GEOLOGICAL SURVEY OF SLOVENIA ANNUAL REPORT 2018

CONTENTS

Knowledge and experience have faces and therefore the 2018 annual report is filled with the faces and stories of our employees. They talk about their jobs, and help present our organisation, projects and achievements. All the faces at the GeoZS form a versatile, exceptional, motivated and indivisible mix of researchers, experts and, support staff – together our team can overcome even the most demanding challenges.

Miloš Bavec, PhD - Director of the GeoZS

OPENING ADDRESS BY THE DIRECTOR

The highlight of Geological Survey of Slovenia's activities and efforts in 2018 was the largest geological event of the year – the 5th Slovenian Geological Congress organised in cooperation with the Slovenian Geological Society and held in October in Velenje. Almost 200 participants from 18 countries, distinguished plenary speakers and panelists at the round table titled Is Slovenia ready to use geological knowledge in its future development? presented their scientific and expert papers at the Congress and discussed the future societal role of geological science and profession. Discussions have shown that Slovenian geology managed to pick the right path whenever it found itself at a crossroads in the past, even though the environment was not always favourable. The geology sector is now in excellent shape and can give society more than it is currently asked. It is therefore even more important that we keep spreading awareness of the importance and benefits of geological science for sustainable development.

In 2018, Geološki zavod Slovenije / The Geological Survey of Slovenia (GeoZS) strengthened its position in basic research and the application of its results to improve the way our society works both in Slovenia and abroad.

Taking part in international projects we have expanded our basic research activities. We started running as many as ten projects within GeoERA, a European programme providing a joint research space for European geological surveys. We have become full members of the EIT RawMaterials Knowledge and Innovation Community (KIC). As one of the three founding members, we began performing concrete activities at the Adria Regional Centre. The Centre acts as a link between research, education and industry in the field of mineral resources in the Western Balkans. When it comes to conducting basic research in Slovenia, we are still waiting for the announced systemic expansion of such activities. Despite this, we improved our research performance indicators and exceeded projections in business operations as well.

In 2018, we saw a noticeable increase in applied research projects, which require top-level expertise for a more efficient and environmentally sustainable operation of the state. We are also experiencing a growing demand for technical bases giving answers to increasingly complex issues in the field of natural resource supply, sustainable living, and environmental protection. This is a very welcome trend, as we approach difficult issues using our knowledge and experience. In resolving such issues, a less gratifying fact is a growing number of attempts to degrade results that are not pleasing to the clients or their opponents. This might be the beginning of a new professional valuation crisis. As such, it is a new challenge facing research institutions. This challenge can only be answered by insisting on transferring basic research results into applied projects with no compromise, no deviations nor adjustments to the demands of clients or other stakeholders.

Knowledge and experience have faces and therefore the 2018 annual report is filled with the faces and stories of our employees. They talk about their jobs, and help present our organisation, projects and achievements. All the faces at the GeoZS form a versatile, exceptional, motivated and indivisible mix of researchers, experts and, support staff – together our team can overcome even the most demanding challenges. And so, we proudly present them to you in this report; unfortunately, there was not enough space for all their knowledge and thoughts, which is why we share with you only a part.

1 ABOUT THE GEOLOGICAL SURVEY OF SLOVENIA

1.1 MISSION AND VISION

MISSION

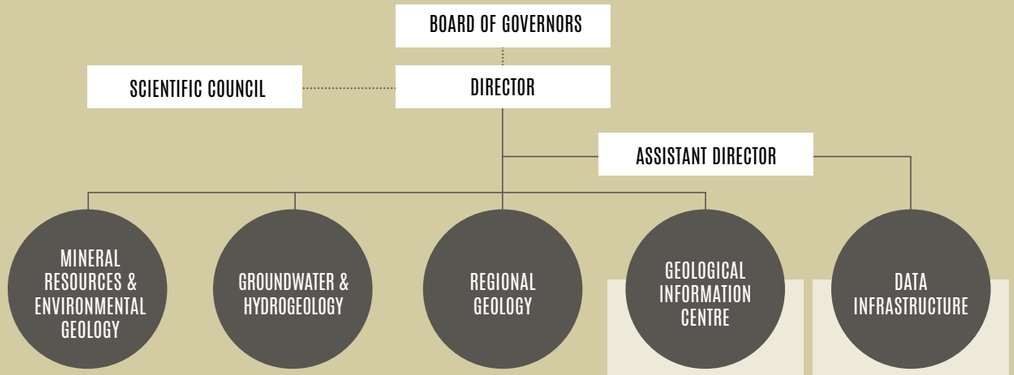
Geološki zavod Slovenije / The Geological Survey of Slovenia (GeoZS) is a multidisciplinary public research institute that operates in various fields of geoscience, and conducts basic research and applied activities in Slovenia and abroad, as well as public services in support of the operation of the Republic of Slovenia and the European Union. It provides knowledge of Slovenia's geological structure, which is the basis for resolving problems of national importance, such as health and environment protection, drinking water and energy supply, protection against natural disasters, land-use planning, discovery and estimation of reserves, and the planning of sustainable exploitation of mineral sites. The GeoZS acquires, stores, interprets and makes available geological data required by the state and society. We are engaged in research on both national and international levels and cooperate with similar organisations in Slovenia and abroad. The GeoZS takes an active part in various EU programmes focused on sustainable living, climate action, as well as efficient and sustainable use of resources and raw materials. We work hard to provide universal accessibility and application of expert knowledge in the society and the economy, transfer research results into practical application, popularise science, spread scientific culture, and raise public awareness.

VISION

The GeoZS aims for its name to become synonymous with the knowledge of everything that can be found beneath the Earth's surface. While our top priority is research, we are also creating an environment that will allow efficient transfer of theoretical knowledge into practice, both in Slovenia and abroad. In the long run, three research programmes will continue to form the core of our research: Regional Geology, Groundwater & Geochemistry, and Mineral Resources.

1.2. ORGANISATION AND MANAGEMENT IN 2018

Technical, development and research work is organised within four units or departments: Regional Geology, Mineral Resources & Environmental Geology, Groundwater & Hydrogeology, and Geological Information Centre. Administrative support is provided by the Back office.



ORGANISATIONAL STRUCTURE

The GeoZS is managed by a Board of Governors. The Scientific Council is an expert body that addresses and decides on issues related to the scientific and technical work performed by the GeoZS. The GeoZS is managed by a director.

Management

Miloš Bavec, PhD – Director of the GeoZS

Jure Krivic, PhD – Assistant director of the GeoZS

Board of Governors

Djordje Žebeljan, MSc – Chair
Holding Slovenske elektrarne d. o. o.

Andreja Umek Venturini – PhD – Vice-Chair
Ministry of Education, Science and Sport

Jože Uhan, PhD – Member
Ministry of the Environment and Spatial Planning

Leopold Vrankar, PhD – Member
Ministry of Infrastructure

Tatjana Dizdarević – Member
Idrija Centre for the Management of Mercury Heritage

Marko Fatur – Member
Ljubljanski urbanistični zavod d. d. (Urban Institute of Ljubljana)

Mateja Jemec Auflič, PhD – Member
Geological Survey of Slovenia

Scientific Council

Nina Mali, PhD – Chair

Gorazd Žibret, PhD – Vice-Chair

Miloš Bavec, PhD – Director of the GeoZS

Bogomir Celarc, PhD – Member

Mateja Gosar, PhD – Member

Mitja Janža, PhD – Member

Tea Kolar Jurkovšek, PhD – Member

Polona Kralj, PhD – Member

Robert Šajn, PhD – Member

1.3 ORGANISATIONAL UNITS OF GeoZS

REGIONAL GEOLOGY

Bases for research in all areas of geology, which are important for key infrastructure projects, among other things

Regional geology covers a very wide range of geological studies. Their common denominator is discovering and identifying the three-dimensional geological structure of Slovenia from its geological history all the way to the present time. The department staff conducts petrographic, sedimentological, stratigraphic and palaeontological studies on rocks, tectonic studies, studies of tectonic geomorphology and active fractures, geohazards, such as earthquakes and landslides, and geophysical investigations. Almost all of us are skilled in geological mapping. The research we conduct serves science, provides findings in various fields of geology, as well as in applied projects. Our core activity is basic research into regional geology conducted within the Regional Geology Programme of the Slovenian Research Agency (Javna agencija Republike Slovenije za raziskovalno dejavnost – ARRS). A highlight in our applied projects is our support in deciding on a possible construction of a second unit of the Krško Nuclear Power Plant, and studies for the second track of the Divača–Koper railway line. Geological research is varied, conducted mostly in the field, and requires ongoing and creative adaptation to a given situation. The value we create for science is new findings in various fields of geology, which have been published in the most renowned scientific journals. Furthermore, we transfer these findings to geological research for the purposes of various infrastructure projects in Slovenia, which certainly helps optimise their siting.

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>
> **Bogomir Celarc, PhD** – Head

MINERAL RESOURCES AND ENVIRONMENTAL GEOLOGY

Slovenia should also consider increasing its self-sufficiency in mineral resources and pay more attention to studying the processes, content and distribution of chemical elements in the natural environment

In line with the European mineral resources initiative, Slovenia will also have to consider increasing its self-sufficiency in mineral resources. Therefore, our research focuses on topics related to mineral resources throughout their life cycle. This involves new ways of exploring and obtaining information on mineral resources, including robotics. We study various forms of mineral processing and recycling, and we make sure that their use is knowledge-supported, sustainable, and has minimal environmental impact.

Due to Slovenia's centuries-old mining tradition, we research environmental effects of past mining and smelting. In geochemistry, we investigate the geochemical processes, contents and distribution of chemical substances and their properties in various materials found in the environment. We perform our own analyses using a SEM/EDS electron microscope. Our research results help create pollutant-transfer models, which are key in designing measures to reduce or eliminate adverse environmental impacts of pollutants. Pursuant to the Mining Act, we also perform the Public Mining Service, which includes keeping a Mining Book, taking samples to make a geological map, and archiving the documentation of disused mines. Our experts are active members of expert groups in the fields of mineral resources, geochemistry, and geoenergy. We are also engaged in a number of European projects in the field, the most important ones being Reseerve, MineService, UNEXMIN, ORAMA and RIS-Recover.

> Our research work focuses on topics related to mineral resources throughout their life cycle.
>
> **Duška Rokavec, PhD** – Head

Our fellow researchers from other organisational units of the GeoZS also take part in most of those projects. Such project work is our major advantage, since modern science and research require a multidisciplinary approach.

GROUNDWATERS AND HYDROGEOLOGY

As much as 95 percent of drinking water in Slovenia comes from underground sources; therefore, we must treat them responsibly

Groundwater is the most hidden part of the water cycle and is Slovenia's most important drinking water source. Research in 2018 focused on improving the knowledge of its flow mechanisms, and presenting results to the public in order to jointly establish and facilitate the proper use of this irreplaceable natural resource.

A team of nearly 30 associates conducted research with exceptional application effects, reflected in the discovery of new drinking, mineral, and thermal water sources. We have participated in engineering and hydrogeological research currently conducted in relation to the construction of infrastructure facilities, such as the C0 waste water canal and second track of the Divača–Koper railway line. The GeoZS also took part in the study into the landslide risk on Potoška Planina, the analysis of groundwater and surface-water interaction for the purpose of re-watering Apaško Polje, the planning of measures for monitoring and improving the status of water resources, especially in water protection areas, in the AMIIGA project in Ljubljana, in the URAVIVO project at Dravsko Polje and Krško Polje, and in the research into Karst groundwater flows. The department also houses the development project conducted by our postdoctoral researcher, who uses a georadar for ground water research and agriculture. At the VODAQUA fair in Ljubljana in October 2018, we presented a new camera and increasingly sophisticated geophysical well measuring equipment, which we used in the INNOLOG project.

In addition to numerous GeoERA projects, our development potential is also confirmed by three junior researchers, two of which specialise in geothermics. The 3D geological models and 4D mathematical models of water flow and the transfer of matter and heat that we develop help us evaluate the potentials of shallow (the GRETA and GeoPLASMA projects) and deep (the DARLINGe project) geothermal energy. Even more importantly, they help us find possibilities for its sustainable use in our ever-evolving economy.

Our work, which is extremely dynamic, is internationally acclaimed. This was demonstrated by the eminent participants at our 5th Slovenian Geological Congress and the post-congress field trip around Slovenia and Croatia with the members and the current president of the Commission on Mineral and Thermal Water at the International Association of Hydrogeologists (CMTW IAH), and the former President of the International Geothermal Association (IGA).

> In addition to numerous GeoERA projects, our development potential is also confirmed by three junior researchers, two of whom engage in geothermics.

Nina Rman, PhD – Head

GEOLOGICAL INFORMATION CENTRE

Useful geoinformation is the cornerstone of successful geoscience research – the GeoZS collects it to the benefit of all interested users

The basic aim of the Centre, which is also the holder of the GeoZS infrastructure programme, is the organisation and storage of spatial data from various surveys and projects, and the sharing of these data with diverse users and applications. Thus we provide users with comprehensive spatial-geology information services. We follow the principle of accessibility by having spatial information and services in one place. We are establishing and maintaining a modern geological information system, which is in line with the European INSPIRE Directive. Our eGeology website gives access and allows for interoperability of geological data for research purposes, administrative procedures conducted by the public sector, the European legislation, and the economy.

Our activities and knowledge in spatial informatics are successfully transmitted from the national level to the wider expert communities in Europe (SCRREEN, ORAMA, DARLINGa projects), the Balkans (the RESERVE project) and Africa (the PanAfGeo project). As a member of the secretariat of the GeoERA programme (Mintell4EU and GIP-P projects), the GeoZS supervises the projects funded and thus helps build a joint research space for European geological surveys.

Together with the geological surveys of Denmark, France, the Netherlands, and Spain, we have established the European Geological Data Infrastructure (EGDI) under the auspices of EuroGeoSurveys, the European geological surveys association. We are also active members of the Geoscience Information Consortium (GIC), which brings together geological surveys around the world in the field of information technology.

We have upgraded MASPREM, an early landslide warning system, which warns the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief twice a day whenever there is or will be an increased risk of landslides in certain areas due to excessive precipitation.

> We are establishing and maintaining a modern geological information system, which is in line with the European INSPIRE Directive.

Jasna Šinigoj, B.Sc.Geology – Head

We are members of the EPOS-SI, a consortium of Slovenian organisations, whose main objective is to establish a national EPOS-SI Centre, which will be part of the international EPOS research infrastructure.

BACK OFFICE

Comprehensive operational support to the GeoZS

The employees of the GeoZS Back office provide administrative, technical, accounting and organisational operational support to the Geological Survey and its individual departments. Back office also support the operation of the Board of Directors and the Scientific Council. The Back office conducts head office activities, financial and accounting services, HR services, project management, and technical services. Our scope of work also includes the implementation and recording of public procurement contracts and administrative support for major public procurement contracts. We provide administrative, technical, and accounting support to the project management of the GeoZS. Quality of the GeoZS is assured by a ISO 9001:2015-certified quality management system. The Back office also manages and maintains the real estate and fleet owned by the GeoZS, and is in charge of its investments and investment maintenance.

We provide administrative, technical and accounting support to the project management of the GeoZS.

Jure Krivic, PhD – Head

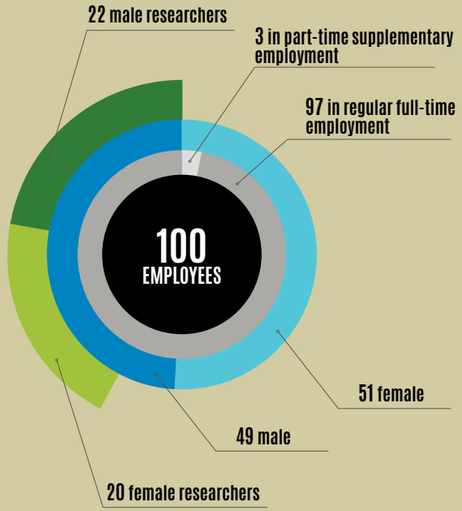
2 THE VALUE OF GeoZS IS CREATED BY OUR EMPLOYEES

NUMBER OF EMPLOYEES AS OF 31 DECEMBER 2018

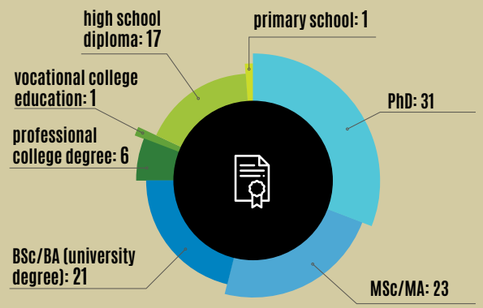
On 31 December 2018, the GeoZS had 100 employees, including 20 female and 22 male researchers. Of all the employees, 97 are in regular full-time employment, while 3 have a part-time supplementary contract with the GeoZS.

