Conference on
Exploration and Exploitation
of Critical Raw Materials

Re-investigation of historical drill cores - Indications for CRMs in Estonian crystalline basement

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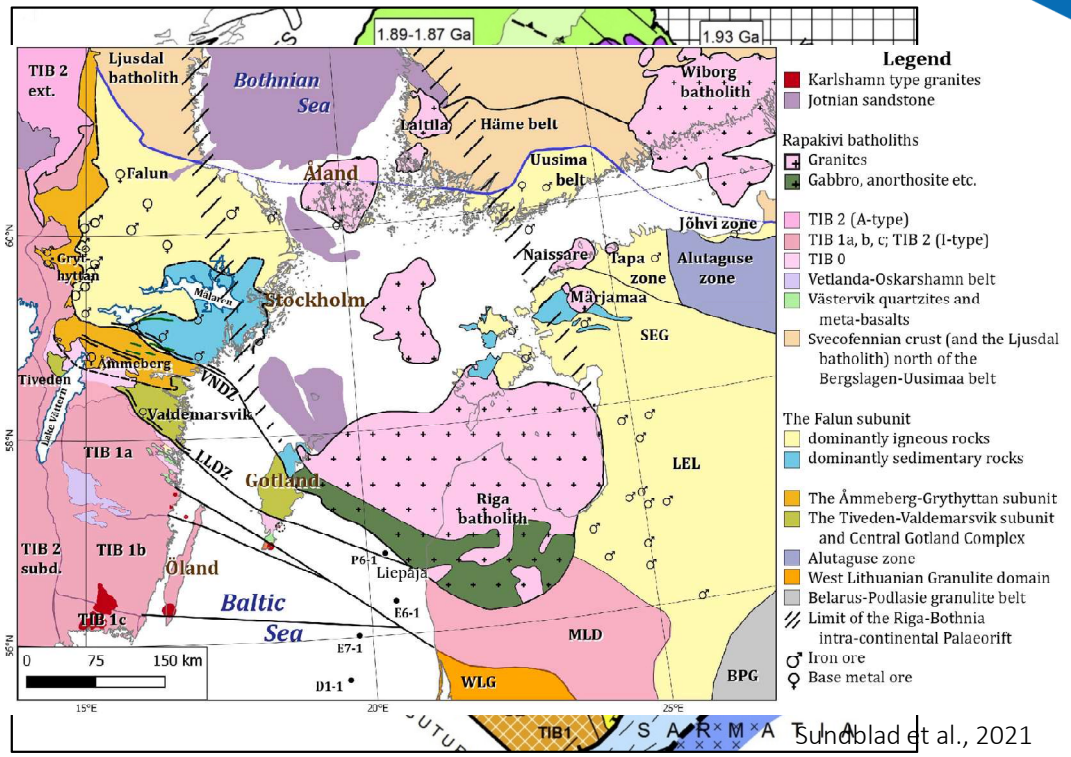
EGT-TWINN

Funded by
the European Union

Background

Crystalline basement:

