

## Posing a question to ChatGPT

Sourcing the European energy transition from domestic resources – vision of wishful thinking?

By Wolfgang Reimer (GKZ Freiberg)

Sourcing the European energy transition from domestic resources – vision of wishful thinking?

This question was the focus of the two-day conference initiated by GREENPEG and organised in cooperation with the European Technology Platform on Sustainable Mineral Resources (ETP SMR) and SVEMIN, the Swedish Association of Mines, Mineral and Metal Producers. Hosted in history-rich Uppsala, Sweden, at the time of Sweden's EU Presidency, the conference was fully booked with over 120 participants from 21 countries. This was the time of the publication of the draft of the Critical Raw Materials Act (CRMA) of the European Commission. Thus, after the key note by Maria Nyberg, Policy Officer at DG GROW, the discussion of the participants mainly revolved around the question of how realistic the targets set therein are. In particular, concerns were raised about achieving the "benchmarks", concrete financing elements were demanded from the Commission to stimulate mining, and the promises for a faster approval process seemed very ambitious and

not in line with practical experience. Above all, they would still clash too much with environmental legislation. As an example of no differentiated relief, it was pointed out that in the future all mining projects would be subject to an EIA. In the opinion of more than a few participants, the European Commission's industrial policy is increasingly showing dirigiste tendencies. Furthermore, in the context of expensive energy and supply risks, it does not look good for the supply of raw materials for the energy turnaround. And the Inflation Reduction Act beckons from America.

This led to the topic around the "Relocation of Supply Chains", presented by Melanie Müller, German Institute for International and Security Affairs, a German think tank. She sees the need for more investment in the upstream and downstream sectors, also in the supplier countries. The supply chain bottlenecks lie in the processing and refining of quite a few SRMs and CRMs. Added to this is the collapse of European smelter capacities in the wake of high

Cover picture:  
Screen shot of Chat GPT's answer to the question "How competitive is the EU in terms of new mining" dated March 2023.

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energy prices. This is even more dramatic because metallurgy is one of the key enablers for the circular economy. Ms Müller, an experienced Africa expert, appealed to the participants not to lose sight of the continent and other important partner countries of the EU in the context of securing raw materials. Again, securing raw materials is only a pawn in the increasing formation of a multilateral world order, in which the non-aligned states would assign themselves less and less to one of the two (China- and US-led) sides. In this context, she lamented a lack of the international and world-wide dimension at the CRMA. The missionary character of the EC's increasingly value-driven raw materials policy was not well received in the states being courted and was often understood as a neo-colonial attitude. The participants confirmed, especially in the Africa session of the conference, that China had also lost a great deal of trust in the same way. The resulting vacuum must be quickly exploited by Europe. Daisy Jennings-Grey, Senior Analyst at Benchmark Mineral Intelligence, presented a realistic picture about the lithium supply chain in Europe from the global view.

She stated that in Europe there are only 2 out of 20 highly probable lithium mines in the pipeline and just one close to operation. Furthermore, the lithium issue becomes a chemical issue as there will be a substantial increase of battery plants in Europe. The question is "who takes the price risk along the value chain". Policy is an important driver in building supply chains, also now that once more recycled lithium will enter the market. Furthermore, she stated that very soon we will face an impact of new battery metals (such as sodium) on lithium mining. Hence, it is for sure that every battery technology will finally have its own phase and involves collaboration in feed stock supply.