EMPLOYEES BY GENDER

Number of employees by gender as of 31 December 2018: 51 women and 49 men.



EDUCATIONAL STRUCTURE



STAFF PERFORMING TEACHING ACTIVITIES

In 2018, two researchers were teaching as qualified university lecturers at the University of Ljubljana. In addition, several GeoZS's researchers helped run courses at the University of Ljubljana.

JUNIOR RESEARCHERS

At the end of 2018, 8 junior researchers were undergoing training at the GeoZS.

EMPLOYEE HIRES AND DEPARTURES

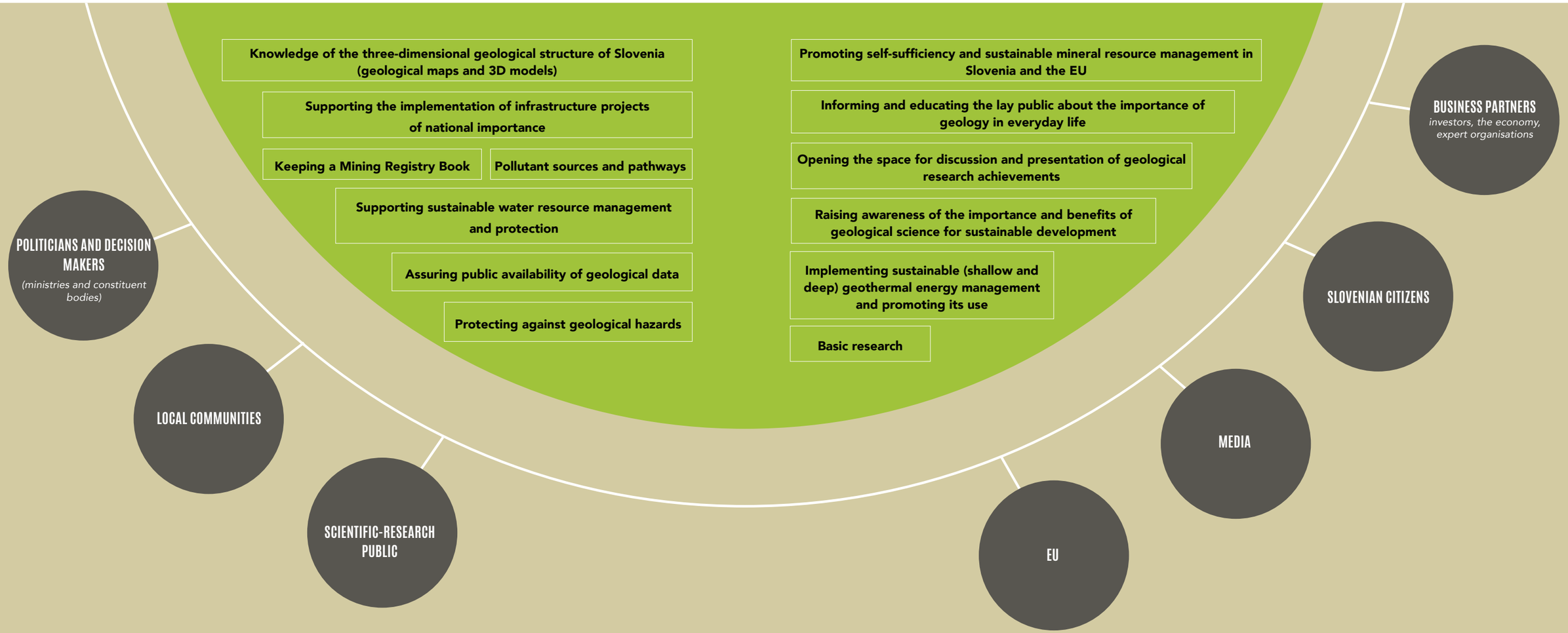
In 2018, we hired 16 new employees, and 11 employees departed.

3 THE BENEFITS GeoZS CREATES FOR ITS STAKEHOLDERS

WE PROVIDE COMPREHENSIVE GEOLOGICAL SERVICES WITH SUSTAINABILITY-ORIENTED RESULTS

The GeoZS, a public research institute, conducts basic and applied geological research of national importance for its key stakeholders, and performs geological expert tasks and studies for the state administration. It also works directly for other clients in Slovenia and the EU.

The GeoZS establishes and maintains transparent relationships with its stakeholders, including them in its operations through presentations, events, meetings, and written communication. We constantly monitor and analyse the expectations of stakeholders concerning our operation, we measure to what extent the expected results are achieved, and report back to them.



4 GOALS SET FOR AND ACHIEVED IN 2018

OPERATING RESULTS	TARGET VALUES 2018	RESULT IN 2018
Fulfilment of all contractual obligations under public service contracts for the ARRS, Ministry of Infrastructure (MzI), Ministry of the Environment and Spatial Planning (MOP), (Slovenian Environment Agency) ARSO and Slovenian Water Agency (DRSV), and EU institutions	Positive assessment of all contractual obligations	**Positive assessment of all contractual obligations**
Fulfilment of all contractual obligations for the market	Positive assessment of all contractual obligations	**Positive assessment of all contractual obligations**
Scientific publications	Increase in the total number of points for scientific performance and number of citations	**2433.96 points counted** **2,921 citations (10-year period)** *** Provisional data of the ARRS.**
Balanced business result in the accounting period	Operations according to plan	**Surplus of revenues: EUR 175,974**
International activities	The amount of funds obtained from international sources exceeded EUR 1 million	**The amount of funds obtained from international sources: EUR 2.5 million**
Implementing the research programme established by ARRS contracts	Maintaining the volume of assets	**19.01 FTE**
Commercial activities	At least 15 % of the total GeoZS revenue Surplus of revenue in commercial activities	**The amount of funds obtained from commercial projects (18 %)** **Surplus of revenue in commercial activities: EUR 127,631**
Resource efficiency in the business year	The resource efficiency index is more than 1	**Resource efficiency index 1.124**
Reorganisation of the GeoZS	The second ISO 9001:2015 audit passed	**The second control ISO 9001:2015 audit passed**
Employee satisfaction	Not less than 3 on a score of 1 to 5	**4.2**
Exemplary cooperation with relevant trade unions and employees who are not members of trade unions	Not less than 3 on a score of 1 to 5	**4.2**
Assuring solvency	Permanent solvency	**Guaranteed solvency**
Customer satisfaction	Not less than 4 on a score of 1 to 5	**4.6**
Maintaining international cooperation	A minimum of 15 international project applications	**20 project applications**

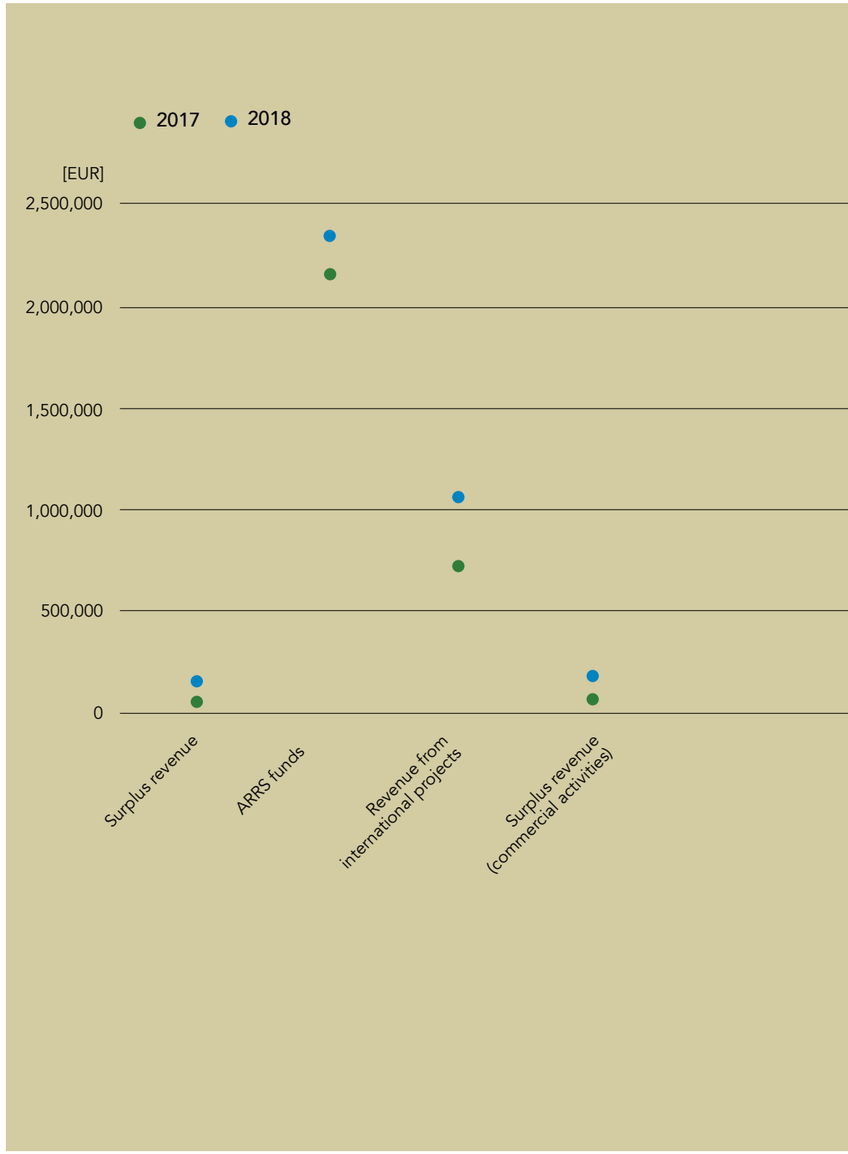
5 KEY PERFORMANCE INDICATORS IN 2018

5.1 NON-FINANCIAL INDICATORS

- We increased the number of papers published (+25%), tripled the points achieved in the most renowned journals (A") and the total number of citations (+25%). The total number of papers published and points increased by 68 (39%) compared to 2017.
- Five of our employees were elected to be awarded higher titles.
- We conducted more than three planned consultations and two major presentations for students.
- By continuing to optimise internal organisation and the use of our project monitoring information system, we significantly improved project management and passed an interim assessment of the quality management system under the ISO 9001:2015 standard.
- Research financed from the budget of the Republic of Slovenia went according to plans – we continued performing the tasks defined in project papers or as part of programmes, and we took up new ones.
- We managed to improve our scientific excellence and efficiency of transferring knowledge to the economy.
- When it comes to providing public services indirectly financed from the budget of the Republic of Slovenia, we have completed all the tasks set and financed.
- The GeoZS participated in 9 Horizon 2020 projects in 2017, and 20 projects in 2018.
- Last year, the GeoZS ran five R&D projects financed by the European structural and investment funds. Two were co-financed under the 2014–2020 Interreg Central Europe transnational programme, one under the 2014–2020 Interreg transnational Alpine Space programme, and two under the 2014–2020 Interreg transnational Danube programme.

5.2 FINANCIAL INDICATORS

- In 2018 we generated EUR 175,974 of surplus revenue, which is a 186 % increase compared to 2017.
- ARRS funds amounted to EUR 2,366,650, which is EUR 229,152 more than in 2017.
- Revenue from international projects increased by EUR 349,322 compared to 2017.
- We also saw a steep increase in surplus revenue in commercial activities – from EUR 61,044 in 2017 to EUR 162,271 in 2018.



5.3 MAJOR SCIENTIFIC PAPERS PUBLISHED IN 2018

Original scientific articles

ŽIBRET, Gorazd, KOPAČKOVÁ, Veronika. Comparison of two methods for indirect measurement of atmospheric dust deposition: street-dust composition and vegetation-health status derived from hyperspectral image data. *Ambio*, ISSN 0044-7447, 13 pp., Online First, doi: 10.1007/s13280-018-1093-0

REIMANN, Clemens, FABIAN, Karl, BIRKE, Manfred, FILZMOSER, Peter, DEMETRIADES, Alecos, NÉGREL, Philippe, OORTS, Koen, MATSCHULLAT, Jörg, CARITAT, Patrice de, GOSAR, Mateja, et al. GEMAS: establishing geochemical background and threshold for 53 chemical elements in European agricultural soil. *Applied geochemistry*, ISSN 0883-2927. [Print ed.], 2018, vol. 88, pp. 302-318, doi: 10.1016/j.apgeochem.2017.01.021

VIDOVIĆ, Jelena, ŠOLAR, Slavko V. Recent developments in Raw Materials Policy in the European Union: perspective of EuroGeoSurveys as a data supplier = Najnowsze trendy w polityce surowcowej Unii Europejskiej z perspektywy EuroGeoSurveys jako dostawcy danych. Biuletyn Państwowego Instytutu Geologicznego, ISSN 0867-6143, 2018, vol. 472, p. 11-20, doi: 10.5604/01.3001.0012.6902

SUDAR, Milan, NOVAK, Matevž, KORN, Dieter, JOVANOVIĆ, Divna. Conodont biostratigraphy and carbonate microfacies of the Late Devonian to Mississippian Milivojevića Kamenjar section (Družetić, NW Serbia). *Bulletin of Geosciences*, ISSN 1214-1119, 2018, vol. 93, no. 2, pp. 163-183, doi: 10.3140/bull.geosci.1690

KOLAR-JURKOVŠEK, Tea, MARTÍNEZ PÉREZ, Carlos, JURKOVŠEK, Bogdan, ALJINOVIĆ, Dunja. New clusters of Pseudofurnishius murcianus from the Middle Triassic of Slovenia (Dinarides). *Bulletins of American paleontology*, ISSN 0007-5779, 2018, no. 395-396, pp. 149-163. https://priweb.org/downloads/pubs/item_abstract_5828.pdf, doi: 10.32857/bap.2018.395.11

ZUPANČIČ, Nina, TURNIŠKI, Rok, MILER, Miloš, GRČMAN, Helena. Geochemical fingerprint of insoluble material in soil on different limestone formations. *Catena : an interdisciplinary journal of soil science, hydrology- geomorphology focusing on geology and landscape evolution*, ISSN 0341-8162. [Print ed.], 2018, vol. 170, pp. 10-24, doi: 10.1016/j.catena.2018.05.040

NÉGREL, Philippe, LADENBERGER, Anna, REIMANN, Clemens, BIRKE, Manfred, SADEGHI, Martiya, GOSAR, Mateja, et al. Distribution of Rb, Ga and Cs in agricultural land soils at European continental scale (GEMAS): implications for weathering conditions and provenance. *Chemical geology*, ISSN 0009-2541. [Print ed.], 2018, vol. 479, pp. 188-203, doi: 10.1016/j.chemgeo.2018.01.009

CEROVAC, Andrea, COVELLI, Stefano, EMILI, Andrea, PAVONI, Elena, PETRANICH, Elisa, GREGORIČ, Asta, URBANC, Janko, ZAVAGNO, Enrico, ZINI, Luca. Mercury in the unconfined aquifer of the Isonzo/Soča River alluvial plain downstream from the Idrija mining area. *Chemosphere*, ISSN 0045-6535. [Print ed.], Mar. 2018, vol. 195, pp. 749-761, ilustr., doi: 10.1016/j.chemosphere.2017.12.105

ŽIBRET, Gorazd. Influences of coal mines, metallurgical plants, urbanisation and lithology on the elemental composition of street dust. *Environmental geochemistry and health*, ISSN 0269-4042, 17 str, Online First, doi: 10.1007/s10653-018-0228-3

GALE, Luka, PEYBERNES, Camille, CELARC, Bogomir, HOČEVAR, Manca, ŠELIH, Vid Simon, MARTINI, Rossana. Biotic composition and microfacies distribution of Upper Triassic build-ups : new insights from the Lower Carnian limestone of Lesno Brdo, central Slovenia. *Facies*, ISSN 0172-9179. [Print ed.], Jul. 2018, vol. 64, iss. 3, pp. 1-24, ilustr. https://link.springer.com/article/10.1007%2Fs10347-018-0531-6, doi: 10.1007/s10347-018-0531-6

SUDAR, Milan, KOLAR-JURKOVŠEK, Tea, NESTELL, Galina P., JOVANOVIĆ, Divna, JURKOVŠEK, Bogdan, WILLIAMS, Jeremy, BROOKFIELD, Michael, STEBBINS, Alan. New results of microfaunal and geochemical investigations in the Permian - Triassic boundary interval from the Jadar Block (NW Serbia). *Geologica Carpathica : international geological journal*, ISSN 1335-0552, 2018, vol. 69, no. 2, pp. 169-186, doi: 10.1515/geoca-2018-0010

IVANČIČ, Kristina, TRAJANOVA, Mirka, ĆORIĆ, Stjepan, ROŽIČ, Boštjan, ŠMUC, Andrej. Miocene paleogeography and biostratigraphy of the Slovenj Gradec Basin : a marine corridor between the Mediterranean and Central Paratethys. *Geologica Carpathica : international geological journal*, ISSN 1335-0552, 2018, vol. 69, no. 6, pp. 528-544, doi: 10.1515/geoca-2018-0031

TERŠIČ, Tamara, MILER, Miloš, GABERŠEK, Martin, GOSAR, Mateja. Vsebnosti arzena in nekaterih drugih prvin v potočnih sedimentih in vodah porečja Medije, osrednja Slovenija = Contents of arsenic and some other elements in stream sediments and waters of the Medija drainage basin, central Slovenia. *Geologija*, ISSN 0016-7789. [Tiskana izd.], 2018, vol. 61, no. 1, pp. 5-24.