- Part of the Fennoscandian shield



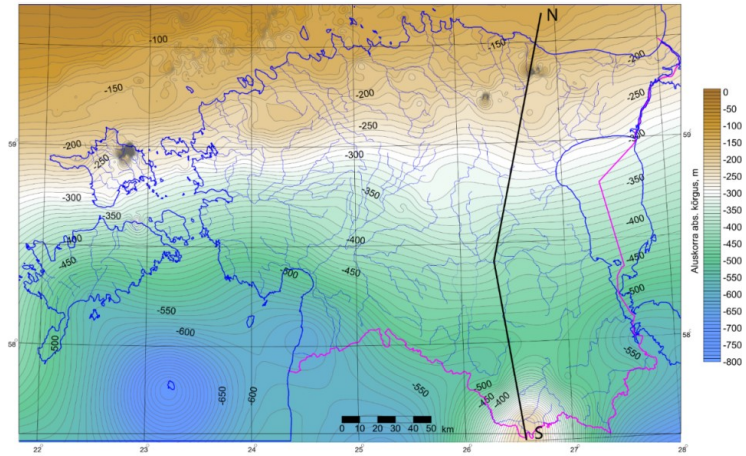
Sundblad et al., 2021

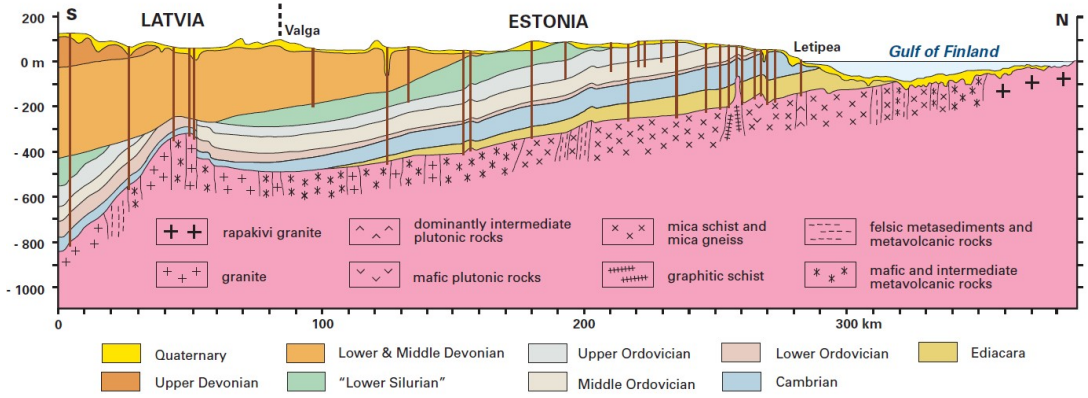
Bogdanova et al. 2015

Background

Crystalline basement:

- Part of the Fennoscandian shield
- Investigated since 1930s – preserved data and rock material





Puura & Vaher 1997

Background

Crystalline basement:

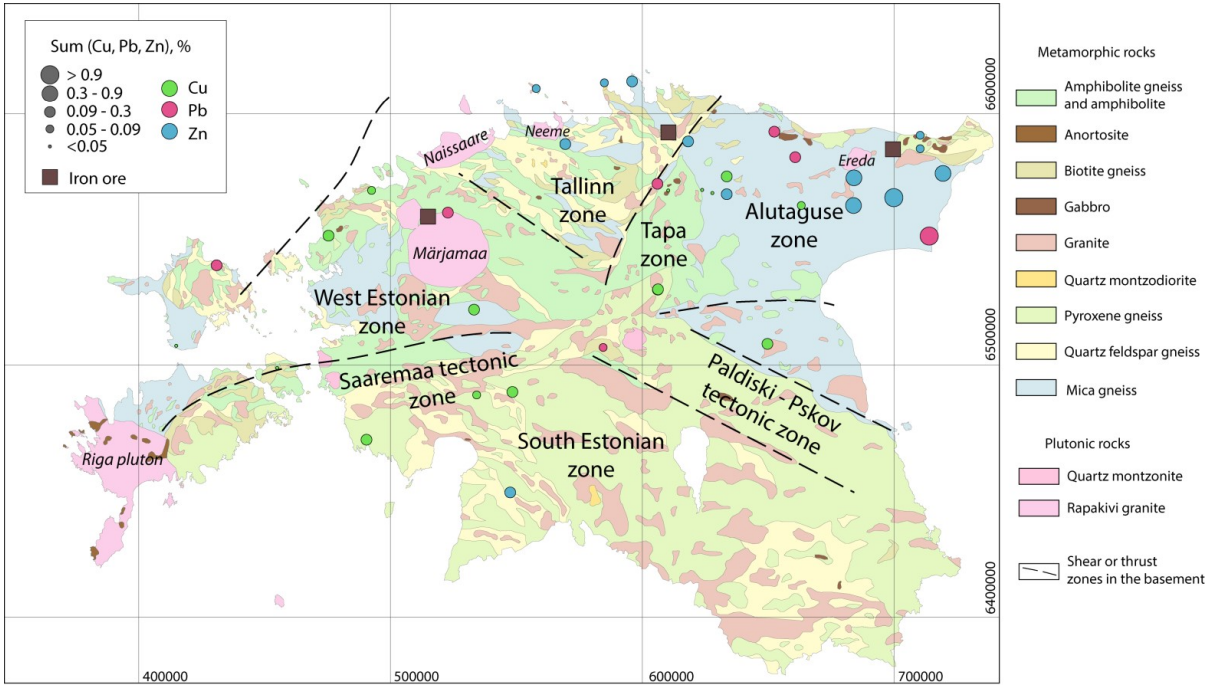
- Part of the Fennoscandian shield
- Investigated since 1930s – preserved data and rock material