During the discussion a participant from BOLIDEN noticed that on the one hand smelters play a big part in the raw materials value but there has been little attention paid. The CRMA demand for an increase of the exploration activities at member state level misses a clear work plan on how this should be implemented and Bob Schäfer, UNITED LITHIUM, posed the question, whether resource nationalism is a danger and whether we are willing to invest in these countries with their legitimate interest. The benchmarks of the CRMA have been intensively criticised, especially how to achieve the 2030 goals with 2 years of permitting time. And Anders Sand from BOLIDEN added that his company faced up to 10 years of permitting time only for brownfield exploration. Mining is not held in the same regard in every region. Sand was also concerned about that in some regions there is very little commitment even at policy level. This was regarded as a major bottleneck also in terms of the implementation of a CRMA. Voices from the affected were to listen through a film SVEMIN produced after interviewing their members. There were two major concerns which still define the bottlenecks in the acceleration of domestic sourcing: the adaptation of the European



Upper Photo: Maria Nyberg, Policy Officer at DG GROW, presenting the key note. Below: Maria Sunér, CEO of SVEMIN moderating the introduction. Katarina Nilsson (President ETP SMR) and Wolfgang Reimer, Vice-President ETP SMR and GREENPEG Exploitation Manager. Photos: GKZ

Water Directive and adopting new financial measures. In the EU, a lot of know-how has been lost over the years with the decline of the raw materials industry, which first needs to be researched again and then, above all, put to use in Europe. The presentations of the second block "research & innovation on critical metals exploration in EU" introduced this, in which GREENPEG coordinator Axel Müller, University of Oslo, also presented the GREENPEG project with initial results. The block "experiences in critical raw materials exploration in the EU by private entrepreneurs" benefited from contributions from European exploration companies, as well as the Canadian company UNITED LITHIUM. The latter is exploring a recently discovered pegmatite-bound lithium occurrence nearby Bergby Lake and was received with great interest among the participants. Moderated by the Geopool Oy company owner, Mathias Forss, it became clear in this block that the Scandinavian countries in particular hold great raw material potential for Europe's economy, but that exploration also requires great efforts to meet the requirements

and accommodate those affected. Therein lies the great value of the more environmentally friendly and cost-defensive exploration methods being developed by GREENPEG. But efforts are also needed to export this "Made-in-Europe" know-how to the large emerging pegmatite exploration areas – as well as in Africa.



The presentation by Rainer Ellmies, Managing Director of GECKO EXPLORATION (PTY), a Namibian exploration company, made it clear that this certainly has potential and could also be the subject of potential raw



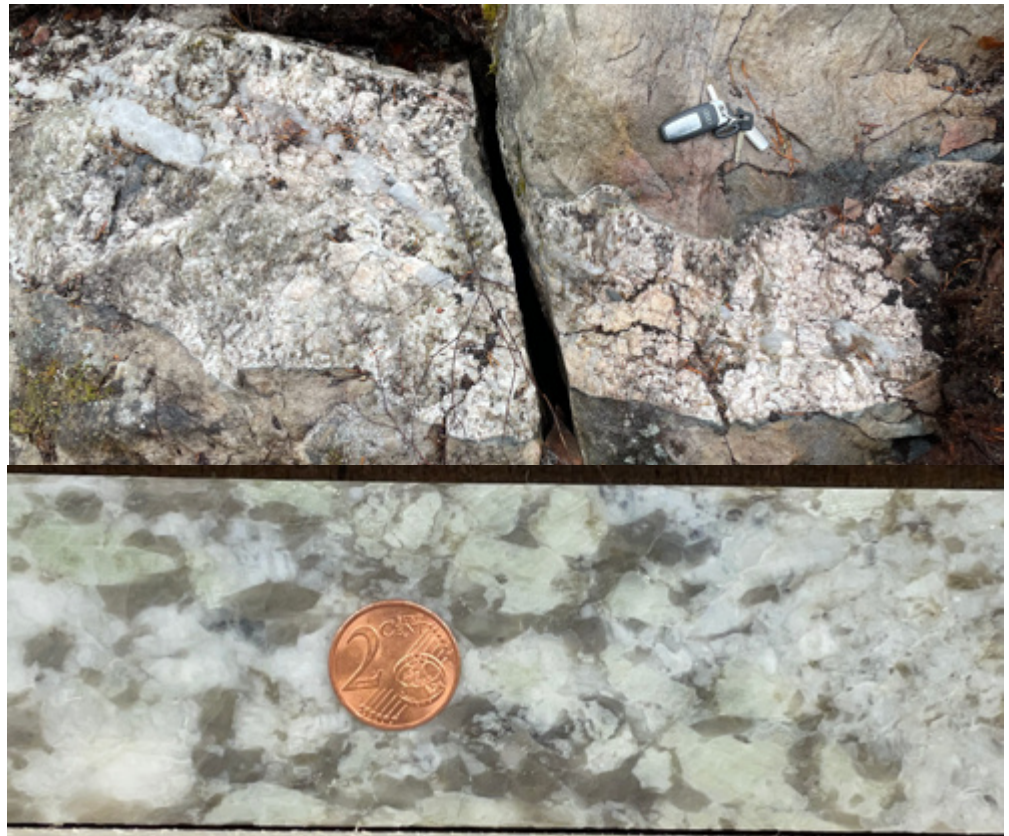
material partnerships with the EU. According to his overview, projects at all development levels are available. This of course raises the question why there is so little involvement of European companies in Namibia. The presentation by Klaus Brauch, CEO TERRATEC, raised security issues. Unstable framework conditions, insecurity and corruption are unfortunately still a major problem for overseas investments in large parts of Africa. Nevertheless, an analysis of the potential of hard rock lithium in Africa by the British Geological Survey, presented by Kathrin Goodenough made it clear that an engagement in Africa can pay off for both sides. In her presentation, however, she also emphasised that quite a few of the projects in Africa are rapidly moving towards production. However under the background of China's influence, with more or less strong political interventions. Zimbabwe, for example, as she stated, is de facto ruled by China in terms of raw materials.

