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Exploration “Made in Europe” – the EU GREENPEG project 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, a unique ore body being relatively common in Europe. The 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 workflows for prospect scale (<50 km²) and district scale (50-500 km²) exploration.

Validation will be ensured from industry-led trials at locations in Norway, Finland, Austria, Portugal, Ireland, and Spain testing different landscape, vegetation and climate environments, and geological settings.



Drone borne geophysics at Tysfjord test site, Northern Norway

Methodology and impact

Exploration for buried pegmatites, both concealed by overburden and situated at depth, presents a major challenge to exploration. They are geophysical non-responders, almost non-magnetic and may not cause a sufficient density contrast to allow for a clear differentiation from the host rock. Airborne radiometric data have proven potential to discover buried pegmatites despite their small penetration depth. However, non-appropriate acquisition like too large flight line distances (>50 m) are commonly applied and prevented successful detection.

Existing wall rock litho-geochemistry and soil and stream-sediment geochemistry have only led to a few surface discoveries and globally have had low exploration success because they have not been integrated with geophysical survey data. Even more, there is a rather poor understanding of petrophysical and chemical-mineralogical properties, including the complex textural, mineralogical and chemical variability of pegmatites and their halos, all in all leading to an allegedly not profitable cost-benefit ratio. Consequently, only an integrated approach can provide exploration success. The GREENPEG choice of geophysical and geochemical methods is based on a well-designed strategy depending on the specific characteristics of the pegmatite ores:

- 1) Low contrast of petrophysical properties compared with their wall rocks;
- 2) High mineralogical variability in different pegmatite types;
- 3) Relatively small ore body volumes (0.01 to 5 million m³) and lateral extent;
- 4) The occurrence of pegmatites in clusters (fields);
- 5) The existence of Li, B, F, Cs, Be, Ta and Sn halos (10 to 100 m scale) around pegmatite bodies.

The toolsets will combine a well-designed, vast array of technologies, including satellite image processing and airborne-borne and ground-based geophysics and geochemical approaches tested in three representative European sites:

Pegmatite field	Pegmatite type	Wall rock	Size of field	Nr. of known pegmatite bodies	Economic commodities	Resources (Mt)	Vegetation/ Topography
Wolfsberg Austria	LCT	Amphibolite mica schist	25 km ²	14	Li, Fs, HPS, (Ta, Cs)	Indicated: 6.3 at 1.17% Li ₂ O	Alpine forest/ mountainous
South Leinster Ireland	LCT	Meta-sediment/ granite	70 km ²	18	Li, Fs, HPS, (Ta, Cs)	Inferred: 0.6 at 1.5% Li ₂ O	Grassland and forest/ hilly
Tysfjord Norway	NYF	Granite	20 km ²	22	HPS, Fs, (Be, REE)	Indicated: 0.4 at 100% HPS, 0.2 at 100% Fs	Open forest and fields/ mountainous

Achievements & Results

The toolsets will include two new instrumental demos (piezoelectric sensor, helicopter-complementary nose stinger magnetometer) and two new datasets (petrophysical properties of ores, hyperspectral properties of ores). The tools will effectively identify buried (up to 350 m depth), small (0.01-5 million m³) and clustered pegmatite ore bodies. The development of the integrated toolsets is based on new genetic model valid for the majority of European pegmatite-type ore deposits, published recently by the GREENPEG partners, and on a new multi-level (province-, district- and prospect scale) approach combining several technological innovations to come forward with integrated solutions.

GREENPEG toolsets will minimise exploration time, costs and environmental impact and expedite deposit development without any big investments.

Our offer to you

Familiarise with GREENPEG achievements at Conferences, or in the demonstration sites as part of our Focus Group Meetings and Excursions held in 2021, 2022, and 2023 in Austria, Ireland and Norway.

E-Mail: contact@greenpeg.eu