Legacy drill core boxes stored in the National core storage, Arbavere, Estonia

Background

Crystalline basement:

- Part of the Fennoscandian shield
- Investigated since 1930s – preserved data and rock material
- No economic deposits inferred... yet



Roadmap for exploring crystalline basement of Estonia

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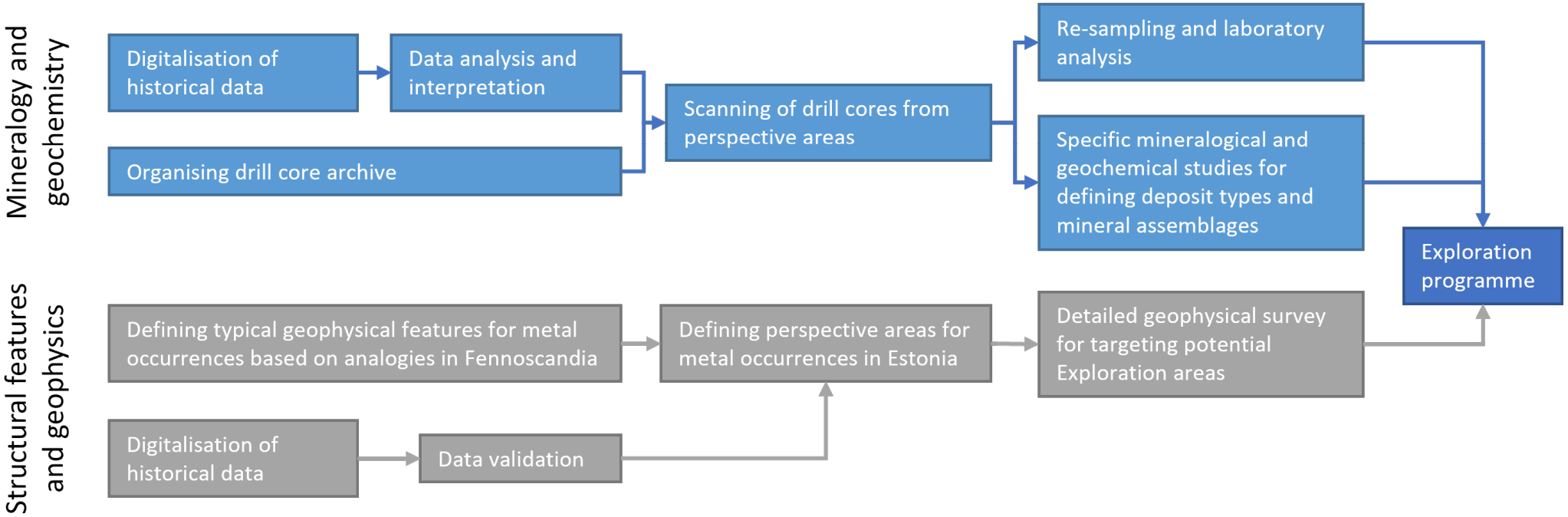

https://egt.ee/en/fields-activity-and-objectives/resources-earths-crust/prospecting