The most obvious change over the past years has been noticed by an increasing buy in of Chinese companies. Africa and South America are the main regions of Chinese investment and bilateral collaboration with its governments. As is particularly evident in Africa, the expansion of transport routes to develop the deposits and ship the concentrates is becoming increasingly important. But the EU is also active here on the ground and is trying to counter China's Belt and Road Initiative (BRI): The EU has unveiled its €300 billion alternative to the BRI — an investment program the bloc claims will create "links, not dependencies." The aim of the EU program — called Global Gateway — is to help underpin the global recovery by mobilising investments in digital, clean energy and transport networks as well as boosting health, education and research systems across the world. The European Commission calls it a "true alternative" to China's global infra-structure program, which has been accused of

saddling some countries with huge debts since its inception in 2013. Global Gateway thus stands for itself and less as a "deal" to obtain the continent's raw materials. In the discussion, Melanie Müller found that European engagement in mining investments would have to be much more comprehensive in order to keep up with the Chinese. GREENPEG will use its findings as an opportunity to hold a workshop on this topic in Windhoek, Namibia, on 14 May 2024. Contact: [contact@greenpeg.eu](mailto:contact@greenpeg.eu). Back to the Critical Raw Materials Act and the task formulated therein for the member states to make significantly more efforts in raw materials exploration. The EU member states geo-

logical surveys are seen as key drivers in widening exploration as considered by the proposal of the CRMA. After all, Europe still has sufficient potential for SRM and CRM. Good prerequisites for this are given, as the presentations by Julie Hollis, Secretary General, Euro-GeoSurveys and Martiya Sadeghi, Swedish Geological Survey showed. Julie Hollis, provided a historic review about the organisations development and considered the following demands as a need for action:

the depth of application of the GREENPEG toolset discussed. All guests contributing substantially to this workshop are welcome and should send their expression of interest for presentations to [GREENPEG\\_contact@greenpeg.eu](mailto:GREENPEG_contact@greenpeg.eu)  
**Resume:** In the end, the statement of ChatGPT could be partially put into perspective. Nevertheless, the results of the conference as well as the functioning of ChatGPT show that the skepticism is justified. The need to increase the innovative strength of the European economy and the investment climate, especially through R&D, is evident. However, the framework conditions for this should be business-friendly.



