported by APVV fulfilled the planned objectives in their projects in very appropriate and clearly documented scientific output. The VEGA projects help researchers with a significantly smaller financial support. Second, most of our researchers are involved in external collaborations. Without such cooperations with partners from abroad that help with collaboratively-priced analyses of high-precision data, it would be impossible to fulfill project targets. Third, external funding sources are very restricted; minor finances also come from casual economic activities. In addition to the Maria Curie project (International Training Netwrok project "Base-Line Earth" in the framework of Horizon 2020), some research is supported by IGCP Projects (International Geological Correlation Programme) in the framework of UNESCO activities. The correlation work on IGCP project was organized through, communications and meetings and writing papers. Participation in meetings by our researchers is refunded by the Ministry of Finance of the Slovak Republic from the budget supporting UNESCO activities.

2.5. PhD studies and educational activities

2.5.1. List of accredited programmes of doctoral studies, period of validity

1. Petrology 4.1.32 Petrology
2. General Geology 4.1.33 Tectonics

2.5.2. Summary table on doctoral studies (number of internal/external PhD students; number of foreign PhD students, number of students who successfully completed their theses, number of PhD students who quit the programme*)*

PhD study	31.12.2012			31.12.2013			31.12.2014			31.12.2015		
Number of potential PhD supervisors												
PhD students	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted
Internal	10,0	0,0	0,0	12,0	0,0	0,0	9,0	2,0	2,0	13,0	0,0	2,0
External	1,0	0,0	0,0	2,0	0,0	0,0	2,0	0,0	0,0	3,0	0,0	1,0
Other supervised by the research employees of the institute												

The students who completed PhD sholarship according to years:

1. Mgr. Peter Vojtko, PhD. – 27.8.2014
2. Mgr. Štefan Čík, PhD. – 27.8.2014
3. Mgr. Martina Sýkorová, PhD – defence was postponed to January 2016

PhD students from abroad:

1. Mgr. Erika Kovacs (Hungary, starting in 2014)
2. Mgr. Tamás Müller (Hungary, starting in 2015)

The number of potential PhD supervisors for programmes that are accredited in 2016: 22

1. Petrology (M. Janák is a co-guarantor): A.Biroň, I.Broska, V.Hurai, M.Janák, J.Lexa, R.Milovský, I.Petrík, J.Soták,
2. Sedimentology (J. Soták is a co-guarantor): A.Biroň, J.Michalík, R.Milovský, R.Pipík, J.Soták, D.Starek, A.Tomášových, P.Vršanský
3. A new programme starting in 2016 – Applied geophysics (I. Broska is a co-guarantor): V.Bezák, M.Bielik, L.Brimich, I.Broska, P.Kristek, M.Kristeková, J.Madaras, P.Moczo, P.Vajda, J.Valach

2.5.3. Summary table on educational activities

Teaching	2012	2013	2014	2015
Lectures (hours/year)[2]	273	337	313	128
Practicum courses (hours/year)[2]	426	254	115	0
Supervised bachelor theses (in total)	5	12	5	5
Supervised diploma theses (in total)	5	9	7	5
Supervised PhD theses (in total)	10	11	10	12
Members in PhD committees (in total)	5	9	8	19
Members in DrSc. committees (in total)	0	2	2	1
Members in university/faculty councils (in total)	4	5	4	3
Members in habilitation/inauguration committees (in total)	3	3	1	6

2.5.4. List of published university textbooks

none

2.5.5. Number of published academic course books

1. Broska I., Petrik I.,& Uher P. 2012: *Accessory minerals of the Carpathian granitic rocks*. Bratislava, VEDA - Publishing House of the Slovak Academy of Sciences, 235 p. (in Slovak with English ressume).
2. Broska I. at al., 2015: *Planet, where we live on*. Edícia Svet vedy. Bratislava, VEDA - Publishing House of the Slovak Academy of Sciences, 170 p. + DVD (in Slovak).

2.5.6. List of joint research laboratories/facilities with universities

1. **Energy geoscience laboratory (EGL)** Joint laboratory of Energy and Geoscience Institute of University Utah and Geological Institute of the Slovak Academy of Sciences was established in 2007. Prospespection and studying ef energetic resources is the objective of common activities funded by worldwide oil companies (leader: M. Nemčok)
2. **Institute of Botany and Geology at Geological Institute of the SAS** is a training workplace for the students of botany and geosciences from the Natural Faculty of Matej Bell University. Recently new treaty is just in preparation (new name, contents and partners - e.g. mathematics, informatics, etc.).
3. **Joint research laboratory of the study of mixed-layered silicates.** Laboratory was established in 1994 upon the agreement between GI SAS and FNS Comenius University Bratislava.

- **Supplementary information and/or comments on doctoral studies and educational activities**

PhD study at the institution is organized in framework of legislation for universities with application of internal written rules. This special direction devoted to the PhD study clearly points to the duties and rights of the students at the institution. During evaluated period 15 internal and 3 external PhD students studied at the Geological Institute of the Slovak Academy of Sciences. Three students ended their study because of weak results. Mgr. Sýkorová defended her PhD work on January 2016 (she recently became a lecturer at the Natural Science faculty of the Matej Bell University). Moreover our experts are sometimes involved to PhD educative programme in the abroad: e.g. recently M. Janák is an unofficial supervisior of Mgr. Ivona Klonowska from the Uppsala university (Sweden).