ROŽIČ, Boštjan, GALE, Luka, BRAJKOVIĆ, Rok, POPIT, Tomislav, ŽVAB ROŽIČ, Petra. Lower Jurassic succession at the site of potential Roman quarry Staje near Ig (central Slovenia) = spodnjejurske plasti na območju morebitnega rimskega kamnoloma Staje pri Igu. *Geologija*, ISSN 0016-7789. [Tiskana izd.], 2018, let. 61, no. 1, pp. 49-71, doi: 10.5474/geologija.2018.004

SOTELŠEK, Tim, GRAČANIN, Nik, RIFL, Matic, GALE, Luka. Fosilni mnogoščetinci spodnjekarnijskega apnenca pri Lesnem Brdu = fossil polychaetes of the Lower Carnian limestone at Lesno Brdo, central Slovenia. *Geologija*, ISSN 0016-7789. [Tiskana izd.], 2018, let. 61, no. 1, pp. 85-99, doi: 10.5474/geologija.2018.006

PETERNEL, Tina, JEŽ, Jernej, MILANIČ, Blaž, MARKELJ, Anže, JEMEC AUFLIČ, Mateja. Engineering-geological conditions of landslides above the settlement of Koroška Bela (NW Slovenia) = Inženirskogeološke značilnosti plazov v zaledju naselja Koroška Bela (SZ Slovenija). *Geologija*, ISSN 0016-7789. [Tiskana izd.], 2018, vol. 61, no. 2, pp. 177- 189, doi: 10.5474/geologija.2018.012

JANŽA, Mitja, SERIANZ, Luka, ŠRAM, Dejan, KLASINC, Matjaž. Hydrogeological investigation of landslides Urbas and Čikla above the settlement of Koroška Bela (NW Slovenia) = Hidrogeološke raziskave plazov Urbas in Čikla nad naseljem Koroška Bela (SZ Slovenija). *Geologija*, ISSN 0016-7789. [Tiskana izd.], 2018, vol. 61, no. 2, pp. 191- 203, doi: 10.5474/geologija.2018.013

BRENČIČ, Mihael. Comparison of the fully penetrating well drawdown in leaky aquifers between finite and infinite radius of influence under steady-state pumping conditions = primerjava znižanja gladine podzemne vode v hidravlično popolnem vodnjaku v polzaprtem vodonosniku med končnim in neskončnim radijem vpliva pri stacionarnem črpanju. Geologija, ISSN 0016-7789. [Tiskana izd.], 2018, let. 61, no. 2, pp. 205-214, doi: 10.5474/geologija.2018.014

BRENČIČ, Mihael. Korespondenca med Vasilijem Vasilijevičem Nikitinom in Vladimirjem Ivanovičem Vernadskim = correspondence between Vasily Vasilyevich Nikitin and Vladimir Ivanovich Vernadsky. *Geologija*, ISSN 0016-7789. [Tiskana izd.], 2018, let. 61, no. 2, pp. 229-238, doi: 10.5474/geologija.2018.016

BRAJKOVIĆ, Rok, BEDJANIČ, Mojca, MALENŠEK ANDOLŠEK, Neža, RMAN, Nina, NOVAK, Matevž, ŠUŠMELJ, Kaja, ŽVAB ROŽIČ, Petra. Sistematičen pregled geoloških učnih ciljev in učbeniških vsebin v osnovnih šolah in v splošnih gimnazijah = systematic overview of geological learning objectives and textbook contents for primary schools and gymnasiums. *Geologija*, ISSN 0016-7789. [Tiskana izd.], 2018, let. 61, no. 2, pp. 239-252, doi: 10.5474/geologija.2018.017

PEULIĆ, Kristina, NOVAK, Matevž, VRABEC, Mirijam. Provenance and characteristics of the pavement stone from the courtyard of the Ljubljana Castle = izvor in značilnosti kamna v tlakovcih na osrednjem dvorišču Ljubljanskega gradu. *Geologija*, ISSN 0016-7789. [Tiskana izd.], 2018, let. 61, no. 2, pp. 253-266, doi: 10.5474/geologija.2018.018

CALLIGARIS, Chiara, MEZGA, Kim, SLEJKO, Francesca Federica, URBANC, Janko, ZINI, Luca. Groundwater characterisation by means of conservative (δ18O and δ2H) and non-conservative (87Sr/86Sr) isotopic values: the classical karst region aquifer case (Italy - Slovenia). *Geosciences*, ISSN 2076-3263, 2018, vol. 8, iss. 9, 25 pp., doi: 10.3390/geosciences8090321.

FIDEJ, Gal, MIKOŠ, Matjaž, JEŽ, Jernej, KUMELJ, Špela, DIACI, Jurij. Presoja varovalnega učinka gozda pred drobirskimi tokovi = Assessment of forest protective function against debris-flows. *Gozdarski vestnik : Slovenska strokovna revija za gozdarstvo*, ISSN 0017-2723. [Tiskana izd.], maj 2018, letn. 76, no. 4, pp. 167-180, graf. prikazi, zvd. http://dirros.openscience.si/IzpisGradiva.php?id=8317

ALJINOVIĆ, Dunja, HORACEK, Micha, KRYSTYN, Leopold, RICHOZ, Sylvain, KOLAR-JURKOVŠEK, Tea, SMIRČIĆ, Duje, JURKOVŠEK, Bogdan. Western Tethyan epeiric ramp setting in the Early Triassic: an example from the Central Dinarides (Croatia). *Journal of Earth Science*, ISSN 1674-487X, August 2018, vol. 29, no. 4, pp. 806-823, doi: 10.1007/s12583-018-0787-3

SMIRČIĆ, Duje, KOLAR-JURKOVŠEK, Tea, ALJINOVIĆ, Dunja, BARUDŽIJA, Uroš, JURKOVŠEK, Bogdan, HRVATOVIĆ, Hazim. Stratigraphic definition and correlation of Middle Triassic volcaniclastic facies in the External Dinarides: Croatia and Bosnia and Herzegovina. *Journal of Earth Science*, ISSN 1674-487X, August 2018, vol. 29, no. 4, pp. 864-878, doi: 10.1007/s12583-018-0789-1

ZAJC, Marjana, GOSAR, Andrej, CELARC, Bogomir. GPR Study of a Thrust-fault in an Active Limestone Quarry (SW Slovenia). *Journal of environmental & engineering geophysics*, ISSN 1083-1363, 2018, vol. 23, no. 4, pp. 457-468, doi: 10.2113/JEEG23.4.457

STAFILOV, Trajče, ŠAJN, Robert, ARAPCESKA, Mila, KUNGULOVSKI, Ivan, ALIJAGIĆ, Jasminka. Geochemical properties of topsoil around the coal mine and thermoelectric power plant. *Journal of environmental science and health. Part A, Toxic/hazardous substances & environmental engineering*, ISSN 1093-4529, 16 pp., Online First, doi: 10.1080/10934529.2018.1445076

JORDAN, Gyozo, PETRIK, Attila, DE VIVO, Benedetto, ALBANESE, Stefano, DEMETRIADES, Alecos, SADEGHI, Martiya, GOSAR, Mateja, et al. GEMAS: Spatial analysis of the Ni distribution on a continental-scale using digital image processing techniques on European agricultural soil data. *Journal of geochemical exploration*, ISSN 0375-6742. [Print ed.], March 2018, vol. 186, pp. 143-157, doi: 10.1016/j.gexplo.2017.11.011

BAVEC, Špela, BIESTER, Harald, GOSAR, Mateja. A risk assessment of human exposure to mercury-contaminated soil and household dust in the town of Idrija (Slovenia). *Journal of geochemical exploration*, ISSN 0375-6742. [Print ed.], 2018, vol. 187, pp. 131-140, doi: 10.1016/j.gexplo.2017.05.005

GABERŠEK, Martin, GOSAR, Mateja. Geochemistry of urban soil in the industrial town of Maribor, Slovenia. *Journal of geochemical exploration*, ISSN 0375-6742. [Print ed.], 2018, vol. 187, pp. 141-154, doi: 10.1016/j.gexplo.2017.06.001

ŠORŠA, Ajka, MILER, Miloš, GOSAR, Mateja, HALAMIĆ, Josip. Follow-up geochemical studies and mineralogical investigations by scanning electron microscopy/energy dispersive spectroscopy (SEM/EDS) of soil samples from the industrial zone of Sisak, Croatia. *Journal of geochemical exploration*, ISSN 0375-6742. [Print ed.], 2018, vol. 187, pp. 168-183, doi: 10.1016/j.gexplo.2017.07.015

VREČA, Polona, BRENČIČ, Mihael, TORKAR, Anja. Application of passive capillary samplers in water stable isotope investigations of snowmelt : a case study from Slovenia. *Journal of Hydrology and Hydromechanics*, ISSN 0042-790X. [Tiskana izd.], [in press] 2018, 9 pp., doi: 10.2478/johh-2018-0017

SZŐCS, Teodóra, RMAN, Nina, ROTÁR-SZALKAI, Ágnes, TÓTH, György, LAPANJE, Andrej, CERNAK, Radovan, NÁDOR, Annamária. The Upper Pannonian thermal aquifer: cross border cooperation as an essential step to transboundary groundwater management. *Journal of hydrology, Region-*

al studies, ISSN 2214-5818, 2018, vol. 20, pp. 128-144, doi: 10.1016/j.ejrh.2018.02.004

TIBERI, Lara, COSTA, Giovanni, JAMŠEK RUPNIK, Petra, CECIĆ, Ina, SUHADOLC, Peter. The 1895 Ljubljana earthquake: can the intensity data points discriminate which one of the nearby faults was the causative one?. *Journal of seismology*, ISSN 1383-4649, 15 pp., Online First, doi: 10.1007/s10950-018-9743-z

BREG VALJAVEC, Mateja, JANŽA, Mitja, SMREKAR, Aleš. Environmental risk resulting from historical land degradation in alluvial plains considered for dam planning. *Land degradation & development*, ISSN 1085-3278. [Print ed.], 2018. https://onlinelibrary.wiley.com/doi/pdf/10.1002/ldr.3168, doi: 10.1002/ldr.3168

JEMEC AUFLIČ, Mateja, KUMELJ, Špela, PETERNEL, Tina, JEŽ, Jernej. Understanding of landslide risk through learning by doing: case study of Koroška Bela community, Slovenia. *Landslides : Journal of the international consortium on landslides*, ISSN 1612-510X. [Print ed.], 10 str, Online First, doi: 10.1007/s10346-018-1110-1

JEŽ, Jernej, OTONIČAR, Bojan. Late Cretaceous geodynamics of the northern sector of the Adriatic Carbonate Platform (W Slovenia). *Newsletters on stratigraphy*, ISSN 0078-0421, 2018, vol. , no. , 30 pp., ilustr., doi: 10.1127/nos/2018/0439

KOLAR-JURKOVŠEK, Tea, JURKOVŠEK, Bogdan, NESTELL, Galina P., ALJINOVIĆ, Dunja. Biostratigraphy and sedimentology of Upper Permian and Lower Triassic strata at Masore, Western Slovenia. *Palaeogeography, palaeoclimatology, palaeoecology*, ISSN 0031-0182. [Print ed.], 2018, vol. 490, pp. 38-54, doi: 10.1016/j.palaeo.2017.09.013

TOMOVSKI, Dimitri, STAFILOV, Trajče, ŠAJN, Robert, BAČEVA ANDRONOVSKA, Katerina. Distribution of chemical elements in surface waters from the Crna River Basin, Republic of Macedonia. *Prilozi*, ISSN 1857-9027. [Print], 2018, vol. 39, no. 1, pp. 31-49, doi: 10.20903/csnmbs.masa.2018.39.1.118

TANG, Anh Minh, HUGHES, P. N., DIJKSTRA, T. A., ASKARINEJAD, Amin, BRENČIČ, Mihael, CUI, Yu Jun, DIEZ, J. J., FIRGI, T., GAJEWSKA, Beata, GENTILE, F., GROSSI, G., JOMMI, C., KEHAGIA, F., KODA, E., MAAT, H. W. ter, LENART, Stanislav, LOURENCO, S., OLIVEIRA, M., OSINSKI, P., SPRINGMAN, Sarah, STIRLING, Ross, TOLL, D. G., VAN BEEK, Ursula J. Atmosphere - vegetation - soil interactions in a climate change context; impact of changing conditions on engineered transport infrastructure slopes in Europe. *Quarterly journal of engineering geology and hydrogeology*, ISSN 1470-9236, 2018, vol. 51, iss. 2, pp. 156-168, ilustr. https://pubs.geoscienceworld.org/qjegh/article/529820/?searchresult=1, doi: 10.1144/qjegh2017-103

GALE, Luka, BARATTOLO, Filippo, RETTORI, Roberto. Morphometric approach to determination of Lower Jurassic siphovalvulinid foraminifera. *Rivista italiana di paleontologia e stratigrafia*, ISSN 0035-6883, 2018, vol. 124, no. 2, pp. 265-282.

NÉGREL, Philippe, DE VIVO, Benedetto, REIMANN, Clemens, LADENBERGER, Anna, CICCHELLA, Domenico, ALBANESE, Stefano, BIRKE, Manfred, DE VOS, Walter, DINELLI, Enrico, LIMA, Annamaria, GOSAR, Mateja, et al. U-Th signatures of agricultural soil at the European continental scale (GEMAS): distribution, weathering patterns and processes controlling their concentrations. *Science of the total environment*, ISSN 0048-9697, 2018, vol. 622-623, pp. 1277-1293, doi: 10.1016/j.scitotenv.2017.12.005

MATSCHULLAT, Jörg, REIMANN, Clemens, BIRKE, Manfred, SANTOS CARVALHO, Debora dos, GOSAR, Mateja, et al. GEMAS: CNS concentrations and C/N ratios in European agricultural soil. *Science of the total environment*, ISSN 0048-9697, 2018, vol. 627, pp. 975-984, doi: 10.1016/j.scitotenv.2018.01.214

CERAR, Sonja, MEZGA, Kim, ŽIBRET, Gorazd, URBANC, Janko, KOMAC, Marko. Comparison of prediction methods for oxygen-18 isotope composition in shallow groundwater. *Science of the total environment*, ISSN 0048-9697, 2018, vol. 631-632, pp. 358-368, doi: 10.1016/j.scitotenv.2018.03.033

IVANČIČ, Kristina, TRAJANOVA, Mirka, SKABERNE, Dragomir, ŠMUC, Andrej. Provenance of the Miocene Slovenj Gradec Basin sedimentary fill, Western Central Paratethys. *Sedimentary geology*, ISSN 0037-0738. [Print ed.], 2018, vol. 375, pp. 256-267, doi: 10.1016/j.sedgeo.2017.11.002

VASILEVSKA, Silvana, STAFILOV, Trajče, ŠAJN, Robert. Distribution of chemical elements in surface waters from the Crn Drim River Basin, Republic of Macedonia. *Water Research and Management : journal of Serbian Water Pollution Control Society*, ISSN 2217-5237, 2018, vol. 8, no. 1, pp. 3-15.