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- Better collaboration with industry
- Private results of exploration to feed European databases
- Strengthening overseas exploration as part of Europe's sourcing strategy

In addition, there is also the cooperation of the surveys with potential raw material partners in overseas. This raises hopes for an exciting workshop that GREENPEG will hold in Vienna in early 2024. On the one hand, the economic potential of European LCT-NYF pegmatites, including those of Ukraine, will be demonstrated and

## Field trip to United Lithium Ltd.

More than 60 participants joined the guided field trip to UNITED LITHIUM Ltd. Bergby Lake asset, near to the world famous Woxna graphite mine, the new NORTHVOLT lithium battery gigafactory, and close to major mining and transportation infrastructure, workforce and equipment. With secured eight exploration licenses that cover a total of 10,828 ha, it is one of the bigger recent discoveries in Europe. The property is prospective for near-surface lithium mineralisation observed in surface boulders and outcrops, positioning the property for cost effective extraction potential. The field trip introduced into the mineralisation and setting including latest results of the exploration works on petalite and spodumene lithium mineralisations rich in tantalum. A special acknowledgement to UNITED LITHIUM who sponsored this field trip and provided extensive information via a comprehensive printed field guide and guidance.

Photos: Top right: Pale pinkish Spodumene crystals embedded in a quartz-feldspar matrix. Outcrop of Bergby Lake pegmatite field of UNITED LITHIUM. Below: Polished drill core section showing greenish Spodumene assemblages. Left: Exposed lithium bearing boulders in the exploration area.

All photos: GKZ

# GREENPEG EU Summer School unites European students in the Arctic

A theoretical and practical introduction into advanced non-destructive exploration techniques



*By Axel Müller (UIO) and Kate Smith (UNEXE)*

From 19 to 30 July 2023 the GREENPEG consortium organised the Student Summer School in Tysfjord in northern Norway, for 12 students from 8 nations. The school aimed to give Masters- and PhD-level students strong practical insight into exploration for pegmatites, one of the most popular exploration targets in Europe now and in years to come. The school equipped the students with the necessary skills to explore for critical and strategic raw materials to secure their future supply. The lectures were held by GREENPEG partners at the scenic Tranøy lighthouse and practical exercises were carried out in the Drag pegmatite mining district, an active mining area where pegmatite minerals have been mined for over 100 years. The exercises led by experienced geologists and geophysicists from the Geological Survey of Norway, IFU GmbH Germany and universities of Dublin, Exeter, Bilbao and Oslo gave a strong practical insight into exploration techniques for lithium-caesium-tantalum (LCT) and niobium-yttrium-fluorite (NYF) pegmatites. The methods and topics introduced and practiced included geochemical mapping, ground-based geophysical exploration me-

thods (electrical resistivity tomography, ground-penetrating radar and radiometry), drone-borne hyperspectral data acquisition, satellite data interpretation, critical raw materials policy and circular economy. The course taught the latest advances in exploration technology that meet the highest social and technical standards. Alongside exploration techniques, the GREENPEG team taught the students about skills for responsible exploration to minimise negative environmental and social impacts. In addition to potential direct environmental impacts on landscape and biodiversity, mineral exploration campaigns vary considerably in their use of energy and materials, and consequently in their global warming potential (GWP), pollution and other environmental and social impacts. Students were introduced to available schemes and approaches for responsible exploration and considered how to apply them. The environmental impact of applied exploration techniques can be quantified by life cycle assessment (LCA). Using LCA in the exploration and development stages of mining ('forecast LCA') can help to significantly reduce the environmental impacts of the mining phase by identifying which processes can or

should be modified. Analysing the role and decision-making approaches of exploration geologists, geophysicists and companies in building community relationships and participation was interesting, looking at exploration from the point of view of different stakeholders. One major conclusion of the discussion was that having good communication between exploration companies and the public, from the earliest possible stage, is essential for a smooth and responsible exploration campaign. During the Summer School, GREENPEG organised an Open Day at the Árran Lule Sami Centre in Drag at 23 July. The local community was invited to learn more about the GREENPEG project and to better learn each other. Geophysical instruments were demonstrated including a heavy-duty drone with a hyperspectral camera. Sven-Roald Nystø, a former president of the Sámi Parliament of Norway, guided the students through the center's exhibition and gave an impressive introduction into the Sami culture and today's challenges of maintaining traditions and societal integration. The response of the students to the summer school was extremely positive and more than fulfilled the student's and partner's expectations.