2.6. Social impact

1. **2012:** Geological curiosities of Bratislava for the pupils of elementary schools; Devínska Nová Ves, 21.06. 2012 (geological lesson in nature, in a protected nature and palaeontological reserve for four classrooms, ca 80 pupils);
2. **2012-2014** expert lectures with the theme of biology, geology and nature protection from the SAS for several hundreds of children from elementary schools in the Bratislava - Petržalka (so called Petržalská superškola - Petržalka super school);
3. **2013:** Expertise for the publication of stamps with minerals from Slovakia: precious opal from Dubník (emission No 548) and quartz from Šobov (emission No 549) - cooperation with Dionýz Štúr State Geological Institute 12. 10. 2013 (historically, the first issue of Slovak postage stamps with the theme of minerals);
4. **2014:** Expert advice during reconstruction of historic landmark Artillery caverns from the First World War above Bratislava, district Dúbravka – geological characterization and assessment of the stability of caverns (a new component in a regional tourism: attractive accessed underground military facilities built directly into the rock environment; combination of geology and history; more than one hundred visitors monthly);
5. **2014:** Expert advice during archaeological excavations on the northern terrace of Bratislava Castle – especially on a historic quarry from 15th century in the granitic rocks of the Bratislava massif (documentation and research of technology of extraction rock in a unique medieval quarry, publication of the results in representative proceeding on castle history);
6. **2014:** Expert advice on the construction of an entrance into the historic gallery of Mariatal black – cooperation with the association Permon Marianka (new type of regional tourism, the history of black shales extraction, exhibition of mining lamps and the rocks from the Small Carpathians Mts. ca 700 visitors anually);
7. **From 2014:** Expert advice on the reconstruction and new exhibition of underground rooms at Devín Castle – National cultural heritage. Cooperation with the Municipal museum Bratislava (the developing of archaeological, geological and paleontological expositions for the Devín Castle which will be open in 2017, estimated number of visitors ca 20 000 anually)
8. **2015:** Expert consultation during restoration of the artillery cavern KK6 situated on the summit of Kamzík hill above Bratislava from the First World War (new component in regional tourism: attractive accessed underground military facilities; more than one hundred visitors every month);
9. **Popularization in the media.** Apart from numerous interviews on TV and Radio, participation in long discussion broadcasts (e.g. Night pyramid, Magazín of radio Regina, Panoráma radio Regina) and Slovak news agency TA3 (Talks through night, Guest in the studio).

2.6.1. List of the most important results of applied research projects. Max. 10 items

1. HURAI V., PAQUETTE J.-L., LEXA O., KONEČNÝ P. & DIANIŠKA I.: *U-Pb-Th geochronology of monazite and zircon in albitite metasomatites of the Rožňava-Nadabula ore field (Western Carpathians, Slovakia): implications for the origin of hydrothermal polymetallic siderite veins*. In Mineralogy and Petrology, 2015, vol. 109, p. 519-530. (1.349 - IF2014). (2015 - Current Contents). ISSN 0930-0708.
2. JELEŇ S., PRŠEK J., KOVALENKER V.A., TOPA D., SEJKORA J., OZDÍN D. & ŠTEVKO M.: *Bismuth sulphosalts of the cuprobismuthite, pavonite and aikinite series from the Rozália Mine, Hodruša-Hámre, Slovakia.* In Canadian Mineralogist, 2012, vol. 50, p. 325-340. (1.115 - IF2011). (2012 - Current Contents). ISSN 0008-4476.
3. CHERNYSHEV I.V., KONEČNÝ V., LEXA J., KOVALENKER V.,A., JELEŇ S., LEBEDEV V.A. & GOLTSMAN Y.V.: *K-Ar and Rb-Sr geochronology and evolution of the Štiavnica Stratovolcano (Central Slovakia).* In Geologica Carpathica, 2013, vol. 64, no. 4, p. 327-351. (1.143 - IF2012). (2013 - Current Contents). ISSN 1335-0552.
4. KHARBISH S., ANDRÁŠ P., LUPTÁKOVÁ J. & MILOVSKÁ S.: *Raman spectra of oriented and non-oriented Cu hydroxy-phosphate minerals: Libethenite, cornetite, pseudomalachite, reichenbachite and ludjibaite.* In Spectrochimica Acta Part A - Molecular and Biomolecular

Spectroscopy, 2014, vol. 130, p. 152-163. (2.129 - IF2013). (2014 - Current Contents). ISSN 1386-1425.

5. KIDWELL S.M. & TOMAŠOVÝCH A.: *Implications of Death Assemblages for Ecology and Conservation Biology.* In Annual Review of Ecology Evolution and Systematics, 2013, vol. 44, p. 539-563. (10.375 - IF2012). ISSN 1543-592X.
6. KODĚRA P., HEINRICH Ch.A., WÄLLE M. & LEXA J.: *Magmatic salt melt and vapor: Extreme fluids forming porphyry gold deposits in shallow subvolcanic settings*. In Geology, 2014, vol. 42, n. 6, p. 495-498.
7. MICHALÍK J., VAŠÍČEK Z., BOOROVÁ D., GOLEJ M., HALÁSOVÁ E., HORT P., LEDVÁK P., LINTNEROVÁ O., MĚCHOVÁ L., ŠIMO V., ŠIMONOVÁ V., REHÁKOVÁ D., SCHLŐGL J., SKUPIEN P., SMREČKOVÁ M., SOTÁK J. & ZAHRADNIKOVÁ B.: *Vrch Butkov : kamenný archív histórie slovenských vrchov a druhohorného morského života : a stone archive of Slovakian mountains and of the Mesozoic sea life history.* 1. vyd. Bratislava : Slovak Academy of Sciences, Geological Institute : Veda Editorial house, 2013. 164 s. ISBN 978-80-224-1287-2.
8. PIPÍK R., BODERGAT A.-M., BRIOT D., KOVÁČ M., KRÁĽ J. & ZIELINSKI G.: *Physical and biological properties of the late Miocene, long-lived Turiec Basin, Western Carpathians (Slovakia) and its paleobiotopes.* In Journal of Paleolimnology, 2012, vol. 47, p. 233-249. (1.898 - IF2011). (2012 - Current Contents). ISSN 0921-2728.