TURPAUD, Philippe, ZINI, Luca, RAVBAR, Nataša, CUCCHI, Franco, PETRIČ, Metka, URBANC, Janko. Development of a protocol for the karst water source protection zoning: application to the Classical Karst Region (NE Italy and SW Slovenia). *Water resources management*, ISSN 0920-4741, 16 pp., Online First, doi: 10.1007/s11269-017-1882-4

Review articles

ŽIBRET, Gorazd, GOSAR, Mateja, MILER, Miloš, ALIJAGIĆ, Jasminka. Impacts of mining and smelting activities on environment and landscape degradation - Slovenian case-studies. *Land degradation & development*, ISSN 1085-3278. [Print ed.], December 2018, vol. 29, iss. 12, pp. 4457-4470, doi: 10.1002/ldr.3198

HERRERA, Gerardo, MATEOS, Rosa María, GARCÍA-DAVALILLO, Juan Carlos, GRANDJEAN, Gilles, POYIADJI, Eleftheria, MAFTEI, Raluca, FILIPCIUC, Tatiana-Constantina, JEMEC AUFLIČ, Mateja, JEŽ, Jernej, PODOLSZKI, Laszlo, et al. Landslide databases in the Geological Surveys of Europe. *Landslides : Journal of the international consortium on landslides*, ISSN 1612-510X. [Print ed.], 2018, vol. 15, issue 2, pp. 359-379, doi: 10.1007/s10346-017-0902-z

MILER, Miloš (avtor, fotograf), GOSAR, Mateja (avtor, fotograf), ATANACKOV, Jure, JERŠEK, Miha (avtor, fotograf). Meteoriti in njihovo pojavljanje na Slovenskem = Meteorites and their occurrence in Slovenia. *Scopolia : glasilo Prirodoslovnega muzeja Slovenije*, ISSN 0351-0077. [Tiskana izd.], 2018, no. 93, pp. 1-128, ilustr

Independent scientific component part or a chapter in a monograph

STAFILOV, Trajce, BALABANOVA, Biljana, ŠAJN, Robert. Lithological distribution of rare earth elements in soil and atmospheric precipitates in the Bregalnica river basin. V: POKROVSKY, Oleg S. (ur.), VIERS, Jerome (ur.). *Biogeochemistry of trace elements*, (Chemistry research and applications). New York: Nova Science Publishers. cop. 2018, pp. 23-54.

BALABANOVA, Biljana, STAFILOV, Trajče, ŠAJN, Robert. Environmental pollution of soil and anthropogenic impact of polymetallic hydrothermal extractions: case study - Bregalnica River Basin, Republic of Macedonia. V: HASHMI, Muhammad Zaffar (ur.), VARMA, Ajit (ur.). *Environmental pollution of paddy soils*, (Soil biology, vol. 53). Cham: Springer. cop. 2018, pp. 27-68 .

KOMAC, Marko, JEŽ, Jernej. TXT-tool 1.386-2.1: Landslide susceptibility assessment method. V: SASSA, Kyoji (ur.), et al. *Landslide Dynamics : ISDR-ICL landslide interactive teaching tools. Vol. 1, Fundamentals, mapping and monitoring*. Berlin: Springer. 2018, pp. 133-138, doi: 10.1007/978-3-319-57774-6_9

KOMAC, Marko, PETERNEL, Tina, JEMEC AUFLIČ, Mateja. TXT-tool 2.386-2.1: SAR interferometry as a tool for detection of landslides in early phases : TXT-tool 2.386-2.1. V: SASSA, Kyoji (ur.), et al. *Landslide Dynamics : ISDR-ICL landslide interactive teaching tools. Vol. 1, Fundamentals, mapping and monitoring*. Berlin: Springer. 2018, pp. 275-285, doi: 10.1007/978-3-319-57774-6_19

JEMEC AUFLIČ, Mateja, ŠINIGOJ, Jasna, PETERNEL, Tina, PODBOJ, Martin, KRIVIC, Matija, KOMAC, Marko. A system to forecast rainfall-induced landslides in Slovenia : TXT-tool 2.386-2.1. V: SASSA, Kyoji (ur.), et al. *Landslide Dynamics : ISDR-ICL landslide interactive teaching tools. Vol. 1, Fundamentals, mapping and monitoring*. Berlin: Springer. 2018, pp. 391-404, doi: 10.1007/978-3-319-57774-6_29

MIKOŠ, Matjaž, ČARMAN, Magda, PAPEŽ, Jože, JEŽ, Jernej. State-of-the-art overview on landslide disaster risk reduction in Slovenia : TXT-tool 4.386-1.1. V: SASSA, Kyoji (ur.), et al. *Landslide dynamics : ISDR-ICL landslide interactive teaching tools. Vol. 2, Testing, risk management and country practices*. Berlin: Springer. 2018, pp. 683-691. https://link.springer.com/chapter/10.1007/978-3-319-57777-7_43

STAFILOV, Trajče, ŠAJN, Robert, ARAPCESKA, Mila, KUNGULOVSKI, Ivan, ALIJAGIĆ, Jasminka. Geochemical properties of topsoil around the open coal mine and Bitola thermoelectric plant, Republic of Macedonia. V: LUND, Jasper E. (ur.). *Soil contamination : sources, assessment and remediation*, (Agricultural issues and policies). New York: Nova Science Publishers. cop. 2018, pp. 1-48.

STAFILOV, Trajče, BALABANOVA, Biljana, ŠAJN, Robert, ANGELOVSKA, Svetlana. Monitoring the polymetallic geochemistry of soil along the Kriva Reka river basin due to the anthropologenic impact of the Pb - Zn Toranica mine. V: LUND, Jasper E. (ur.). *Soil contamination : sources, assessment and remediation*, (Agricultural issues and policies). New York: Nova Science Publishers. cop. 2018, pp. 49-79.

Monographs and other completed works (publishing)

Geologija. Gosar, Mateja (glavni in odgovorni urednik). Knjiga 61, no. 1, 2. Ljubljana: Geološki zavod Slovenije: Slovensko geološko društvo, 1953-. ISSN 0016-7789. http://www.geologija-revija.si/

Mineral resources in Slovenia year 2018. Senegačnik, Andreja (urednik). Ljubljana: Geološki zavod Slovenije, 2008-. ISSN 1855-4725. http://www.geo-zs.si/index.php/en/products/publications2/periodicals/mineral-resources

Mineralne surovine v letu 2017. Senegačnik, Andreja (glavni in odgovorni urednik). Ljubljana: Geološki zavod Slovenije, 2005-. ISSN 1854-3995. http://www.geo-zs.si/index.php/publikacije2/periodi%C4%8Dne-publikacije/mineralne-surovine.

NOVAK, Matevž (urednik), RMAN, Nina (urednik). *Geološki atlas Slovenije = Geological atlas of Slovenia*. 2., popravljena in dopolnjena izd. Ljubljana: Geološki zavod Slovenije, 2018. 1 atlas (128 pp.), barve. ISBN 978-961-6498-55-5.

JEMEC AUFLIČ, Mateja (urednik), MIKOŠ, Matjaž (urednik), VERBOVŠEK, Timotej (urednik). *Advances in landslide research : proceedings of the 3rd Regional Symposium on Landslides in the Adriatic Balkan Region, 11-13 October 2017, Ljubljana, Slovenia*. Ljubljana: Geological Survey of Slovenia, 2018. 156 pp., ilustr., zvd. ISBN 978-961-6498-58-6. http://www.geo-zs.si/PDF/Monografije/Advances_landslide_research.pdf

NOVAK, Matevž (urednik), MARKIČ, Miloš (urednik), PETKOVŠEK, Ana (urednik), TRAJANOVA, Mirka (urednik). *Vodič ekskurzij : petek, 5.oktober 2018 = Field trips guidebook : Friday, 5 October 2018*. Ljubljana: Geološki zavod Slovenije, 2018. 60 pp., ilustr. ISBN 978-961-6498-63-0. http://www.geo-zs.si/?option=com_content&, http://view=article&id=434

RMAN, Nina (urednik). *Geology, hydrogeology and geothermy of NE Slovenia and N Croatia = Geologija, hidrogeologija in geotermija SV Slovenije in S Hrvaške : Post Congress Field Trip*. Ljubljana: Geological Survey of Slovenia, 2018. 42 pp., ilustr. ISBN 978-961-6498-62-3.

NOVAK, Matevž (urednik), RMAN, Nina (urednik), 5. slovenski geološki kongres, Velenje, 3.-5. 10. 2018. *Zbornik povzetkov = Book of abstracts*. Ljubljana: Geološki zavod Slovenije, 2018. 143 pp. ISBN 978-961-6498-60-9. http://www.geo-zs.si/?option=com_content&view=article&id=413

ŽIBRET, Gorazd (urednik), ŽEBRE, Manja (urednik,), Joint Conference of UNEXMIN, ¡VAMOS! and RTM Projects, 30 January 2018 Bled, Slovenia. *Use of robotics and automation for mineral prospecting and extraction : conference proceedings*. Ljubljana: Geological Survey of Slovenia, 2018. [II], 59 pp., ilustr. ISBN 978-961-6498-57-9, doi: 10.5474/9789616498579

6 EVENTS IN 2018

JANUARY

We organised an international conference Use of Robotics and Automation for Mineral Prospecting and Extraction

In cooperation with iVAMOS!, UNEXMIN in RTM, the GeoZS organised an international conference Use of Robotics and Automation for Mineral Prospecting and Extraction in Bled, Slovenia. The conference was attended by experts from the fields of geology, mining, electrical engineering, information technology and robotics. They exchanged development experiences and business challenges brought by modern and innovative mineral extraction technology.

FEBRUARY

Establishment of the first regional mineral resource centre

Adria Regional Centre (RC) was established on the premises of the GeoZS. Its founding members are the GeoZS, the Slovenian National Building and Civil Engineering Institute, and the Faculty of Mining, Geology and Petroleum Engineering, University of Zagreb. Adria RC is a hub and a one-stop shop for stakeholders from Slovenia, Croatia and the countries of the Western Balkans. There, they will have access to information on projects funded by the European Institute of Innovation and Technology (EIT) as part of its RawMaterials (Minerals) Knowledge and Innovation Community (KIC).

We published a geological map of the eastern Krško Basin

The GeoZS published the long-expected geological map of the eastern Krško Basin at a scale of 1 : 25,000. The new map is based on the findings of the Basic Geological Map of Slovenia at a scale of 1 : 100,000, especially on the sheets depicting Celje, Rogatec, Novo Mesto and Zagreb, and on the geological mapping of the Krško Basin at a working scale of 1 : 5,000.

MARCH

We attended the 2018 Prospectors & Developers Association of Canada (PDAC) annual meeting in Toronto

This is one of the world's largest fairs dedicated to exploration and mining. On the EIT RawMaterials @ PDAC 2018 presentation day, we held two lectures: Mineral potential in South-East Europe (SEE) & Mineral Resources in Slovenia, and Mineral Potential of East and South-East Europe – EIT RawMaterials RESEERVE Project.

APRIL

e-Plaz online app – training for landslide recording

As part of an R&D project titled MASPREM3 – Upgrading the Information and Warning System in Event of Landslides, the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief in cooperation with the GeoZS held training for landslide recording using the e-Plaz online app, which took place in April in Celje, Slovenia. The app is used for central collection of landslide data and creating a single record of landslides. In September, we conducted similar workshops in Pekre, Sežana and Ig.

1st meeting of SINQUA

On 18 April 2018, the GeoZS hosted the 1st meeting of the Slovenian National INQUA Committee (SINQUA). SINQUA has been operating under the auspices of the Slovenian Geological Society since 2015. The meeting was dedicated to the organisation of the committee's work, the presentation of members and their research, and the definition and presentation of activities planned in 2018.

MAY

We held a round table on a conceptual hydrogeological model of the Iška Alluvial Fan (Iški vršaj)

In cooperation with JP Vodovod Kanalizacija Snaga and the University of Ljubljana, the GeoZS organised a round table titled Conceptual Hydrogeological Model of the Iška Alluvial Fan (Iški vršaj). The round table discussed the complex structure of the Iška Alluvial Fan and how to capture the groundwater dynamics in a numerical model.

Meeting of the Spatial Information Expert Group (SIEG)

The GeoZS hosted an international meeting of the EuroGeoSurveys' Spatial Information Expert Group (SIEG).

JUNE

Preliminary meeting of the RESEERVE project

The GeoZS hosted a preliminary meeting of the RESEERVE – Mineral Potential in the ESEE Region project. The project brings together 14 research, education and industrial partners from 12 countries and is implemented as part of the EIT RawMaterials KIC.

Presentation: Potential of Shallow Geothermal Energy in the Municipality of Cerkno (GRETA project)

At the event, the GeoZS presented the results of the GRETA project, which is run under the Interreg transnational Alpine Space programme. Using the Municipality of Cerkno as a pilot case, we presented a way to evaluate the potential of shallow geothermal energy in the municipality and incorporate it into the local energy concept.

Potential of Shallow Geothermal Energy in Slovenia

On 19 June 2019, the Geological Survey of Slovenia hosted a workshop titled Potential of Shallow Geothermal Energy in Slovenia, and organised it in cooperation with the Slovenian Energy Efficiency Centre.

AUGUST

We conducted geological mapping training in Namibia

Within the PanAfGeo project, EuroGeoSurveys provides training in various geological fields to geologists working at African institutions. The project tasks include training in geological mapping. We co-organised mapping training, which took place in late August and early September in Namibia.

SEPTEMBER

We hosted a meeting of the international SIMONA project

The project will focus on establishing a transnational system for observing the geochemical composition of river deposits in the Danube Basin area. It will set out uniform criteria and protocols for the sampling of river sediments, their laboratory preparation, and the most appropriate methods of chemical analysis. Geochemical data will be displayed in the SIMONA online system, which will be open-access and will thus allow any interested stakeholders to use the data.

Testing a UX-1 robot in the Idrija Mine

Within the Unexmin – Underwater Explorer for Flooded Mines project, GeoZS employees who are developing an autonomous UX-1 robot took part in a two-week robot navigation, sensorics, and positioning testing in the flooded parts of the Idrija mercury mine.

OCTOBER

We organised a workshop on efficient groundwater management

As part of the DARLINGe project, we held an international workshop aimed at exchanging experience between a Belgian water inspector and Slovenian representatives.

We organised the 5th Slovenian Geological Congress

The Congress was attended by 188 participants from 16 countries. We received 169 abstracts, 112 of which were lectures and 57 were posters. Guests came from Croatia, Austria, Germany, Macedonia, Belgium, Montenegro, Iceland, Hungary, Poland, Portugal, Russia, Slovakia, Switzerland, United Kingdom and the United States. In addition to the exchange of research achievements, the congress paid great attention to the importance of geoscience for the wider society and its sustainable use of minerals, groundwater and energy, the siting of infrastructure projects, and the assessment of geological hazards.

The central event of the 5th Slovenian Geological Congress was the round table titled Is Slovenia ready to use geological knowledge in its future development? with representatives of geoscience and major geological data users from the public sector and the economy.

The Congress included three single-day expert field trips, as well as one two-day international field trip to Slovenia and Croatia.

The guidelines and recommendations of the RoofOfRock project are being put into practice

High-quality Repen limestone from the Povirje quarry is being used to restore the roofs of cultural heritage sites. In 2018, the roof of the church in Dolenja Vas, and the roof of the parish church in Podnanos, the largest slate roof in Slovenia, were restored.

The use of such limestone slabs in the wider Karst region was recommended in the joint guidelines of the RoofOfRock project. Long ago, the stone from the same locations was used primarily in the southern parts of Karst, except that the slabs were obtained entirely by hand. The transfer of project guidelines into practice signifies a major contribution to the protection and preservation of cultural heritage, since, until now, building owners and contractors have faced major problems when trying to obtain suitable slabs for roof renovation.