# YOUNG GREENS deal with mining. Notes from the 3<sup>rd</sup> GREENPEG Focus Group Meeting

By Wolfgang Reimer (GKZ Freiberg)

Focus Group Meetings are an essential tool in GREENPEG project to familiarise stakeholders with the research and socio-economic environment as well as with the test sites. This includes also measures of raising raw material awareness of local people living in these test sites and affected by mining, including politi-

Conditions. This coincided with the publication of the European Commission's draft Critical Raw Materials Act (CRMA). The discussion thus also focused on issues relating to the competitiveness of Europe as a business location and its socio-economic framework conditions. Of particular interest was the point of view of the Saxon and Carinthian EU - parliamentarians as well as those at the state level, since in both regions the development of a lithium mine is advanced and comparable challenges are faced.

Unfortunately, the addressed EU parliamentarians and chairmen of the political parties in Saxony, if they responded at all to our personal invitation, did not show any concrete interest in the topic. Also our recommendation to send at least the parliamentary advisers or to send a representative remained unanswered or were negative. Against the background

bal framework conditions and the still unresolved energy crisis and increasing regulation in Europe as the location show that the effect of a CRMA will be severely limited if it is not possible to optimize the socio-economic location factors. This was aptly demonstrated by the example of the ECM project on the Koralpe, especially with regard to the financing of mining projects in the EU. On the other hand, the discourse with the YOUNG GREENS also showed how important it is to differentiate between political groups and not to "put them in a box".

Even if there were no reservations about the project on the Koralpe, the Focus Group Meeting was an example of how the demand of young people for more participation and transparency in the changes in their environment can lead to more knowledge and acceptance with the help of a fact-based exchange. This is particularly important when it comes to multiplying what has been learned. This also applies to the other side: the mine developers and mine operators. Both must learn to accept legitimate concerns and objections. And it is beneficial for both sides when pragmatism is used to try to find solutions. In the end the organizers looked back on three satisfying Focus Group Meetings: The intensive work of GREENPEG with young people from the European countries of origin of the GREENPEG partners (see also the GREENPEG Newsletter October 2022 issue) has made an important contribution to this and has shown the HORIZON program new formats of dissemination.

Photo left: Group photo underground. For most of the YOUNG GREENS it was the first time entering a deep mine site and to get in touch with the raw materials feeding the energy transition. Photo: ECM



cians: Raw material projects are very often viewed critically by local politicians, since mining and its impact on the environment have little impact on the electorate. Many players in the economy complain that high energy costs, overregulation, bureaucracy and an unsatisfactory supply and security of skilled workers and little financial support are eroding the economic stability and strength of the raw materials sector in the EU27. In downstream operations the waves of bankruptcies were increasing even before Russia invaded Ukraine and are increasingly weighing on the commodities sector and basic industries. Value chains are being relocated. In this last meeting of the three Focus Group Meetings, which had science journalists and students as their target group, politicians at regional level were therefore now in demand. The lithium exploration mine on the Koralpe in Austrian Carinthia of our project partner ECM was once again the venue. The aim was to communicate the opportunities and risks of developing a lithium mine in Europe from the operator's point of view and to enter into a discourse with the politicians on the above-mentioned framework

of the importance of the topic in parliamentary work, this made us think.