2.6.2. List of the most important studies commissioned for the decision-making authorities, the government and NGOs, international and foreign institutes

1. LEXA J. 2013: Evaluation of directives and methodical instructions for basic mapping of the territory of Czech Republic in the scale 1:25000 (Czech geological survey, Prague) – Expert review
2. SOTÁK J. 2014: Final report “The geological map Biele Karpaty Mts. – south branch and Myjava highlands in the scale 1 : 50 000” (Dionýz Štúr Geological State Institute) – assessment of the geological task for the Ministry of environment SR
3. SOTÁK J. 2014: Final report “The geological popularization map of the Zemplínske vrchy Mts in the scale 1:50 000 (ŠGÚDŠ) - (Dionýz Štúr Geological State Institute) – assessment of the geological task for the Ministry of environment SR
4. SOTÁK J. 2014: Partial final report “The geological map of the region Biela Orava in the scale 1 : 25 000” (Dionýz Štúr Geological State Institute) – assessment of the geological task for the Ministry of environment SR
5. SOTÁK J. 2014: Final report “The geological map of the Žiar Mts in the scale 1 : 50 000” (Dionýz Štúr Geological State Institute) – assessment of the geological task for the Ministry of environment SR
6. SOTÁK J. 2015: Final report “The task Turčianska kotlina – 3D geological modelling” (Dionýz Štúr Geological State Institute) – assessment of the geological task for the Ministry of environment SR
7. SOTÁK J. 2015: Partial final report “The geological map of the Biela Orava in the scale 1 : 25 000 (northern region), (Dionýz Štúr Geological State Institute) – assessment of the geological task for the Ministry of environment SR

2.6.3. List of contracts and research projects with industrial and other commercial partners, incl. revenues

1. Hornonitrianske bane Prievidza a.s., (2012-2013/20 000,-€)
2. Nafta a.s. (2014/9300,-; 2015/9300,- €)
3. State protection of nature, Administration of the Slovak caves (2015/7351,-€)
4. Archeological Institute of the Slovak academy of Sciences, (2015/19500,-€)

2.6.4. List of licences sold abroad and in Slovakia, incl. revenues

2.6.5. List of most important social discourses under the leadership or with significant participation of the institute (max. 10 items)

1. TV discussion – TA3: Interviews past midnight: Mysterious Earth, 13.9. 2014, Madarás J. (1 hour)
2. TV discussion – TA3: Interviews past midnight: Destruction of Civilizations, 31.5. 2014, Madarás J. (1 hour)
3. Presentation of the new author book connected with a discussion: Geological Friday's evening in Dubnica n/Váhom, 25. 4. 2014, Michalík J. (ca 1 hour)
4. Public presentation of research results: Science Festival - European Researchers' Night in Slovakia, Banská Bystrica, Bratislava, 2012 – 2015, Kyška-Pipík R., Jeleň S. (the whole day)
5. Presentation of the new book "The planet, where we live on", Incheba Exhibition Centre, Bratislava, 5. 11. 2015, Broska I., Madarás J., Petrík I., Nelišerová E., Durišová A. (1 hour)
6. Radio discussion on geology - RTVS: Night pyramid**,** 7.04.2014, Broska I. (1 hour)
7. Discussion in the Café scientifique SAS SAVinci: Cockroaches contribution to space and time. 4.10.2014., Vršanský P. (ca 1hour)
8. TV discussion – TA3: M. Janák about finding of natural diamonds in Norway. Guest in the studio. 9.8.2013, Janák M.
9. TV discussion – RTVS: Slovakia in pictures - Research on Poprad Lake. 4.8.2013, Milovský R. Kyška-Pipík R.
10. TV discussion – RTVS: Aktuality: Zbudza - Prospective of the salt deposit in the Eastern Slovakia. 22.10.2015. Soták J.

2.6.6. Summary of relevant activities, max. 300 words

The institute is an important source of scientific and expert information for the industrial partners. Except traditional partners Nafta a.s (Slovak oil company ltd), Hornonitrianske bane Prievidza (Upper Nitra mining company ltd.), Cement factory Ladce a.s. also various expert consultings have been done within the assessment period: e.g. geological hazards along future highway line in the area of the Veľká Fatra Mts., evaluation of bed rock sediments of Gabčíkovo dam, consulting for the fy Geofos a.s., Cad-Eco Bratislava, Gumárne Púchov and Chirana Stará Turá. Recently the important industrial collaboration began through the treaty with the Technical university of Brno (Czech Republic).

2.7. Popularisation of Science (outreach activities)

2.7.1. List of the most important popularisation activities, max. 20 items

2012

- participation in exhibition „Kamenár 2012" in Trenčín
- participation in the festival of science - European Researchers' Night in the shopping malls in Banská Bystrica
- participation in the presentations of Centres of excellence in areas Congress and Exhibition Centre Incheba Bratislava
- organization of "Open doors" within the the Science and Technology Week in Banská Bystrica
- two all-day field trips and scientific-popular discussion with children at the Children's University Hospital in Banská Bystrica
- appearances in telecommunication media popularizing the results of science, for example discussion by P. Vršanský to describe the luminescent cockroach, public popularization lectures
- participation in the Petržalka Super school - cooperation project of the SAS Presidium and city district of Petržalka - activity of P. Vršanský