NOVEMBER

We took part in the European RawMaterials Week in Brussels

The GeoZS staff attended numerous events, among which the *EIT RawMaterials Day* should be highlighted. There was a presentation of the European Minerals KIC, the GeoZS being one of its partners.

We participated in the 9th East and South-East Europe community conference on raw materials (9th ESEE Dialogue Conference)

Working together with the main organiser, Montanuniversität from Leoben, Austria, representatives of the EIT RawMaterials KIC, and the local partner, Geological Survey of Montenegro, we helped present the ways of involving Montenegrin stakeholders from the field of mineral resources into the activities run by EIT RawMaterials.

DECEMBER

We hosted a meeting of geoenergy experts from EuroGeoSurveys

At the meeting, the participants drew attention to the need to incorporate subsurface area-management into the objectives of emerging European programmes, including Horizon Europe. This is because, due to the increasingly diversified use, some conflicts are expected to escalate, e.g. relating to the use of aquifers for the production of drinking water, for heating and cooling with geothermal energy, and for CO_2 storage.

We conducted an expert consultation on arranging the acquisition, collection, interpretation, and accessibility of geological data in Slovenia

The GeoZS organised an expert consultation on how to arrange the acquisition, collection, interpretation and accessibility of geological data in Slovenia. At the event, two modern arrangements in this field – in Switzerland and the Netherlands – were presented. The solutions in the two countries are comparable to the one desired in Slovenia based on previous discussions in expert circles.

We participated in the meeting of the Slovenian Soil Partnership

At the meeting of the Slovenian Soil Partnership, which took place on 5 December 2018 at the Environmental Agency of the Republic of Slovenia, we presented the findings of the study titled Slovenian Soil – Geochemical Background and Upper Limit of Chemical Elements' Natural Variability.

7 PROJECTS IN 2018

Knowledge and experience have faces

Tea Kolar Jurkovšek, PhD

Head of the Regional Geology programme group

»The basic goal of the Regional Geology programme group is to study the geological structure and geodynamics in Slovenia. Doing so, we connect into a coherent whole with other geological studies, while also being an active member of the wider expert community in Europe. We deal with stratigraphy, tectonics, active tectonics, palaeontology, geological hazards, and geophysics. Since 2004, we keep becoming more multidisciplinary in our research, which ranges from traditional geological studies to new methodologies introduced into Slovenian science by our programme group. These include tectonic geomorphology, high-resolution reflection seismics, low-frequency georadar and paleoseismology.

> The basic goal of the Regional Geology programme group is to study the geological structure and geodynamics in Slovenia.

In 2018, much of our research focused on studying the ecological disaster at the end of Perm, which caused the greatest extinction in the history of the Earth. The layers near Žiri, Slovenia, were selected as the standard profile for determining the Permian-Triassic border in the wider area of the Dinarides according to international criteria. At the same time, we began research into rare preserved conodont clusters using X-ray microtomography.Our studies were conducted as part of some globally oriented projects (International Geoscience Programme (IGCP) Project 630: Permian-Triassic climatic and environmental extremes and biotic response; IGCP Project 632: Continental Crises of the Jurassic, where I was the national coordinator).

As a paleontologist, I am taking an active part in the European MINE TOUR project within the 2014–2020 Cooperation Programme Interreg V-A Slovenia – Croatia, where I am in charge of producing paleogeographic and paleoecological expertise for the rock of the Sitarjevec Mine.

In 2018, we were also busy performing finishing works and preparations for the printed monograph *Conodonts of Slovenia* (*Konodonti Slovenije*).

Having worked as a researcher for a long time, I cannot help but feel this activity that used to be called 'basic' geology is taken up by fewer and fewer researchers; despite all of our achievements. The many new research methods and rapid technological development have already led many aspiring geologists away from what we know as traditional geology. Undoubtedly, the interruption of regular financing of the geological mapping of Slovenia played a role in this. Consequently, a number of parallel research activities in support of mapping discontinued – they were a solid foundation for many other applied and basic research projects. If a need emerges to resume geological mapping activities, this could become a problem, which is unsolvable in the short term.«

> At the GeoZS, I have recently been working on projects related to the use of robotics and automation in the exploration and exploitation of mineral resources.

Gorazd Žibret, PhD

Head of the Mineral Resources programme group

»Research activities of the Mineral Resources programme group encompass the exploration of minerals throughout their life cycle, ranging from studying raw material bearers, such as rocks and geological formations, to researching individual sites, conducting research into raw material extraction, the planning of sustainable supply and management of raw materials at the local and national levels, the environmental impacts of current and past extraction and processing of raw materials, recycling of mining waste and other fields related to mineral and energy resources. This is a wide range of research, which is important for the functioning of the state, because sound knowledge of the raw material base and the possibilities of its exploitation is at the core of almost any kind of sustainable and eco-friendly planning of raw material use.

At the GeoZS, I have recently been working on projects (iVAMOS! and UNEXMIN) related to the use of robotics and automation in the exploration and exploitation of mineral resources. In 2018, we were chosen to take part in the new ROBOMINERS project, and we also applied for two similar projects. The project is very topical, because it pushes the boundaries of what is possible. It is much more difficult to explore underground passages than celestial bodies. When exploring the latter, operators can communicate with their machines – albeit with limited bandwidth and time lag – whereas communication in underground passages is no longer possible due to the absorption of waves in dense rock, even at short distances. Another problem concerns the perception of the environment – it is often impossible to use electromagnetic wave reflection due to the abundance of particles and other disturbances in the surroundings. Therefore, it really comes down to pushing the capacities of autonomous machines to the limit. In all these projects, geologists work closely with mechanical engineers, mechatronic engineers, programmers, miners, and experts in related disciplines when designing robots. We test them in real environments, and ultimately evaluate the usefulness of new devices and propose further improvements. These are undoubtedly the technologies that will revolutionise the exploration and extraction of minerals in the coming decades.«

Assist. Mateja Gosar, PhD

Head of the Groundwater & Geochemistry programme group

»The Groundwater & Geochemistry programme group, which I have been running for 16 years, brings together various branches of geology. Our job is to acquire deep understanding of geological phenomena and interactions caused by human activity. The geological environment and processes that take place within are extremely complex and vast.

For many years I have been studying adverse environmental effects of past metal mining. Metal mining in geologically enriched areas and metal use in industry often result in substantially increased concentrations of metals in the surrounding soil, sediments, water catchments and the atmosphere. Hence, to understand the situation, precise geochemical inspection of existing metal accumulations in natural environments is essential. Our studies have also been expanded to mining waste dumps. Further, we have drawn up a list of major dumps for the Ministry of the Environment and assessed their environmental impacts. In the same field, we also take part in the EU ORAMA, ReActivate and Stings projects.

Another important area of research is urban geochemistry. Urban environments are often the subject of geochemical studies. In these environments, there are complex interactions between chemical elements and their compounds due to geogenic influences along with past and present anthropogenic activities. The information obtained through geochemical research into the urban environment is essential for assessing potential health risks.

In the past year, we conducted an interesting study for the Ministry of the Environment on the geochemical background and the upper limit of the natural variability of 47 chemical elements in the upper layer of Slovenian soil. The study will be used as a basis for new soil legislation being drafted by said ministry.

I also transfer knowledge to younger generations. Under my mentorship, three colleagues obtained their doctor's degrees. Occasionally, I participate in the geology study programme at the Faculty of Natural Sciences and Engineering as a visiting lecturer and as a mentor or co-mentor in Bachelor's and doctoral theses.

> I also transfer knowledge to younger generations. Under my mentorship, three colleagues obtained their doctor's degrees.

For over 10 years, I have been a member of the EuroGeoSurveys' Geochemical Expert Group, which carried out geochemical mapping of Europe (the GEMAS project). I am the editor-in-chief of *Geologija*, a major Slovenian scientific journal, and a member of the Research Council for Natural Sciences and Mathematics (Representative for Geology) under the ARRS.«

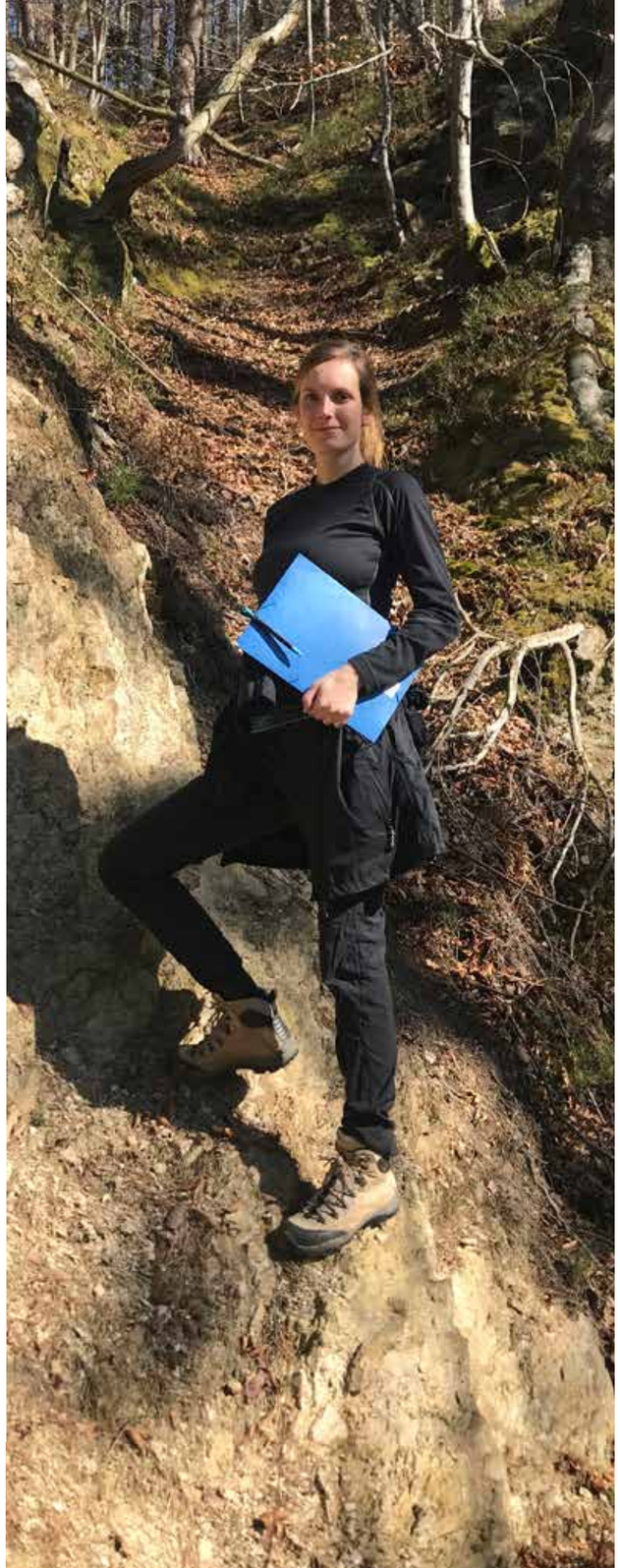
Jure Atanackov, PhD

»My fields of research include structural geology, active tectonics, earthquake hazard and applied geophysics. These fields intertwine in basic and applied projects. In those projects, I feel lucky and honoured to work with the best possible team. Our projects are varied, ranging from a map of active fractures in Slovenia to the suitability of locations for a possible new nuclear power plant, finding a precise location for quartz sand mining, and assessing the terrain suitability for the construction of a gas pipeline, to list only some of the most important ones. Applied geophysics is particularly challenging, because it can be an extremely powerful tool for determining the subsurface structure, but it only works well if combined with a suitable method, in-depth understanding of the method, and its optimisation for each type of study. The findings of geophysical research are generally useful for research and applied purposes alike.

In 2018, we completed the Analysis and Assessment of Seismic Risk for Krško Nuclear Power Plant 2 project, and continued working on active tectonics and earthquake safety within the Seismotectonic Maps for Slovenia and Hazard and Impact Knowledge for Europe (HIKE) projects. In the GeoConnect3D and HotLime projects, we delve in geophysics and its application in determining deeper geological structures. In the PREMPLAZ project and in determining the shallow geological structure for quartz sand exploitation as part of the Geophysical Research for the Podstran-Soteska (Moravče) Site project, we applied shallow geophysics.

Future challenges in geophysical research include the formation of a team that will tackle a wide range of geological challenges – most effectively solved by geophysics – in a comprehensive manner; further, we will engage in basic and applied projects that improve the quality of life indirectly and form the basis for sustainable development; and we will study our geological history to better understand our geological in the present time. An even more important challenge is the long-term research into and saving of Slovenia's deep geological structure, which is not being explored at this moment. But we are about to change that.«

> Future challenges in geophysical research include the formation of a team that will tackle a wide range of geological challenges.



> The knowledge and experience I gained during my doctoral education and while being a member of international organisations have allowed me to improve knowledge of landslide exploration in Slovenia.

Mateja Jemec Auflič, PhD

»The knowledge and experience I gained during my doctoral education and while being a member of international organisations have allowed me to further knowledge on landslide exploration in Slovenia. We will make significant progress in understanding the dynamics of landslides within the ARRS project titled Studying landslide movements from source areas to deposition zones using a deterministic approach. In the project, we are developing an interdisciplinary methodological approach that will help assess the risk of landslides and debris flows in two Slovenian pilot regions, and it will be possible to apply the same methodology to the wider Alpine region. In my work, I pay great attention to remote sensing techniques, which allow real-time, millimeter-accurate landslide monitoring. Thus, the GIMS project focuses on developing low-cost remote sensing technologies (EGNSS, Copernicus SAR and other in-situ sensors), which will measure movements in the Vipava Valley, while the U-Geohaz project aims to produce a radar-image processing software for obtaining information about movements on the Earth's surface.

The techniques used in studying landslides are no longer a novelty in the global sense; however, as we apply them on soil so geologically diverse as that of Slovenia, we contribute to further technological development as well as to natural-disaster risk reduction.«

Špela Bavec, PhD

»As an environmental geochemist, I am part of the Groundwater & Geochemistry programme group, and I work with Slovenian and foreign researchers. My work builds on decades of research on how mining and processing of ore impacts the environment. I also research urban areas that are heavily influenced by various anthropogenic activities. My most challenging research undertaking is focused on environmental media (soil, sediments, dusts and mining waste) that are burdened with potentially toxic elements (PTEs) and can affect the quality of water, air, etc. Based on field investigations, laboratory work and the use of various geochemical methods, I determine the content, physico-chemical properties, speciation, mobility, mineral composition, and many other properties of PTEs. This research contributes to the overall characterisation of PTEs in the environment and a better understanding of the mechanisms of release, transport, resources, sinks, and spatial distribution of PTEs in burdened environments. I work on applied projects focused on environmental impact assessments (Natural Variability of Elements, Barje – SNAGA, Dump Monitoring). In addition, I take part in several EU projects related to mining waste, namely the STINGS project for the development of a tailings supervision system, RE-ACTIVATE, which is establishing a community of experts needed to reactivate mining areas in a sustainable way, and ORAMA, in which data collection on primary and secondary raw materials in the EU is being optimised.«

> My work builds on decades of research on how mining and processing of ore impacts the environment.

From 2015, I have mostly focused on GeoZS's work in the world's largest consortium on mineral resources (MR) – EIT RawMaterials KIC.

Tina Zajc Benda

»Since 2015, I have mostly focused on GeoZS's work in the world's largest mineral resources (MR) consortium – EIT RawMaterials KIC. The GeoZS joined this community as an associate member, but in only three years, our small team of experts created a success story. With a lot of effort, self-initiative, rapid work, out-of-the-box thinking and networking with European and global partners, the GeoZS has become a full partner in this consortium, which has been a link between the EU and the Western Balkans for many years.

Because EU citizens need ever more mineral resources each year for transport, living, everyday work, and leisure activities (sports equipment, smartphones, smart toys, etc.), Europe needs to become as independent as possible in regards to the supply of mineral resources. Therefore, the EU is turning to regions with untapped stocks of mineral resources. In 2018, we set up the project RESEERVE – Mineral potential of the East & South-East Europe (ESEE) region, the main result of which will be a Register of Primary and Secondary Mineral Resources of the Western Balkans.«

I help manage and maintain the online Mining Book, the Mineralne surovine (Mineral Resources) bulletin, and I work in spatial planning.