The Focus Group Meeting therefore focused on young politicians and here representatives of the youth organization of the Green Party from Styria and Carinthia, the so-called YOUNG GREENS. A party which (in the past) was rather critical of mining, but which is increasingly opening up to the topic in view of the important European transformation processes and their securing of raw materials required for this as well as its geopolitical challenges. The YOUNG GREENS did not need a big speech; they were immediately interested and looked forward to the discussion and the tour of a mine. For quite a few, it was the first time they had visited a mine. What's more, a group that tends to be said to swim in its own bubble showed itself to be extremely interested in the topic and constructive in the discussion. The participants from the YOUNG GREENS from Styria and Carinthia were also convinced by the course of the program and the principle of mutual listening and articulating within the framework of an open discourse. There was a consent that the glo-



Photo: CEO EUROPEAN LITHIUM Ltd., Dietrich Wanke, in conversation with a reporter of the regional press who accompanied the meeting with the YOUNG GREENS. Photo: GKZ



Satellites and screens feed on soil adjusted landscapes.

## Art meets science – Insights of a collaboration of GREENPEG researchers with media artist Stephen

By Stephen Cornford

Some partners of the GREENPEG Project Consortium gave support to the media artist Dr Stephen Cornford <https://stephencornford.net/> and spent quite some time with him in the field in Tysfjord, Wolfsberg and in Leinster (project demonstration sites) assisting him with questions and guiding him in the field sites. Having visited all three locations, Stephen documented a wide range of the exploration tools and devices used in GREENPEG, recorded some typical scenes of people doing geophysical work and took videos from stills and made sound records such as the internal clicking and beeping of some of the devices. The result of Stephen's work is a video artwork called Spectral Index that explores the geological or mineral conditions of its own production. The production of digital images requires many minerals, and the prospecting for those minerals requires many digital images.

The video explores this reciprocal relationship between image and mineral, focusing specifically on the technics of colour: comparing the RGB systems used in consumer digital media with the spectral indices used in geophysical imaging. The video collages together various different, predominantly vertical, viewpoints including: timelapses made from Sentinel 2 data, microscope images of image sensors from consumer

cameras, scientific data from GREENPEG, camera footage made in Stephens studio using lights, prisms and mirrors, archive earth observation images from NASA Skylab. Data used from GREENPEG includes RGB and multispectral (RGN, NGB) images from drone surveys and GPR data.

The drone images are combined into video timelapses and/or used as mosaics so that the video frame moves within a single high-resolution image. The GPR data may be shown as 2D profiles and/or a 3D model. For the 3D model, Stephen worked with IFU to make a 'fictional' landmass from the GPR data, by jumbling the profiles incorrectly, so that the model used in the video is not a true representation of any location. This will demonstrate the principles of geophysical mineral prospecting without infringing proprietary rights. The video has been so far commissioned by [Avantwhatever.com](http://Avantwhatever.com) a festival and digital residency program run from Melbourne. Avant whatever premiered a new series of audiovisual commissions of digital sound, art, and design, presenting the works from the artists, amongst them Stephen Cornford (Bristol), on Friday May 26 in the RMIT Black Box space in Naarm.

The artists plans to subsequently produce this video work for an online special edition of Media & Environment, more academic context. In addition, Stephen is

very much hoping to show the work at an in-person exhibition off the back of those two events. Besides, the video will be submitted to open calls at European film / media art festivals including: Oberhausen Short Film Festival, Lausanne, Underground Film Festival, European Media Art Festival, Transmediale. See web site under: <https://www.greenpeg.eu/media-corner.html>

More information about Stephen Cornford this work and previous works can be found at the artist's blog: <https://www.stephencornford.net/SpectralIndex.html>

See the video which is now online available for streaming in our video corner of GREENPEG web site under: <https://www.greenpeg.eu/media-corner.html>

### Artist Biography

Stephen Cornford is a media artist who works with consumer electronics, critiquing the ideologies they embody and the constitutive role they have come to play in our lives. His current research is concerned with the toxicity of digital media, the complex metallurgy of ubiquitous technologies and relationships between planetary and photographic space. Much of his recent work has been made in collaboration with scientific researchers. He has worked alongside commercial geophysicists prospecting for technology metals in Europe and volcanologists studying magma crystallisation with X-rays. His practice often employs laboratory processes or scientific imaging, using geological furnaces to transform electronic waste or optoelectronics facilities to damage cameras. In 2018 he completed a PhD affiliated to the Archaeologies of Media & Technology Research Group at Winchester School of Art.