2013

- participation at exhibition „Kamenár 2013" in Trenčín
- participation in the festival of science - European Researchers' Night in the shopping malls in Bratislava and Banská Bystrica

- organization of “Open doors” within the the Science and Technology Week in Banská Bystrica
- two all-day field trips and scientific-popular discussion with children at the Children's University Hospital in Banská Bystrica
- appearances in telecommunication media popularizing results of science and public popularization lectures
- participation in the Petržalka Super school - cooperation project of the SAS Presidium and city district of Petržalka - activity of P. Vršanský

2014

- participation in the exhibition „Kamenár 2014“ in Trenčín
- participation in the festival of science - European Researchers' Night in the shopping malls in Bratislava and Banská Bystrica
- participation in the exhibition Historical mining in the Polish Tatry and the Slovak Ore Mountains – Ľubietová in Krakow (Poland) and Banská Bystrica
- the establishment of the new mineralogical exhibition "The most beautiful minerals from Ľubietová" in Ľubietová
- organization of “Open doors” within the the Science and Technology Week in Banská Bystrica
- two all-day field trips and scientific-popular discussion with children at the Children's University Hospital in Banská Bystrica
- appearances in telecommunication media popularizing results of science and public popularization lectures

2015 Geological and Geophysical divisions

- participation in the Mining Exhibition for Cu and Fe ore in Ľubietová, in Bratislava, Kremnica, Brezno, Ľubietová, Banská Bystrica, Ľubiechová (PL)
- participation in the festival of science - European Researchers' Night in the shopping malls at Banská Bystrica
- organization of “Open doors” within The Science and Technology Week in Banská Bystrica
- participation at opening ceremony of The Science and Technology Week in the Centre of Science in Bratislava
- two all-day field trips and scientific-popular discussion with children at the Children's University Hospital in Banská Bystrica
- appearances in telecommunication media popularizing results of science and public popularization lectures
- new popular publication "The Planet, we live on” written by the authors, coordinated by Igor Broska from the Earth Science Institute of the SAS

2.7.2. Table of outreach activities according to institute annual reports

Outreach activities	2012	2013	2014	2015	total
Articles in press media/internet popularising results of science, in particular those achieved by the Institute	34	24	11	38	107
Appearances in telecommunication media popularising results of science, in particular those achieved by the Institute	4	17	17	20	58
Public popularisation lectures	25	44	32	54	155

- **Supplementary information and/or comments on popularisation activities, max. 300 words**

Science popularization activities played important roles in the activities of the Institute.

Every year we take part in many exhibitions and festivals intended for the popularization of science and presentation of research results. They include “Kamenár“ in Trenčín, the festival of science - European Researchers' Night in Bratislava and Banská Bystrica, Historical mining in the Polish Tatry and the Slovak Ore Mountains – Ľubietová, presentations at Centres of excellence in regions, Congress and Exhibition Centre Incheba Bratislava.

Within the activity “Open doors” during the Science and Technology Week in Banská Bystrica and Bratislava, intended for students and teachers, exhibitions of minerals, rocks and fossils, processing of geological samples in laboratories and short animated films on geological topics were presented. It allows students to observe minerals and fossils in binocular microscope and the polarizing optical microscope, and even scanning electron microscopes and state of the art equipment (e.g. SEM, Raman) obtained through the structural funds.

Accompanying events, organized as “Open doors” within the Science and Technology Week two are usually all-day field trips and scientific-popular discussion with children at the Children's University Hospital in Banská Bystrica.

In 2015 the popularizing educational publication "The Planet, we live on” was published. It was written by authors, coordinated by Igor Broska from the Earth Science Institute of the SAS, in response to the popular and successful exhibition with the same name.

Every year, scientists appear in the telecommunication media popularizing the results of science and giving public popularization lectures.

2.8. Background and management. Human resources and implementation of recommendations from previous assessment

2.8.1. Summary table of personnel

Personnel	2012	2013	2014	2015
All personnel	47,0	46,0	43,0	41,0
Research employees from Tab. Research staff	25,0	25,0	23,0	23,0
FTE from Tab. Research staff	21,350	20,200	20,000	19,650
Average age of research employees with university degree	47,0	49,5	48,0	49,0

2.8.1.1. Professional qualification structure (as of 31.12. 2015) FEMALE

FEMALE	AGE								
Number of	**< 30**	**31 - 34**	**35 - 39**	**40 - 44**	**45 - 49**	**50 - 54**	**55 - 59**	**60 - 64**	**> 65**
DrSc. / prof.									
II.a / Assoc. prof.									
Other researchers PhD./CSc.				**3**		**1**			
doc. / Assoc. prof.									

2.8.1.2. Professional qualification structure (as of 31.12. 2015) MALE

MALE	AGE								
Number of	< 30	31 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	> 65
DrSc. / prof.							3	2	1
II.a / Assoc. prof.			1	3	4	1			
Other researchers PhD./CSc.		1	2						
doc. / Assoc. prof.							1		

2.8.2. Postdoctoral and mobility scheme

2.8.2.1. Postdoctoral positions supported by national and international resources

2.8.2.2. Postdoctoral positions supported by external funding

2.8.2.3. SAS stipends and SASPRO stipends

2.8.2.4. Internal funding - the Slovak Academy of Sciences Supporting Fund of Stefan Schwarz

1. Mgr. Andrej Čerňanský, PhD. – 01.01.2012 – 31.12.2015
2. Mgr. Marek Vďačný, PhD. – 01.05.2015 – 30.4.2019

2.8.3. Important research infrastructure *(max. 2 pages)*

The infrastructure of the Geological Institute SAS includes essential technical equipment necessary in geological, mineralogical, petrological and palaeontological research. Computer and technological infrastructure of the former Geological Institute branch in Banská Bystrica has been significantly improved during the last six years, especially by implementation of the Structural Funds of EU, including (1) High-resolution 3D computed tomograph micro-CT v|tome|x L 240, (2) field emission Electron Probe Microanalyser (EPMA) JEOL JXA 8530F, (3) the laboratory of optic microscopy, and (4) other computational and communication technologies. These new devices are placed in a new building built in 2014. The new building in Banská Bystrica offers 2000 m^2 of laboratories, lecture rooms, and a modern depository for geological samples. In addition, it also includes rooms with sanitary facilities, including kitchens, for accommodation of 20 students. Therefore, this building is now one of the most comfortable education centre of the Slovak Academy of Sciences.