Ana Burger

»In the Mineral Resources & Environmental Geology Department, I work on tasks related to mineral resources. I help manage and maintain the online Mining Book, the Mineralne surovine (Mineral Resources) bulletin, and I work in spatial planning. In addition, I take part in various European projects. I like this type of work because it is dynamic and diverse. I work with geologists, miners, programmers, ministries (especially the Ministry of Infrastructure), lawyers, etc. We want our products, which are in the form of applications and publications, to be accessible and useful not only for professionals, but also for the general public. In the future, we intend to add more data to the online Mining Book (e.g. a basic geological map, disused metal mines, and coal mines). We transfer our knowledge to other countries via European projects, and our expertise on the state of mineral resources in Slovenia allows us to cooperate in the European network of mineral resources. At work, I gain new experience and get to tackle problems in many different areas. One of the biggest challenges is coordinating positions represented by experts from different fields, all of which have to be taken into account.«

Over the last few years at the GeoZS, I have been working on projects that assess the impact of various activities on the quality of groundwater.

Sonja Cerar, PhD

»In the last few decades, we have been paying increasing attention to preserving the quality of groundwater. It is important to know the natural characteristics of groundwater, i.e. its composition, which depends primarily on the rock composition of the aquifer. This allows us to assess whether the values of the measured parameters are geogenic (natural) or whether the groundwater is contaminated due to various anthropogenic factors. To assess the natural characteristics of groundwater, we need to accurately sample it and thus obtain reliable data on its composition, which is expertly evaluated using statistical methods. Based on the expert evaluation, we can determine which further measures need to be taken to improve groundwater quality and to what extent.

Groundwater pollution is caused mostly by point and diffuse sources, such as industrial plants, settlements and agriculture, and to a lesser degree by other activities. The problem of groundwater pollutants is very complex, since this issue has to be faced both by polluters and protectors of water resources. Taking a constructive approach to maintaining groundwater quality has been a great challenge in recent years. The proper approach should include openly coping with problems and finding common solutions, rather than shifting responsibility.

Over the last few years at the GeoZS, I have been working on projects that assess the impact of various activities (remediation of disused sand quarries, military activities, dumps, and IED devices) on the quality of groundwater. Naturally, we also have to know the natural characteristics of underground water, which can vary locally, based on the lithological composition of the aquifer. More and more studies are conducted because various new groups are becoming involved in environmental licensing procedures. We work closely with soil-geochemistry experts, as soil is an important agent in groundwater contamination pathways.«

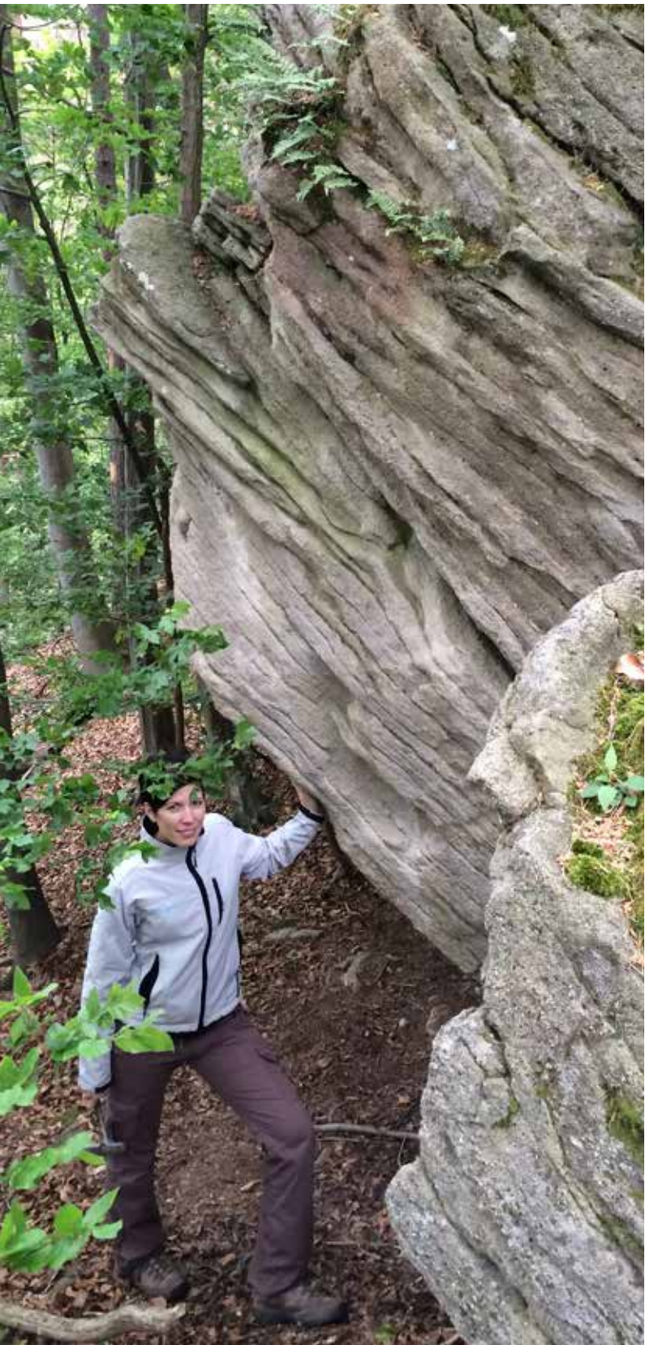
I also like to take lead in large-scale projects with a very tight deadline.

Staška Čertalič

»It is 2018... January... 'Staša, are you available? This has to be done by the end of February... Staša, are you available?... March... mid-June...' Overnight, the decision is made that I have to design the interior decorations of the hotel where the 5th Slovenian Geological Congress it will take place. I have take care of the editing and printing of the accompanying publications, arrange the outdoor exhibition to be held in Velenje from October to May 2019, reprint the Geological Atlas of Slovenia, design the 2017 GeoZS Annual Report, prepare the publication of the 3rd ReSyLAB book... search for a print office... Until the end of August–September. So much to do, but so little time! Panic? No way, it's a challenge! Ideas and images are formed on the drive home, on the train, during numerous lonely walks in the woods, and in the evening in front of the computer... December... the end?... It is 2019...

In addition to regular tasks related to various state-funded (ARRS – PREMPLAZ, MiZP) and EU projects (GIMS, eoPLASMA-CE, RESEERVE), in hindsight, my 2018 was very productive and creative. I also like to take lead in large-scale projects with a very tight deadline.

This is how my work has looked like for the last 15 years, since I joined the GeoZS. It is fast-paced, creative, and full of challenges in different areas, but with one single goal – to make geology more accessible in a visually interesting and appealing way.«



Kristina Ivančič

»As a junior researcher, I work in basic geology, namely clastic sedimentology and Neogene stratigraphy. My work is very dynamic. My field work consists mainly of mapping, writing detailed sedimentological lists, and sampling. I then 'slice open' the samples and do petrographic, geochemical, and palaeontological analyses to determine when and how the sediments settled, and identify the dynamics and environment of sedimentation. I publish my results in reputable scientific journals. In addition to research itself, I take part in projects that allow me to acquire the necessary practical experience. I attend various training courses, workshops and congresses, where I present my results and network with researchers from abroad. Research takes a considerable amount of work, and often cuts into my leisure time, which can be quite exhausting.

All in all, being a junior researcher at the GeoZS has been a very positive experience. I have a mentor who gives me directions, instructions, and helpful tips. I am also happy to say that people at the institution listen to junior researchers and we can always count on the help of other colleagues.

The first thing that I want to accomplish in the future is finishing my doctoral dissertation. One of the challenges that awaits me is organising a transparent database of Neogene rocks in Slovenia. I definitely want to make use of my knowledge and experience in current and future projects.«

> All in all, being a junior researcher at the GeoZS has been a very positive experience. I have a mentor who gives me directions, instructions, and helpful tips.

Mitja Janža, PhD

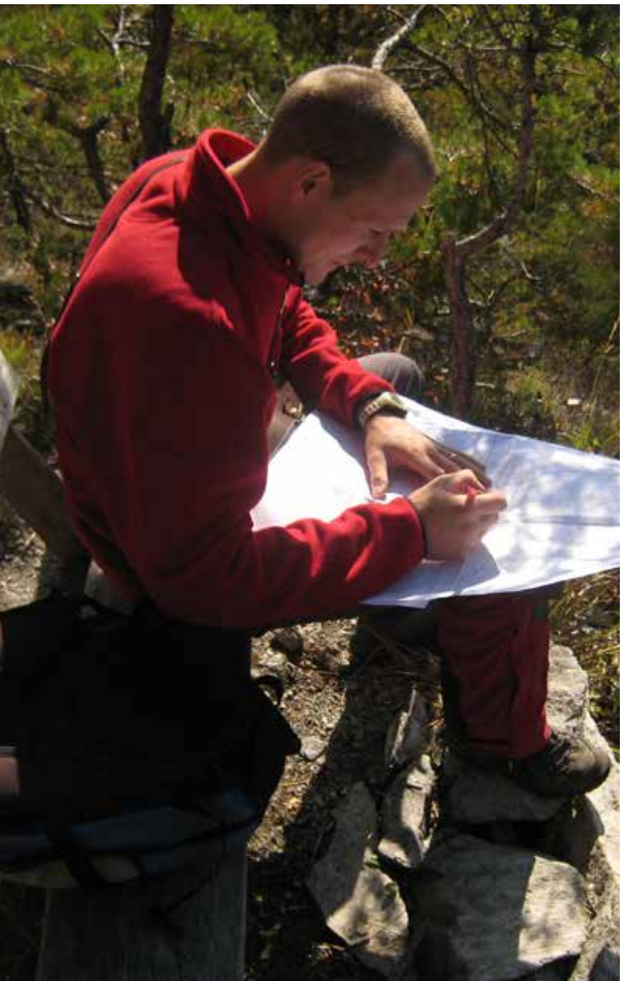
»The alarming rate of climate change, reinforced by scientific findings, shows the need to reduce our dependence on fossil fuels. Shallow geothermal energy, a renewable and local energy source, is accessible almost everywhere and can play an important role in this endeavour.

Considering the global trend of population growth in urban areas, assuring an adequate living environment in cities will require a more rational use of space, including the one below the surface. We rarely consider the subsurface of cities as a source of heat or cold, and people are usually not aware how important geological conditions are for the protection of groundwater, which is a drinking water source. Understanding the subsurface is also the basis for safe construction. We start thinking about these important factors of urban growth only when disasters bring them to our attention.

We work with international experts from various fields to research shallow geothermal energy and urban geology. It is our goal to understand the geological phenomena and conditions for efficient use of geothermal energy and sustainable urban development. We try to make this information accessible and understandable to potential users, especially to developers, as only findings that are useful allow the society to progress and justify investment into research.«

> We work with international experts from various fields to research shallow geothermal energy and urban geology.

Ever-increasing geological knowledge of Slovenia allows me to research sedimentology, structural geology and, more recently, quaternary sediments.



Jernej Jež, PhD

»The core of my expert and scientific work is closely linked to regional geology. It includes knowledge of basic surface and subsurface properties in an area, and the production of precise three-dimensional geological models. Ever-increasing geological knowledge of Slovenia allows me to research sedimentology, structural geology and, more recently, quaternary sediments.

It means a lot to me that I can translate knowledge directly into applied tasks. In the framework of these tasks, I work on engineering projects focused primarily on the prevention of landslides and other geological hazards, I prepare expert documentation for major infrastructure facilities, and I study the potential of shallow geothermal energy and its possible uses.

Recently, I have been working primarily on the PREMPLAZ and HUDORNIKI projects, in which we are studying slope movement, and on the GIMS project, in which we are developing and testing an innovative integrated geodetic system for monitoring slope movement. In the past year, I participated in the GRETA project, in which we investigated the potential of geothermal energy in the Municipality of Cerkno.

I expect that in the future, knowledge on basic geology at local, national and international levels will become increasingly important for constructing difficult infrastructure, providing drinking water, finding mineral resources, and discovering renewable and environmentally friendly energy sources. Remote sensing methods help us obtain more accurate data of Earth's surface, but we do not yet have an automatic tool for geological mapping and creating geological models. Thus, key data can still be obtained only in the field, with hiking boots and a hammer in hand. It is especially gratifying that we always discover something new if we do our work with precision.«

Matija Krivic

»I was employed at the department Geological Information Centre as an expert for geographic information systems, the basis of which are spatial databases. Over the years, the focus of my work has shifted to managing data, i.e. collecting, editing, and storing geological data. I started working in this field by editing a metadata catalogue that, by tracking objectives of the INSPIRE directive on the regulation and accessibility of spatial data, has evolved into the eGeologija website. eGeologija is becoming Slovenia's main hub for accessing geological data.

Last year, I became Head of Data Infrastructure and my main task is to ensure that the spatial information system is operating smoothly. The latest result of our work is a 2018 borehole database, which contains basic data on boreholes in the Republic of Slovenia, and is accessible to the expert and general public.

I am delighted that I have been able to successfully transfer the knowledge and experience with experts-in-training via a training programme for African geological surveys within the PanAfGeo project. I have also participated in other projects (RESEERVE) and bilateral agreements; one of them was a course on capturing digital geological data for the Geological Survey of Montenegro.«

Over the years, the focus of my work has shifted to managing data, i.e. collecting, editing, and storing geological data.

Špela Kumelj

»In recent years, my work has been focused mainly on managing, coordinating and transferring knowledge at the level of European projects and within the GeoZS infrastructure programme. I am active in various geological areas, such as geological hazards (GH-14, e-Plaz), geothermal energy (T-JAM, TRANSENERGY and DARLINGe), and mineral resources (Mintell4EU).

Among my current activities, I would like to point out the PanAfGeo project, which supports the partnership between The Geological Surveys of Europe (EuroGeoSurveys) and the Organisation Of African Geological Surveys. In an innovative training programme, we improve the knowledge of experts from African geological institutes, especially in the areas of sustainable mineral exploitation and associated activities, prevention and mitigation of the consequences of natural disasters, and the management of spatial data. The biggest challenges that we face are sustainability, transferrability and applicability of my knowledge.

My involvement in the projects depends on good and focused communication, because only proper exchange of information can help us understand the connection between spatial factors, their interdependence, and joint effects.«

Among my current activities, I would like to point out the PanAfGeo project, which supports the partnership between The Geological Surveys of Europe and the Organisation Of African Geological Surveys.

Tomislav Matoz

»In the Hydrogeology Department, we deal with all uses of groundwater. Direct users, who I am in contact with, play a role, albeit a small one. In 2018, most of our work was focused on major state projects. The second track was one of the more complex projects, for which we conducted extensive geophysical and hydrogeological monitoring of boreholes. In the EU-funded INNOLOG project, in addition to site selection, we had to ensure that the pilot borehole was drilled so that the geophysical probes could be tested, which was the goal of the project. Even before the implementation of the new deep borehole Ng-1/18 in Rogaška Slatina, we had to carry out preparations that affected later work.

Most of my work is comprised of geophysical well logging with most parameters that are hydrogeologically important in designing new and remediating old boreholes. We have to be aware that we are working with very expensive equipment, and a lot can go wrong when working with boreholes, especially if they are already worn out. This means that we have to be very familiar with each borehole that needs to be logged. Every departure to the field is therefore inevitably linked to a feeling of unease... will everything go smoothly? Clients usually expect a solution, not a new problem. Luckily, we can depend on a lot of field-work experience and familiarity with drilling technology.«

Most of my work is comprised of geophysical well logging with most parameters that are hydrogeologically important in designing new and remediating old boreholes.

> Meteorites also pose an important research challenge, since we do not encounter such material very often.