Stephen has had solo exhibitions in Tokyo, Berlin, Brighton, Bergen, Ljubljana & London and his work has been included in group exhibitions at the ZKM Center for Art & Media, Karlsruhe; ICC, Tokyo; Haus der Elektronische Kunst, Basel; Sigma Foundation, Venice; Finnish Museum of Photography and Coventry Biennial.

Artists web site: <https://stephencornford.net/>

# Going Africa – verification of the GREENPEG Toolset in Northern Mozambique

By Axel Müller (UIO) & Violeta Buzula (GKZ)

**Mining in Mozambique** has been known for over 1000 years, mainly through the trade in gold between Mozambicans and the Arabs and Persians. The first pegmatite deposits in the province of Zambézia in the north of the country were discovered by Portuguese immigrants at the end of the 19th century. Since then, these pegmatites have been the source of various gemstones such as tourmaline (rubellite, elbaite, schorl) and beryl (morganite, aquamarine), as well as coltan ores (columbite-tantalite). The interest in gemstones in Europe resulted in small-scale but continuous mining in the province from 1926 to 1974. Since 1974, largely sporadic and uncontrolled mining has been carried out by illegal miners from home and abroad. The new boom in Mozambican gemstone mining began in 2001 when farmers discovered precious blue Paraíba tourmalines in placer deposits in the Shalawa area of Nampula province. The success story continued in 2008, with the discovery of one of the world's largest ruby deposits at Montepuez in Cabo Delgado Province in northern Mozambique. Currently, the mining sector in the country is in a phase of restructuring and reactivation, which is seen as a new beginning. With the increase of mining activities in Mozambique, the central government in Maputo has dedicated itself to the development of services and delegations in order to better respond to the needs of companies operating in the country's mining sector. In this context of the development of the mining sector, the government of Mozambique has made efforts to improve and increase the number of qualified young people in the different mining areas so that they can respond to the demand and provide the different service. The topic of occupational health and safety and the upgrading of mining administration has been and continues to be the subject of a long-term international cooperation, including a strong cooperation with the Free State of Saxony, Germany.

## In search of lithium

In the context of the energy transition, the mining of lithium minerals for lithium battery production has become the focus of attention. The demand for these minerals has reached Mozambique. A not insignificant number of companies as well as illegal or legal small-scale mining have joined the race of mining the lithium minerals spodumene and lepidolite. As part of the collaboration between the Mozambican Ministry of



Mines and Energy and GREENPEG partners GKZ and UIO, several pegmatite occurrences in Zambézia Province were visited and assessed during a joint field visit in August 2023 as part of the verification of geochemical exploration methods of the GREENPEG toolset for the pegmatite exploration in tropical environments. The field data and geochemical analysis will be performed and evaluated in the frame of a student master project by Violeta Buzula at the Technical University of Freiberg in Saxony, Germany.

Participants of the field visit were regional geologist Silvio Ribeiro, from INAMI (National Institute of Mining), Azarias Macuacua, chemist from INAMI Gonçalves Manhique, Violeta Buzula from GKZ and Professor Axel Müller from the University of Oslo. In the Alto

Ligonha area, there are a large number of pegmatite bodies of the lithium-cesium-tantalum type, up to 500 metres in size. Some of these pegmatites are rich in the lithium minerals lepidolite and spodumene, which are specifically enriched in the core of these pegmatites. Lepidolite and spodumene have so far been treated as overburden. Because of the current huge demand for lithium, these minerals are now separated and stockpiled by miners during active gemstone mining. Besides lithium minerals, coltan and gemstones, these deposits also have the potential for mining industrial minerals such as kaolin and quartz.