During the period 2010-2015, the Geological Institute benefited from the European Regional Development Fund to establish (1) the stable isotope laboratory dedicated to analysis of light stable isotopes, (2) laboratory of vibrational spectroscopy with the Raman, (3) infrared micro spectroscopy laboratory equipped with LabRam HR 800 from fy Horiba Jobin-Yvon, (4) X-ray diffraction laboratory with diffractometer D8 Advance SolXE fy Bruker, (5) the scanning electron microscope fy JEOL JSM-6390LV purchased in 2007 upgraded with an energy dispersive spectrometer from OXFORD Instruments Ltd., Inca X-Act cathodoluminescence spectral imaging system CLue (Horiba Jobin-Yvon) and with new sputter coaters for carbon and gold coating samples, (6) laboratory for geofluids and microthermometry, (7) laboratory for palaeolimnology equipped with a floating platform and chirp sonar, and (8) laboratory of X-ray fluorescence spectrometry equipped with M4 TORNADO. The preparation laboratory at the workplace in Bratislava equipped with the latest automatic device set from Logitech purchased in 2009 was partly modernized, especially the Wilfley shaking table. The laboratory covers special requirements of the geologists and palaeontologists in the whole domain of trimming, lapping and polishing of geological materials, preparation of polished and covered thin sections. Moreover the mobile laboratory unit from the Banská Bystrica branch also includes the Raman spectroscopy fy Horiba.

The infrastructure of the Geological division of the Earth Science Institute of the Slovak Academy of Sciences offers the services of 12 fully organized laboratories. The Banská Bystrica branch It also allows for the possibility to organize the workshops and meetings on the basis of video conferences. The high technological analytical devices and optical microscopes placed in laboratories in Banská Bystrica provide the opportunity to organize courses for graduate and postgraduate students in specific analytical geological methods. The first course for 40 students will happen in October 2016 on the basis of cooperation between our institute and AGH University in Krakow (Poland).

The infrastructure is presented on the institutional web page and offered for a broad academic community. The microCT attracts many users. For example, researchers from the Archaelogical Institute used the 3D imaging of historical swords and other human artefacts to improve the understanding of the evolution of investigated swords; the Astronomical Institute analysed the meteorites from Slovak area with 3D tomography to recognize meteoritic impact breccias; Slovak Technical University investigated a spatial distribution of the iron rods in the concrete to improve the concreting technological process; Speleothems from caves have been investigated in detail by microCT for the Cave Research Center at Liptovsky Mikuláš; porozity, as the very important mechanical property, were analysed for Comenius University, Nafta Oil Company; evolutionary trends in the reptile sculles and morphology of the microcrustacean fossil soft body were analysed for Comenius University and Unoversity in Munchen (Germany) The infrastructure have been used also by investigators from abroad, mainly from the Czech Republic, Poland and Hungary, but also from Russia, Bulgary, Romania. The field emission microprobe (unique device by its analytical parameters available in the central Europe) started its operation just recently (in summer in 2015) but already attracted researchers from Slovak universities and from abroad to investigate the chemical composition of the gemstones (Poland), ore minerals (Slovakia), diagenetic and taphonomic proceses (both from Hungary). Raman spectroscope and XRF spectrometer helped in restauration of the original colours on the Slovak Barroc sculptures and to historians in investigation of the origin and causses of the death of famous historical people from the Slovak territory. Laboratory of stable isotopes applies analytical methods in research of origin of the natural gas stored in the Slovak underground storages, climatic and paleoecologic record in the post-Paleozoic period. Laboratory of Limnology was successfully applied in research of quaternary climatic record and in investigation of sedimentary record in actual water dams.

2.8.4. Description of how the results and suggestions of the previous assessment were taken into account

The previous assessment of the Geological Institute of the Slovak Academy of Sciences performed in 2011 was very positive. At that time the evaluation report highly appreciated (1) increase of number of publications in the high ranked international journals (2) increase of impact factor of the scientific journal Geologica Carpathica as well as the constitution and good strategy of its editorial board (3) increase in the number of references especially of young scientists (4) increase in the number of good project from structural funds (5) high quality of PhD education and educational activities of researchers, (6) good social economic outputs (7) significant popularization activity mainly due to organizing the exhibition in the Slovak National Museum „The Planet where we live“ in the framework of the International Year of Planet Earth (59 600 visitors and three re-installations in other museums) (8) background and management as well as good age situation at the institution. The institution at that time obtained 91.51 % points and the whole organization was finally classified to the category „A“.

The positive evaluation encouraged the staff of the institution and the results are in many aspects now even better, in spite of quite a number of huge problems with the implementation of projects financed by structural funds which sucked significant portion of time from planned research. The number of publications and citations remain on the same level and still high compared with previous evaluated years. The good reputation of the institution is visible in the increased number of offers of projects from the side of the industrial partner Nafta a.s. Moreover the institute became a leader in the integration policy of the Slovak Academy of Sciences and the experiences from this process are now widely utilized. The Geological Institute continues as the Earth science institute of the Slovak Academy of Sciences.