Miloš Miler, PhD

»My primary scientific and research fields are environmental mineralogy and geochemistry, which include studying micromineralogy and micromorphology of metal pollutants in various environmental media such as sediments, soil, air, and household and road dust. The purpose of this research is to determine the sources, effects and fate of metal pollutants, which was also the main topic of my completed postdoctoral project. I am especially pleased by the cooperation and exchange of ideas with Slovenian researchers from various scientific fields. Together, we explore the sources of particles in the air and on cave formations in tourist karst caves, and we research the origin and formation of the soil in sinkholes and around caves. The cave environment of the Sitarjevec mine is interesting to my colleagues and myself. With geochemical-mineralogical research of mining sediments, waters and the microclimate, we are trying to determine the processes that have contributed to the formation of sediments and cave formations. Meteorites also pose an important research challenge, since we do not encounter such material very often. We have successfully investigated two Slovenian meteorites: Javorje and Jezersko. I endeavour to use my acquired knowledge to contribute to the economy by researching the quality of synthetic fibres for the textile industry, and participating in international projects, such as the mineralogical-granulometric characterisation of phosphoric gypsum for the EIT RawMaterials project raPHOSafe. A wide range of research topics and cooperation with researchers from different fields help understand and spread the word about my primary research, and, most importantly, they provide additional research momentum and widen the horizon.«

> As co-editor and co-author of major overview works, such as Geology of Slovenia, Geological Atlas of Slovenia, several transparent geological maps and as contributor for the web portal eGeologija and the borehole database, I helped spread scientific data and knowledge gathered at the GeoZS.

Matevž Novak, PhD

»After my doctoral studies, during which I specialised in biostratigraphy of the paleozoic and sedimentology, the CEO had a collegium on the future of GeoZS, and afterwards I received a message that I will be in charge of outreach. At that time I did not yet know what exactly was expected of me, but looking back at my activities and the results of the previous years, I can say that this task defined my role at GeoZS. As co-editor and co-author of major overview works, such as Geology of Slovenia, Geological Atlas of Slovenia, several comprehensive geological maps and as contributor for the web portal eGeologija and the borehole database, I helped spread scientific data and knowledge gathered at GeoZS among experts, and I helped connect GeoZS with other research institutes. As co-editor and co-author of the popular publications of 70 Geological Attractions of Slovenia, A Geological Tour Of Ljubljana, as member of the editorial board for the Proteus magazine, and as an active member in related associations, a lecturer and an excursion guide, I present the science of geology to as many people as possible. In the past four years, as the president of the Slovenian Geological Society, I participated in the activities of the Group for the Promotion of Geological Science. Our goal has been to regulate the field of geological research and geological data, and as head of the organisational committee, I included these issues in the 5th Slovenian Geological Congress«

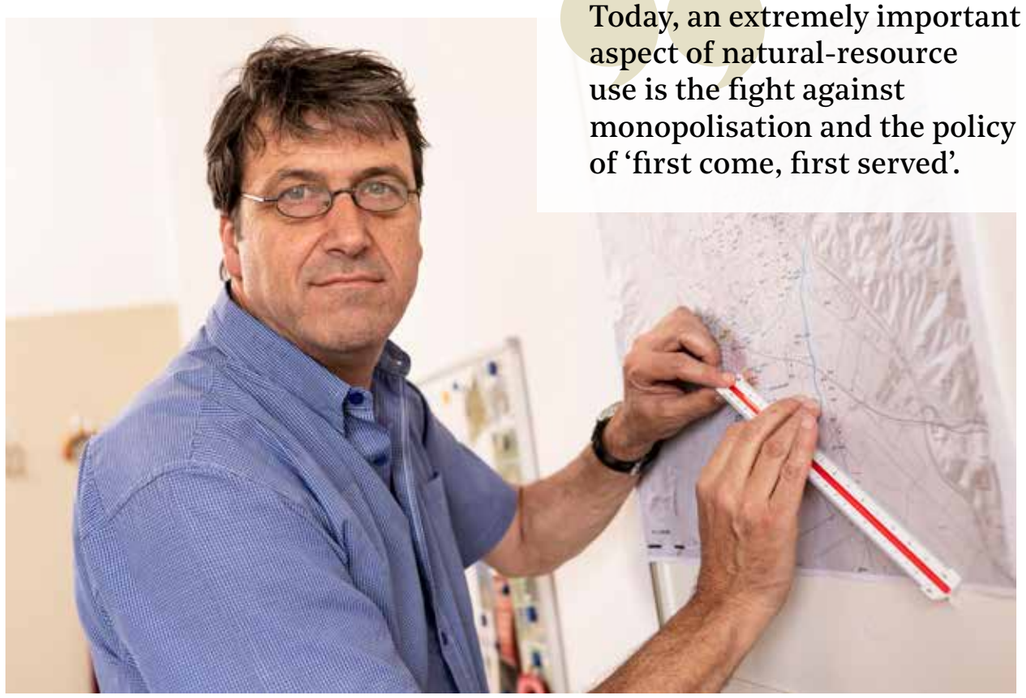
Tina Peternel, PhD

»My field of work and research are focused primarily on studying slope movement in terms of the engineering-geological structure of the terrain, precipitation, and other influential factors.

From the doctoral thesis, I have been studying slope movements in hilly and hard-to-reach parts above the village of Koroška Bela, where numerous avalanches occur that directly threaten the densely populated settlement below. By utilising various research grants and technical tasks (ARRS projects: J1-8153; J-8273 and tasks financed by the Ministry of the Environment and Spatial Planning, and by the Municipality of Jesenice) and by carrying out various research activities, we try to understand these processes, the main goal being damage prevention or at least mitigation. Obtaining relevant and useful data, which make good interpretation of slope movement possible, presents a great challenge because of all the time and financial restrictions inherent in my work.

In recent years, I have also been part of the development and research team of the Early warning system for landslides – MASPREM, which was implemented by the GeoZS in 2011 on the order of the Administration of The Republic of Slovenia for Civil Protection and Disaster Relief. By performing various activities, we develop preventive control measures in areas with higher avalanche risk both at the state level and at the level of municipalities.«

From the doctoral thesis, I have been studying slope movements in hilly and hard-to-reach parts above the village of Koroška Bela, where numerous avalanches occur that directly threaten the densely populated settlement below.



Today, an extremely important aspect of natural-resource use is the fight against monopolisation and the policy of ‘first come, first served’.

Joerg Prestor, MSc

»In 2018, we continued our work in two important Interreg projects – GRETA and AMIIGA. With both projects, we have opened up great opportunities to combine and use past knowledge and experience. The two projects deal with completely different areas, namely shallow geothermal energy and remediation of groundwater pollution, but they have a lot in common. Both require knowledge on geology and hydrogeology, which needs to be presented to the general public for important decision-making on sustainable use of natural resources, such as geothermal energy and drinking water. Today, an extremely important aspect of natural-resource use is the fight against monopolisation and the policy of ‘first come, first served’. This is one of the most important EU-policy orientations, which requires broad support from the population and active participation of each individual. A very important EU-policy orientation in this programme period (2014-2020) is also the self-supply, interdependence and interconnection of cities and their surroundings, especially the more remote areas. Our most important achievements are the guidelines for harmonising regulations on the use of geothermal energy in the Alpine states, and the plan to reduce the pollution of Ljubljana’s drinking water sources by reducing the concentration of Cr(VI), nitrate, boron, decylatrazine, and new-age pollutants.«

Petra Jamšek Rupnik, PhD

»In our region, a very powerful earthquake occurs once every several hundred years, which lessens the earthquake-threat awareness in Slovenia. However, experts posses tools for finding tangible evidence that earthquake-active fractures exist in Slovenia and that in the geological past, strong earthquakes have occurred and will occur again. I use tectonic geomorphology and paleoseismology to research earthquake geology. Tectonic geomorphology studies how fault movements shape the surface, while paleoseismology looks for evidence of past earthquakes in young sediments just below the surface. In paleoseismological trenches, we study sediments, from which the seismic story of a fault can be interpreted. Using other tools for studying tectonics and quaternary, we obtain information on earthquake threats in individual areas, and based this we can determine which in areas buildings need to be earthquake-resistant. This knowledge comes with responsibility, which is why we pass it on to competent institutions, raise public awareness, and contribute to reducing potential harm. In our line of work, we often have to be innovative and adapt standard methods to field-research conditions. We are setting an example for researchers facing similar challenges all over the world. The field of earthquake geology combines several different geological disciplines, which means that researching this topic relies heavily on teamwork. At GeoZS, 2018 was marked the completion of two large-scale projects in this field: Assessment of seismic risk for JEK 2, and the development of seismotectonic maps for Slovenia. Within the framework of the Regional Geology Programme, our colleagues and us conduct research on this topic all across Slovenia.«

This knowledge comes with responsibility, which is why we pass it on to competent institutions, raise public awareness, and contribute to reducing potential harm.

The greatest challenge in 2018 was the management of the Project Monitoring system, financed by the GeoERA Programme, the most extensive cooperation of geological institutes in Europe to date.

Barbara Simić

»The Project Office team, with its expertise in finance, administration, and quality management, helps implement research and development projects. We ensure that data and analyses for internal and external users are accurate and delivered in a timely manner. We connect with similar teams in Slovenia and Europe, and contribute to better information interpretation and management. The core of our operation are cooperation, networking, and accepting the challenges inherent to a dynamic work environment. This motivates us to accept new expertise and roles in projects.

The greatest challenge in 2018 was the management of the work package titled Follow-Up and Monitoring of the Results of Projects Financed by the GeoERA Programme, the most extensive cooperation of geological institutes in Europe to date. Within the programme, we have established a system for project reporting and result evaluation, thus directly influencing the timeliness and quality of project results, and indirectly contributing to the success of the GeoERE programme and to future large-scale cooperation of European geological institutions.

In total, we have finished over 50 projects. In the future, cooperation will be extended to new areas of European cooperation and integration. I am proud to direct such an excellent team on an interesting path and work on projects of European significance.«

Robert Šajn, PhD

»My mission is to strengthen international scientific cooperation and partnerships with countries in the Western Balkan region, improve research standards and technological innovation, and promote regional centres of excellence. My research is focused on endangered and vulnerable areas, i.e. areas with operating and, more importantly, abandoned mines, metallurgical plants and their mining or smelting waste dumps. I estimate anthropogenic pressures and separate anthropogenic anomalies from geogenic anomalies based on statistical comparisons and mathematical models. An important part of my research is assessing potential mining and metallurgical repositories. Because of relatively low technological efficiency in the past, repositories are a potential source of mineral resources, but they are also a severe ecological burden. At GeoZS, we follow the Zero Waste principle, which means that inert residues are used for construction purposes. In 2018, I participated in the projects Trans-boundary contamination risk assessment and modelling for sustainable soil management, food safety and natural riverine habitat protection in the Drava River floodplain, in the RESEERVE project – Mineral potential of the Eastern and South-Eastern Europe region, RIS CuRE – Zero waste recovery of copper tailings in the ESEE region, and in the RIS RECOVER project - Slovenian Regional Innovation Scheme for Zero-Waste Extraction of Critical Raw Materials. My research results define local and regional geochemical conditions, and they help us understand the processes and causes of environmental changes. They are important for agriculture, forestry, land-use planning, understanding impact on human health, and, most importantly, for sustainable development planning, and thus for the overall development of Slovenia and the wider Western-Balkan region.«

> My research is focused on endangered and vulnerable areas, i.e. areas with operating and, more importantly, abandoned mines, metallurgical plants and their mining or smelting waste dumps.

> At work, I began to realise that everything we use in everyday life is made from hundreds of different types of raw materials derived from mining or recycling.

Urša Šolc

»Soon after I started working on projects related to EIT RawMaterials, I came to the realisation that it truly is the world's largest network of organisations operating in the field of raw materials. It offers numerous opportunities for boosting research cooperation with other research and educational institutions, and, very importantly, with companies.

At work, I began to realise that everything we use in everyday life is made from hundreds of different types of raw materials derived from mining or recycling. The sites located near the surface have already been almost completely exhausted. Therefore, innovation in the field of raw materials is very important, as we need to develop new, more efficient, and environmentally friendly ways of making materials and extracting raw materials. In doing so, we need to be innovative and think about how we can sustainably use raw materials, and thus ensure future supply.

In order to increase the innovation potential and involvement of partners from SE Europe in the EIT Rawmaterials community, the Regional Centre Adria, EIT RawMaterials hub was established in 2018. The three co-founders – GeoZS, the University of Zagreb, and the Institute for Construction – work hard every day to make RC Adria a recognizable information point, at which resource stakeholders from Slovenia, Croatia and Western Balkan countries can obtain information on research, education, and business opportunities offered by the community.«

Janko Urbanc, PhD

»Groundwater studies, performed within the framework of preparing the Slovenian water-management plan, have shown that the three important aquifers (Drava, Mura and Savinja basins) do not meet the required groundwater quality standards, and the aquifer in the Krško region is also almost at the threshold of groundwater load. In addition to pesticides, the biggest problem that these aquifers face are elevated nitrate concentrations in groundwater.

Therefore, the Groundwater Research Group pays special attention to the presence of nitrates in groundwater, especially those that leak into groundwater from agricultural areas. Current research is being carried out within the Uraviva project, which is lead by the Biotechnical Faculty. In order to more precisely define the amounts of nitrogen that actually leak into groundwater, we have developed special lysimeters for sampling percolating water. These lysimeters are placed directly under a field or an orchard where normal agricultural production takes place. The results so far have been very encouraging and show that it is possible to quantify the amount of nitrates from agricultural land using lysimeters.

In 2018, we also cooperated intensively with Ihan Farms. They exemplify livestock-breeding operations with large quantities of excess nitrogen. As part of this cooperation, I was in charge of two interesting projects, namely identifying the potential impact of liquid manure from the Klinja Vas pig farm near Kočevje on the karst groundwater, and removing iron from the groundwater used as drinking water at the Pristava Farm near Krško.«

Therefore, the Groundwater Research Group pays special attention to the presence of nitrates in groundwater, especially those that leak into groundwater from agricultural areas.

7.1 A 2018 PROJECT OVERVIEW

The research framework of GeoZS is provided by three ARRS research programmes: Regional Geology, Groundwater & Geochemistry, and Mineral Resources; the infrastructure is provided by the Infrastructure Programme. In addition, we carried out numerous research and development projects in 2018, which we briefly summarise below.

PROJECTS FINANCED FROM THE BUDGET
Prepare expert bases and offer expert support in setting criteria and conditions for granting water rights, and setting crite-ria and conditions for issuing opinions in procedures for granting of mining rights
Upper Paleozoic coral and foraminiferal biostratigraphy for the correlation of Pale-otethyan and Uralian paleobiogeographic provinces on the global stratigraphic chart (Bilaterala SI-RU)
Upper Paleozoic coral and foraminiferal biostratigraphy for the correlation of Pale-otethyan and Uralian paleobiogeographic provinces on the global stratigraphic chart (Bilaterala SI-RU)
Trans-boundary contamination risk as-sessment and modelling for sustainable soil management, food safety, and natural riverine habitat protection in the Drava River floodplain
Improved water and nutrient use efficien-cy in plant production to protect drinking water sources (URAVIVO)
Studying landslide movements from source areas to deposition zones using a deterministic approach (PREMPLAZ)
Identifying potentially dangerous torren-tial streams using geomorphometry and simulating the formation of fans (HU-DOURNIK)
PROJECTS STARTED IN 2018
The monography Conodonts of Slovenia
Natural-variability limits of chemical elements in the upper soil layer in Slovenia
Protection against earthquakes and restoration activities after an earthquake
Quaternary landscape dynamics in the Slovenian Alps: Reconstruction of glaciers and the climate, and implications for the assessment of geologically-determined hazards (Bilaterala SI-DE)
Effect of geotechnical filling from recycled materials on groundwater (Recycled materials)
Development of seismotectonic maps for 2018
Hydrogeological mathematical model of groundwater flow and heat transfer in a deep geothermal body of groundwater in north-eastern Slovenia – new modelling in 2018
Review and analysis of the national groundwater-quality measuring points, and preparation for sampling in 2018
Analysis of programmes and reports for monitoring groundwater pollution around dumps, and parties obliged by the Industrial Emissions Directive for 2017
Analysis of programmes and reports for monitoring groundwater extraction under the concession contracts in 2018
Analysis of license reports for groundwater research in 2018