## Artesanal mining activity

The mining of pegmatites still takes place mainly in small-scale mining. This is often legal, i.e. groups of miners who form associations or cooperatives recognised by the government. Even if their activity is legal, the harsh and unsafe working conditions to which these mostly very young people are exposed lead to accidents and health problems. The often unstructured mining also leads to environmental damage, especially water pollution. In some discussions with the miners, it was noted that many have no school education and see mining as the only possible source of income because they know of no other prospects. The lack of knowledge leads to miners

Upper photo: View at the Napepeso artesanal mine with insufficient health and security provisions. Middle: Working group (vltr: Azarias Macuacua, Gonçalves Manhique, Chibale, Silvio Ribeiro, Violeta Buzula and Axel Müller). Down: Miners of the Napepeso miners cooperative.

Photos: UIO, GKZ

being underpaid and occasional profits are not invested sustainably to improve working and living conditions. Only an association of miners in cooperatives has proven to be more financially responsible. With their profits, they have started the construction of a primary school in the village of Nanro.

## Industrial Mining

Discussions with local miners revealed that due to the high socio-economic importance of small-scale mining, it is extremely important for the establishment

of larger mining companies to inform and involve the local population in the various activities of the establishment. Furthermore, agricultural land and areas that are considered sacred by the population must be respected. A major challenge for mining companies is the poorly developed infrastructure. Most of the pegmatite deposits are often more than 50 km away from the nearest asphalt road and can only be reached via narrow, makeshift mud roads that are hardly passable in the rainy season.

Mozambique is a developing country with mineral deposits of different types and sizes, the modern exploration of which is still in its infancy. However, it must not be forgotten that around these deposits lives a population that struggles daily for a minimum of living conditions and deserves the respect and attention of all who are interested in the raw materials there.



Photos: Left: Spodumene in the core zone of the Nanro pegmatite. Right: Panning of tantalite ores aside Natchepo pegmatite in Alto Ligonha. Photos: UIO, GKZ

## GREENPEG on tour

### Save the date!

GREENPEG at 14<sup>th</sup> Fennoscandian Exploration and Mining conference (FEM), 31 October – 2 November 2023 in Levi, Lapland, Finland  
<https://femconference.fi/fem-2021-2/>

GREENPEG at Mineral Exploration and Mining Convention (PDAC), 3 – 6 March 2024 in Toronto, Canada  
<https://www.pdac.ca/convention>

GREENPEG Exploration Workshop and site visits on pegmatite mining, 14 – 16 May 2024 in Windhoek, Namibia  
<https://www.greenpeg.eu/news.html>

## GREENPEG at a glance

Many of the raw materials for green energy production can be sourced from lithium-caesium-tantalum (LCT) and niobium-yttrium-fluorine (NYF) pegmatites. Being relatively common in Europe, pegmatite deposits have the size and grade to especially attract small mining operations. GREENPEG aims at reducing exploration costs and impact on environment by developing two innovative and competitive toolsets, including: three new instrumental techniques and devices (piezoelectric sensor, helicopter-complementary nose stinger magnetometer, drone-borne hyperspectral imaging system), two new datasets and work flows for prospect scale (<50 km<sup>2</sup>) and district scale (50–500 km<sup>2</sup>) exploration. Validation will be ensured from industry-led trials at locations in Norway, Austria, Ireland, Finland, Portugal and Spain testing different surface environments, morphology and geological settings. With the development of exploration technologies tailored to pegmatite ore, GREENPEG closes a technology gap, counteracts the lack of specific exploration strategies and increases the competitiveness of users. Furthermore, GREENPEG will feed the EU raw materials data base in support of responsible and secure sourcing and attracting investments.

Web site: [www.greenpeg.eu](http://www.greenpeg.eu) Contact: Prof. Dr. Axel Bernd Müller, UIO: [a.b.muller@nhm.uio.no](mailto:a.b.muller@nhm.uio.no)



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