- **Supplementary information and/or comments on management, research infrastructure, and trends in personnel development**

The merging of institutions led to the unification of the former Geological Institute and Geophysical Institute. The present structure of the Earth Science institute SAS is unified under one scientific board, library and administration. The primary suggestion on the personnel development remains on the division leaders and leaders of departments or scientific branches. Trend to the sustainable development of institution also strongly depends on the strengthening of research branches by young scientists. Possible extension of research targets also towards geomorphology and hydrology tasks is planned.

3. Research strategy and future development of the institute for the next five years (2016-2020) (Recommended 3 pages, max. 5 pages)

The research strategy and future development concerns the Earth Science Institute of the Slovak Academy of Science newly established on 1st July 2015. Therefore, this part of the assessment is common for both the former institutes, the Geological Institute of the Slovak Academy of Sciences and the Geophysical Institute of the Slovak Academy of Sciences.

The Presidium of the Slovak Academy of Sciences issued the order no. 557 on March 12, 2015 that approved the merger of the two institutes – the Geological Institute and the Geophysical Institute. The Geophysical Institute of the Slovak Academy of Sciences ceased the existence as a organization without liquidation on July 1, 2015. Its legal successor was represented by the Geological Institute of the Slovak Academy of Sciences that continued as the contributory organization. By order of the Presidium of the Slovak Academy of Sciences no. 591 issued on April 9, 2015, the Geological Institute of the Slovak Academy of Sciences was renamed to the Earth-Science Institute of the Slovak Academy of Sciences, with the effective date starting on July 1, 2015.

The early period of existence of the new joined Institution was characterised by general administrative re-organisation: unification of the Economy department, establishing of new management, new property evidence, preparation of new identification document, new agreements with the supplying firms, as well as instructions for financial operation at the institution. The election of common Scientific Board completed this process.

3.1. Present state of the art in both the national and the international contexts

The current research in the Geological division generated a significant progress in several fields, including petrology, stratigraphy and palaeobiology. One of the most prominent examples is represented by investigations of ultrahigh pressure metamorphism and by reconstructions of marine ecosystems and depositional environments during the Mesozoic and Cenozoic. The outcomes of this research were mostly published in journals that belong to the first quartile in their research categories. Moreover Hurai et al. published in Elsevier the monograph for the first time devoted to geofuids. Improvements in research, in quality and in educational outreach at national and international level were connected with improvement of infrastructure and development of laboratories with new analytical instruments. The discovery of diamonds was honoured by one of the highest Slovak awards for scientists - “Crystal Wing“ for the year 2013, and Prize of the Slovak Academy of Sciences for the year 2015.

The core research at the Geophysical division is in international cooperation in seismology, gravimetry, geothermics, geomagnetic activity, and analyses of atmospheric data in high mountains. The most prominent research at the top international level is the development and application of numerical methods for seismic wave propagation and dynamic rupture modelling. The monograph published by the Cambridge University Press together with identification of the team as one of the Excellent Research Teams of the Slovak Academy of Sciences, and Prize in the category “Science and technology team of the year” also illustrate the strong position of the team in the international and national contexts. The outcomes from analysis of seismic data for the use of civil protection in Slovakia, seismic hazard analysis for economically important sites (e.g., nuclear power plants), and the use of geomagnetic measurements by Slovak military airports underlines the national importance of the Institute.

3.2. Research strategy of the institute in the national and the international contexts, objectives and methods

Project proposals submited to 7RP or H2020	2012	2013	2014	2015
Institute as coordinator				
Institute as participant				1

The research strategies and methods that will be applied at our institution reflect the merging of two former institutes and documents clear compatibility of the main topics. The research can be divided into six major research orientations with detailed plans for the next five years:

1. **investigation of the physical processes and the dynamics of the Earth's continental lithosphere:**
   a. research of the composition, history and dynamics of the lithosphere: lithologies, thermodynamic, density, seismic, magnetic, palaeomagnetic, geothermal and magnetotelluric modelling;
   b. validation of the 3D seismic model using the seismic noise analysis and improvement of the model using full waveform inversion;
   c. transformation of continental crust and upper mantle during deep subduction;
   d. preservation of ultrahigh-pressure minerals and their transformation during exhumation back to the Earth's surface;
   e. reconstruction of metamorphic P-T-t paths of crustal and mantle rocks, especially eclogites, garnet peridotites and diamond-bearing gneisses;
   f. fluid-rock interaction at upper mantle/lower crustal levels;
   g. partial melting and formation of granitoid magma, with particular emphasis on the role of water and oxidation/reduction conditions and evolution of I-, S- and A-type granite magmatism;
   h. volcanism in connection with metalogenesis;
   i. accessory minerals in relation to magmatic, metamorphic and melt/fluid reactions;
   j. isotope study in minerals and geochronology of mineral evolutionary stages.

2. **analysis and interpretation of important phenomena and characteristics of the physical fields of the Earth**
   a. analysis of seismic recordings from the National Network of Seismic Stations as well as from the European AlpArray temporary seismic network as a part of the international data exchange;
   b. collection and analysis of macroseismic data after earthquakes observed in the territory of Slovakia;
   c. implementation of state-of-the-art methods for increasing precision of earthquake hypocentre locations, improving focal mechanism solutions of weak local earthquakes;
   d. research focused on space weather and developing the prediction models of geomagnetic activity due to various solar energetic events;
   e. research focused on testing and application of new Prutkin method to understand the gravity changes especially in volcanic area.