COMMERCIAL PROJECTS
Analysis and assessment of seismic risk for JEK 2
Prepare an audit of expert bases and a hydrogeological opinion on the impact of the Hrastje quarry remedia-ti-on on the Hrastje water source
Pilot flooding of the Enajstmlinski potok (Eleven-Mill Stream)
Advising on the projects of the Slove-nian Geological Society
Determining the communication between surface waters and the pumping wells of the Kolovec drinking water catchment
Upgrading the early information and warning system for landslides (MASPREM)
Landslides – field reviews and reports
Storage of geological drill cores on the project of constructing the second track of the Divača-Koper railway line
Geological and hydrogeological control during construction of the connecting C0 pipeline
Establishment of operational monitoring, preparation of the annual report on the operational monitoring of ther-mal-water extraction for 2018, and execution of a pumping test at the Mo-1 and Mo-2 boreholes in Mala Nedelja – PZA Bioterme
Detailed expert report on the classifi-cation and categorisation of quartz sand and gravel stock and resource calcu-lations at the Kuštanovci I deposit
Advisory and support work for the production of the Ng-1 borehole in the area of Trije Ribniki (the Three Ponds)
Implementation of geophysical well logging on the project Maintenance work on structures at HC H4 Razdrto--Vipava; REBERNICE
The Ig fan: Modelling the quantity of groundwater while taking into account various scenarios how land use affects the supply of drinking water from the Brest water plant
Measuring liquid manure seepage at the Klinja Vas pig farm
Establishment of operational monitoring, preparation of the annual report on the operational monitoring of ther-mal-water extraction for 2018, and execution of a pumping test
Implementation of a monitoring pro-gramme in Stara Vas due to the con-struction of HPP Brežice
Implementation of a geothermal-borehole monitoring programme for Sava Hotels & Resorts
Maintenance of the existing monitor-ing, implementation and maintenance of electronic geotechnical monitoring, and interpretation of monitoring data and reporting for the Urbans and Čikla landslides
Executing pumping tests at the Trebija pumping station to determine the optimal pumping regime and indirectly enhance groundwater quality
Performing complementary structural geological, hydrogeological, karstolog-ical, and geotechnical research for project implementation of the second track of the Divača–Koper railway line (2TDK)
Water-resistance analysis of soil in a dedicated area for storing and pro-cessing inert waste of the company Termit d.d.
Prepare an audit of expert bases and a hydrogeological expert opinion on the impact of the Hrastje quarry remediation on the Hrastje water source – Municipality of Šentjur
Risk analysis of pollutants leaking into groundwater, Snaga d.o.o. – Update of the analysis with data for 2014, 2015, 2016 and 2017

COMMERCIAL PROJECTS
Hydrological investigations for the project “Construction of a Science Centre as a Demonstration Facility”
Hydrogeological investigations for pile-dwelling settlements at Ig – Phase 1
Preparation of geological data from the Mursko-Zala geothermal basin for the production of a 3D model
Preparation of drinking water at the Pristava Farm near Krško
Hydrogeological report for the small municipal waste-water treatment plant Češnjica near Trebelno in the Radulja Valley
Implementation of a monitoring programme in Stara Vas due to the construction of HPP Brežice
PROJECTS STARTED IN 2018
Installation and extraction of a pump and measuring equipment, and execution of a pumping test in Ljubljana
Implementation of a pumping test at the VB-2 borehole in Bled and preparation of a hydrogeological report
Plenšak – Hydrogeological work on the boreholes of the Plenšak water system for obtaining a water permit – Municipality of Železniki
IJS LIFE 2050 – Analysing the potential impact of geothermal energy in Slovenia by 2050 for the LIFE Climate-Path2050 project (LIFE 16 GIC/SI/000043)
Geophysical and geological measurements in the quartz-sand extraction area of Zabritof – Soteska
Prepare an audit of expert bases and a hydrogeological opinion on the impact of the Hrastje quarry remediation on the Hrastje water source
Drill a replacement borehole for groundwater monitoring at the Vič location, clean existing boreholes for monito-ring, and prepare a monitoring plan at the Barje non-hazardous waste dump
Production of a trial borehole with an estimated depth of up to 150 m and provide opinion on heating and cooling possibilities with geothermal heat pumps – Museum of Modern Art, Bled
The Poček national spatial plan: Preparation of a project task for supplementing Expert documents on envi-ronmental protection of the national spatial plan for the central practice grounds of the Slovenian Army (OSVAD) at Postojna – Water segment
Expert training at the Sitarjevec mine for the MineTour project
Optimisation of borehole-use in Terme Čatež
Design and implementation of piezometric wells at the new Šumi building and hydrogeological monitoring for one year
Hydrogeological report for obtaining a water permit for the Jepihovec catchment
Geological and hydrogeological control during sewage-system construction in Kleče
Review and analysis of the national groundwater-quality measuring points, and preparation for sampling in 2018
Video recording and geophysical measurements of the Ples V-1/90 pumping wells in Moravče, a hydrogeological survey of the direct water catchment area and implementation of a tracer test
Geophysical well logging of 4 wells up to 30m deep in the 3RO-north site
Creation of a geological column of the Municipality of Sevnica for the tender “Varuj vodo” (Protect Water)
Creation of a geological column of the Municipality of Brežice for the tender “Varuj vodo” (Protect Water)
Geological column and aquifer model for the project “Varuj vodo” (Protect Water)
Geological and hydrogeological control during construction of the connecting C0 pipeline

INTERNATIONAL PROJECTS

MINATURA 2020 – Developing a concept for a European minerals deposit framework
INTRAW – International coopera-tion on Raw materials
VAMOS – Viable and Alternative Mine Operating System
MICA – Mineral Intelligence Capacity Analysis
UNEXMIN – Autonomous Un-derwater Explorer for Flooded Mines
SCRREEN – Solutions for critical raw materials – a European Expert Network
ORAMA – Optimising quality of information in RAw MAterials data collection across Europe
GIMS – Geodetic Integrated Monitoring System
GeoERA – Establishing the Euro-pean Geological Survey Research Area to deliver a Geological Service for Europe
DARLINGe – Danube Region Leading Geothermal Energy
AMIIGA – A comprehensive Approach to Mitigate the Impact of Groundwater contamination in urban Areas
GRETA – Near Surge Geothermal Energy for Alpine Tourist Regions
GEOPLASMA-CE – Shallow geo-thermal energy usage-development of tools for as-sessment and quality in regi-onal and urban areas
MineService – Mining/Mineral Support Services
InnoLOG – Inovative geophysical logging tools for mineral exploita-tion
RE-ACTIVATE – Developing supe-rior tecnical infrastructure throughout EIT RawMaterials community to foster tehnologies and methodologies for re-activation of former mine sites
U-Geohaz – Geohazard impact assessment for urban areas
PanAfGeo – Geoscientific knowledge and skills in African Geological Surveys
EMODnet – Operation, devel-opment and maintenance of a European Marine Observation and Data Network
PROJECTS STARTED IN 2018
MINLAND – Mineral resources in sustainable land use
HotLime – Mapping and Assess-ment of Geothermal Plays in Deep Carbonate Rocks – Cross-domain implications and Impacts
GeoConnect3d – Cross-border, cross-thematic multiscale framework for combining geolog-ical models and data for resource appraisal and policy support
HOVER – Hydrological processes and geological settings over Europe, controlling dissolved geogenic and anthro-pogenic elements in groundwater of relevance to human health and the status of dependent ecosys-tems
RESOURces – Resources of groundwater, harmonised at Cross-Border and Pan-European Scale
HIKE – Hazard and Impact Knowledge for Europe
Mintell4EU – Mineral Intelligence for Europe
EuroLithos – GeoERA European Ornamental Stone Project
MUSE – Managing Urban Shallow geothermal Energy

INTERNATIONAL PROJECTS

PROJECTS STARTED IN 2018
FRAME – Forecasting and As-sessing Europe's Strategic Raw Materials needs
GIP-P – GeoERA Information Platform
SIMONA – Sediment-quality Information, Monitoring and Assessment System to support transnational coopera-tion for joint Danube Basin water management
RC Adria – Regional Center Adria
RESEERVE – Mineral potential of the ESEE region
AWARD – A Series of RM Docu-mentaries followed by interactive Workshops
RM@SCHOOLS 3.0 – Raw Matters Ambassadors at Schools 3.0
RIS-RECOVER – Regional innovation scheme for zero waste extraction of critical raw materials
InvestRM – Multifactor model for investments in the raw material sector
raPHOsafe – Classification and Sorting of Radium-rich Phosphogypsum Tailings
IncluESEE – Inclusion of the ESEE region and Ukraine in innovative exploration developments
Permian-Triassic climatic and environmental extremes and biotic response
Continental Crises of the Jurassic
Heritage Stone Designation
Characterisation and sustainable exploitation of geothermal resources
The Critical Zone and the Karst Systems

8 RAISING AWARENESS OF THE IMPORTANCE OF GEOSCIENCE

GeoZS has taken on the important task of informing and raising public awareness about the role of the geological profession in everyday life and its importance for forming a society based on the principles of sustainability and a responsible attitude towards the natural environment. A major target group, in which GeoZS researchers want to foster interest for geology, are children attending primary or secondary school. In 2018, GeoZS employees participated in professional discussions and consultations, published articles in popular science journals, and organised various excursions along the paths that depict various geological features. They tried to introduce geology to the broadest possible public with media contributions and participation in broadcasts aimed at the popular presentation of scientific achievements and phenomena.

5TH SLOVENIAN GEOLOGICAL CONGRESS

Spreading awareness of the importance of geological science was one of the key goals of the 5th Slovenian Geological Congress that was held 3-5 October 2018 in Velenje. The central event at the Congress was a round table titled Is Slovenia ready to use geological knowledge in its development? We were presented different views and experiences of geoscience representatives and users of geological data on the role and importance of collecting, interpreting and publicly accessing geological data to contribute to societal development.

To present geosciences to the widest possible public, we organised a series of activities and events: the *Geoscience for Society* photo contest, the same-named exhibition at the Velenje Outdoor Gallery, and the *Geology Day* with geological workshops for pupils from primary and secondary schools.

5.000.000.000 _ 5.0
5. SLOVENSKI GEOLOŠKI KONGRES
Do 5 milijard let z družbo 5.0
Velenje, 3.–5. 10. 2018

MINFOS – INTERNATIONAL DAYS OF MINERALS, FOSSILS AND ENVIRONMENT

We also participated at MINFOS – The International Days of Minerals, Fossils and Environment MINFOS in Tržič. We organised a professional exhibition and workshop entitled the *Periadriatic Fault System*.

ZNANSTIVAL

At the workshop entitled *Razsekana Slovenia (Chopped Up Slovenia)*, visitors of the Experiment Garden at the Znanstival in Ljubljana used simple tests, models and posters to acquaint themselves with various types of tectonic phenomena.

In these activities, GeoZS cooperated with the Geology Department of the Faculty of Natural Sciences and Engineering (University of Ljubljana), and the Slovenian Geological Society.

INSTALLATION OF THE GEOTHERMAL LEARNING PATH IN CERKNO

We helped install the geothermal learning path in Cerkno. It was designed within the international project GRETA, under the auspices of GeoZS and in cooperation with the Idrija-Cerkno Development Agency. On the learning path, the first of its kind in Slovenia, there are ten points that teach about geothermal energy on the surface and deep within Earth.

GEOLOGICAL TOURS OF LJUBLJANA

Our expert-guided tour on use of natural stone in cultural monuments is intended for all nature lovers, educational institutions, primary and secondary school pupils, students of natural sciences and the humanities, tourist guides, and tourists. In 2018, tours were carried out for members of the Natural Science Society of Slovenia, for students of the Third Age University, during the European Researchers' Night, for a report on Radio Prvi, and for the Delo newspaper.

ATTENDANCE AT THE VODAQUA FAIR

At the Ljubljana Exhibition and Convention Centre, we presented our geophysical well-logging team and the equipment used for geophysical measurements and video surveys of wells.

GEOLOGICAL ATLAS OF SLOVENIA

Due to great interest, we published the 2nd revised and updated edition of the *Geological Atlas of Slovenia*, and we continuously upgrade and update the web portal eGeologija. Our aim is to improve the accessibility of geological data.

GEOLOGICAL WORKSHOPS

In 2018, we continued organising geological workshops for pupils. We held presentations at the Youth and Mountains competition in Trzin, which was organised by the Alpine Association of Slovenia, at the Family Hiking Camp, held at the Mountaineering Training Centre Bavšica, and at the Borovnica Primary School.

9 BUSINESS PERFORMANCE

FINANCIAL RESULT IN 2018

Compared with the 2018 financial plan, GeoZS exceeded the planned revenue by 10% and planned expenses by 7%. The planned surplus for 2018 amounted to EUR 27,773, while there was a surplus of revenue over expenses in the amount of EUR 175,974. Total revenue was 17% higher than in 2017.

TOTAL REVENUE	5,233,190
REVENUE FROM THE SLOVENIAN RESEARCH AGENCY	**2,366,650**
OTHER BUDGET FUNDS	**856,185**
REVENUE – DOMESTIC MARKET	**765,974**
REVENUE – FOREIGN MARKET	**34,528**
REVENUE – BUDGET USERS	**133,790**
REVENUE FROM LETTING	**17,610**
REVENUE – EU PROJECTS	**1,058,453**

TOTAL EXPENSES	5.063.590
MATERIAL AND SERVICE COSTS	**1,523,973**
LABOUR COSTS	**3,133,566**
AMORTISATION COSTS	**242,317**
OTHER COSTS	**125,394**
FINANCIAL AND OTHER EXPENSES	**38,340**

REVENUE

Total revenue in 2018 amounted to EUR 5,233,190. Most revenue (61.58%) came from budget funds in the amount of EUR 3,222,835; the revenue from EU projects amounted to EUR 1,058,453 (20,23%), and market-generated revenue amounted to EUR 951,902 (18.19%).

EXPENSES

The total expenses for 2018 amounted to EUR 5,063,590. Material and service costs amounted to EUR 1,523,973, representing 30.1% of total expenses. Labour costs amounted to EUR 3,133,566, representing 61.9% of total expenses. Amortisation costs amounted to EUR 242,317. Other costs amounted to EUR 125,394.

COMPARISON OF ACTUAL AND PLANNED BUSINESS PERFORMANCE IN 2018

	Actual performance in 2018	Planned performance in 2018	Actual/planned index
TOTAL REVENUE	5,239,564	**4,774,047**	1.10
Operating revenue	5,233,190	**4,765,497**	1.10
Financial revenue	546	**150**	3.64
Other revenue	5,828	**8,400**	0.69
TOTAL EXPENSES	5,063,590	**4,746,274**	1.07
Material and service costs	1,523,973	**1,539,837**	0.99
Labour costs	3,133,566	**2,919,199**	1.07
Amortisation	242,317	**234,153**	1.03
Other costs	125,394	**51,350**	2.44
Financial expenses	4,289	**525**	8.17
Other expenses	7,068	**1,210**	5.84
Revaluated operating expenses	26,983	**0**	-
Revenue/expense surplus	175,974	**27,773**	6.34

COMPARISON OF KEY FINANCIAL PERFORMANCE INDICATORS IN 2017 AND 2018

INDICATOR	2017	2018
Surplus of revenue over expenses	**61,437**	**175,974**
Funds from the Slovenian Research Agency	**2,137,498**	**2,366,650**
Revenue from international projects	**709,131**	**1,058,453**
Surplus of revenue over expenses – market activity	**61,044**	**162,271**

Establishing the European Geological Surveys Research Area to deliver a Geological Service for Europe (GeoERA)

By understanding underground processes and knowing what consequences interventions in nature will have, we can reduce the negative effects on the environment and indirectly on health, and improve safe raw-material supply and the quality of our lives. This can only be based on harmonised and comprehensive information as well as extensive knowledge and understanding of the subsurface. To face this challenge, 48 national and regional geological institutes from 33 European countries combined their strengths within the GeoERA programme – the European Geological Surveys Research Area to deliver a Geological Service for Europe. The long-term ambition of the programme is to establish a common European geological service.

At the end of 2017, the GeoERA Secretariat published a joint call for co-financing transnational research projects, and 15 projects were selected and started on 1 July 1 2018. The GeoZS is participating in ten projects, and as a member of the Secretariat, we also monitor all projects. The projects address the challenges of groundwater, mineral resources and energy sources, emphasising cross-border coordination of data, information and expertise, and the improvement of existing methodologies and techniques. GeoERA's achievements will be aimed at supporting policy decision-making for sustainable use and integrated management of underground resources, and will be publicly available via the European Geological Data Infrastructure (EGDI).

http://geoera.eu/

and

http://www.geo-zs.si/index.php/en/projects2

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