3. **reconstructing climate, ecosystem, and environmental changes across major global and regional environmental events**
   The major goal is the integration of stratigraphic patterns generated by past climatic, tectonic and biological events during the Mesozoic and Cenozoic and to infer the dynamics of these events on the basis of geochemical, palaeobiological, sedimentological, taphonomic and geochronological approaches. We will target the following questions:
   a. tracing and quantifying the effects of climatic changes, extinctions, and ecosystem disturbances on the composition and diversity of benthic and planktonic communities preserved in the stratigraphic record of marine shelves and oceanic basins during the Mesozoic in the Western Carpathians, Alps, and other Tethyan regions (end-Triassic mass extinction, early Toarcian anoxic event, Jurassic/Cretaceous boundary, and Cretaceous anoxic events);
   b. inferring the sequence stratigraphy and depositional mechanisms of Palaeogene synorogenic turbidite basins in the Carpathians;
   c. detecting the Palaeocene-Eocene thermal maximum, the Mid-Eocene climatic optimum, and middle Miocene climatic optimum in the stratigraphic successions of the Carpathians, Mediterranean, and Atlantic, using planktonic foraminifers, calcareous nanoplankton, and benthic communities;
   d. reconstructing the environmental history of Late Miocene-Pliocene lake systems in the Pannonian Basin;

e. reconstructing palaeoclimatic conditions during the Pleistocene and Holocene preserved in cave sediments and speleothems with geochronological and geochemical methods;
f. modelling time averaging, stratigraphic mixing and fossilization dynamics of benthic skeletal assemblages on modern continental shelves since the last glacial maximum, and
g. detecting human disturbances in the sedimentary record of continental shelves over the last centuries (Adriatic, California). We also intend to nominate several sections in the Western Carpathians as reference stratotype sections to calibrate the geological timescale and sedimentary archives of global and regional events. Multidisciplinary integration will be a major agenda of advanced stratigraphic, sedimentological and palaeobiological research because independent climatic and biotic proxies of environmental events significantly improve and constrain our inferences.

4. **development and improvement of the analytical and numerical methods, especially of the integrated modelling with the specific emphasis on the numerical modelling of seismic wave propagation and seismic motion at sites of interest**
   a. identification and characterization of a potential for anomalously large earthquake ground motion (site effects) in a local surface structure using robust numerical modelling of earthquake ground motion and statistical analysis;
   b. development and improvement of forward numerical methods for simulation of earthquake motion with the main focus on optimization and computational efficiency;
   c. increasing precision of methods for earthquake hypocentre location and improvement of focal mechanism solutions of weak local earthquakes;
   d. improvement of seismic noise analysis methods suitable for validation of seismic model;
   e. development and improvement of full waveform inversion methods for improvement of seismic model.

5. **investigation of the origin and evolution of raw material**
   a. genesis and origin of mineral deposits based on the study of geofluid, mineral, rock and melt compositions. Special care will be devoted to the stable isotope research and thermodynamic modelling of mineral- and rock-forming processes.
   b. perlite genesis to support exploitation strategy and utilization of this important environment-friendly industrial mineral;
   c. genesis of an unusual caldera-hosted epithermal Au deposit in the central zone of the Štiavnica stratovolcano (Western Carpathians) with the aim of supporting further exploration for this type of Au-rich mineralization;
   d. hydrocarbon potential of sedimentary basins, application-oriented basic research for developing various types of geological reservoirs
   e. maintaining, developing and extending the non-destructive micro-beam analytical basis needed also for research on historical artefacts, biominerals, and industrial stones;
   f. part of the existing analytical techniques and human capacity will be devoted to the public service and educational outreach, e.g. determination of rocks, minerals and meteorites, expert advice and consultation.

6. **analysis of the geo-hazards, the effects of climate change and the factors menacing the environment**
   a. seismic hazard assessment of the territory of Slovakia compliant with the Eurocode 8 standard: microzonation of the territory of Slovakia and estimation of suitable response spectra;
   b. continuous recordings of the climate parameters, air substances composition, and phenology at high-mountain localities;
   c. harmonization of monitoring methods of cryosphere;
   d. climate change impact at regional scale with a focus on mountain areas and impacts of climate change on biosphere in high mountains of the North-West Carpathians;
   e. multi-hazard assessment of the territory of Slovakia and enhancement of early warning systems;
   f. analysis of radon risk in the Slovak tourist caves.

The working areas include mainly the Western Carpathians, Eastern Carpathians, Eastern Alps, Rhodopes, Pontides, Scandinavian Caledonides, Brazilian Highlands, Central volcanic Carpathians complex, Volcanics of Tenerife, Mygdonian basin in Greece.

Future of the Earth Science Institute of the Slovak Academy of Sciences

The Earth Science Institute of the Slovak Academy of Sciences was established on July 1, 2015 by merging the *Geological Institute of the Slovak Academy of Science*s with the *Geophysical Institute of the Slovak Academy of Sciences.* The former institutes were founded in 1953 therefore and it is also an oficial date of origin of the whole Earth Science Institute. Presently, the institute is situated at four locations – Bratislava, Banská Bystrica, Hurbanovo, Stará Lesná. The diverse locations of the Earth Science Institute are an advantage for its orientation, and the further development of all locations should be in focus. The integration of the employees in Bratislava into a single building will be crucial for the future development of the institution.

(1) Infrastructure

Institute operates and maintains the Slovak National Network of Seismic Stations which was extended and modernized in 2003. Since that time there were very low investments to hardware, the network must be modernized in the next years. We will continue in our effort to include this infrastructure into Slovak ESFRI roadmap which will enable our full membership in EPOS-ERIC (European Plate Observing System - European Research Infrastructure Consortium).
Institute uses very modern laboratories and unique equipments in Banská Bystrica workplace, including e.g. mass spectrometry, electron microprobe, Raman spectroscopy, stable isotope laboratory. In the future these laboratories will be utilisied not only for the basic research but also for service purposes. The laboratories are used not only by our researchers and workers from Comenius and Matej Bel universities, but also internationally by researchers and students from the Czech Republic, Hungary, Poland, Ukraine, Russia, and Romania. We will continue in the policy of the high accessibility of our infrastructure to other researchers. The modern laboratories with sensitive devices will be further developed at the workplace in Banská Bystrica as institutional core facilities for research and for service aplications or purposes.
The core infrastructure and instruments must be modernized in the next years also in Bratislava work place of Geological division, mainly its separation and optical laboratory as well as some modernisation of the former analytical facilities. These laboratories will require care and next investments for sustainable future development.
A renovation of paleomagnetic laboratory and modernization of meteorological observation point are necessity in near future. Plan of modernisation will be progressively realised within years 2017-2020.

(2) Human resources

The backbone of research at our institution is formed by a team of highly qualified experts supported by active young scientists, students and technicians. The differentiated financial funding of the best experts will be widely applied. The organization will need to enhance its research capacity by improving salary conditions for the key scientists and by increasing the number of research positions, including the number of graduate students and postdoctoral scholars. A stronger effort to obtain international projects will be required from the core scientists. The core infrastructure needs high qualified, skilled researchers for it permanent and effective use, too.

A potential enlargement of the Institute by incorporating and creating a new branch oriented towards geomorphology and hydrology, is desirable if projects oriented towards water resources and management will be implemented at the institution.

Maintaining the high quality level of the international journal Geologica Carpathica and developing the quality of the journal Contribution to Geophysics and Geodesy will be an important agenda leading to integration of edition offices.

(3) Basic and applied research

The research realized in future must be basic and mostly international. It will be realized according to the above mentioned research directions mainly in the teams. The Institute will apply for projects

towards wide international collaboration, for example, in the framework of the raw material strategy of the European Union, especially by cooperation with the Montana University at Leoben.

The majority of researchers are now also partly involved in applied research, mainly in collaboration with the Slovak oil company (Nafta a.s.) that can provide us access to unique borehole material. The target of such research in future will be the investigation of the structure, physical properties and tectonic evolution of the crust and lithosphere in the Carpathian-Pannonian region and quantitatively to improve the existing geophysical and geological models. The research aimed at the underground storage of hydrogen in Earth's gas reservoirs will probably form an important part of the institute's applied research activities. In addition to the research of high energy underground storage, we will also investigate low-capacity hydrocarbons reservoirs.

Another applied research activity with outcomes for basic research will be seismic hazard assessment and microzonation of sites with facilities critically important for operation of the nuclear power plant Jaslovske Bohunice. This study will be in cooperation with the Nuclear Regulatory Authority of the Slovak Republic.

The institute will only do the kind of applied research that will be open for publication of the obtained data. In this manner we will attempt to integrate applied and basic research.

One of the latest important activities of the institute is preparing a joint multidisciplinary research project based on complex modelling of cycles between Geology - Environment - Water and relations with forecasting the sustainable development of society.

4. Other information relevant for the assessment

Compared to the past we are extending our activities to get financial support for researchers via external funding sources, and this effort is visible already in this year. Through the Slovak Academic Information Agency, we obtained a short-term research scholarship of Jakub Bazarnik from Poland (Warszaw) and Liubomyr Gavryliv from the National Taras Shevchenko University of Kyiv (Ukraine). Moreover, we are more intesively involved to the training courses of foreign students which offer further new research data. During this summer, our institute organized mapping course for four students from the University of Texas at Austin (USA) accompanied by Prof. L. Catlos and prof. R.Kyle. During this course, we adviced them on sampling of granites from the Western Carpathians for new datings, and these activities can lead to future collaborative papers. Fourty students from the AGH University of Science and technology (Krakow, Poland) will take part at a course of laboratory techniques at our laboratories. Our Institute employs Dr. Jan Vozar, who worked for six years at the Trinity University in Dublin, he is co-funded by the European Union (SASPRO project). We started to participate within international KIC or EIT Raw Material scheme headed by the Montana Universität in Leoben (e.g. project bauxite deposits). Further coming activity will be the participation in the project WATERS in Central Europe via the Joint Research Centre of the European Commission.

The coming soon conferences in abroad are internationaly appretiated: e.g. The 12th International eclogite conference in Åre, Sweden (august 20-29, 2017) is organized as collaboration between Lund and Uppsala Universities (Sweden), the University of Utrecht (the Netherlands), and the Earth Science Institute SAS (Slovak Republic). Representatives are Charlotte Möller (LU, SE), Jarek Majka UU, SE), Herman van Roermund (UU, NL), and Marian Janák (SAS, SK) (http://www.geology.lu.se/IEC12). Other example is a conference on Accessory minerals organised by Vienna University (L. Nasdala), Earth Science Institute SAS (I.Broska) and Masaryk University (Milan Novak) (Sept.13-17, 2017; http://www.univie.ac.at/Mineralogie/CAM-2017/).

The Earth Science Institute at the beginning of new existence needs the stability and consolidation of personel according to rules accepted by our Scientific council. It means a distinct motivation of core researchers and more significant mobility of the rest of researchers. The contribution to the existence of Earth Science Institute from the Presidium of the SAS is able to cover most of the personnel costs but only partly operation expences. The running cost - administration, maintance of buildings and infrastructure, insurance - is covered mainly from the projects and external contracts. Therefore, further development of institution strongly depends on quality of well-funded projects.