Roadmap for exploring crystalline basement of Estonia

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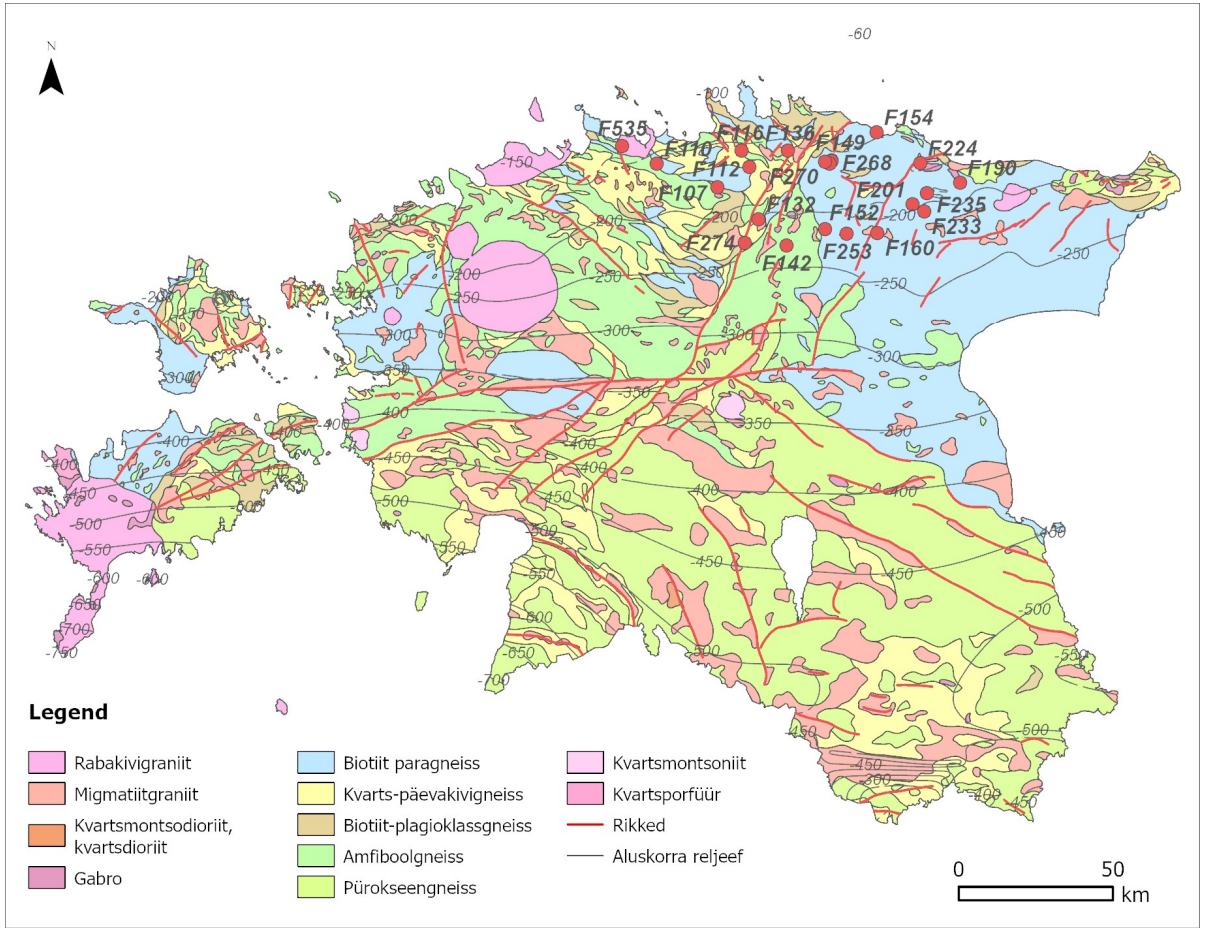
Commodity	Resource potential	Potential area
Bismuth	Potential co-product in Cu-Co-Au deposits	Tallinn-, Tapa- and Jõhvi zones
Cobalt	Potential co-product for Ni	North Estonia, West Estonia and Alutaguse zone
Indium	Co-product in Zn-mineralisation	North- and West Estonia
Lithium	Li-pegmatites	North- and West Estonia
Rare Earth Elements	Pegmatites	North Estonia (Tallinn- and Jõhvi zones), West Estonian granite pegmatites and anorthosite-rapakivi intrusions)
Tantalum and Niobium	Pegmatites	North Estonian granite pegmatites
Tungsten	Skarns	North-Estonia
Copper and Nickel	Sulphide mineralisation	North Estonia, West Estonia and Alutaguse zone
Silver and gold	Co-product in Cu-Ni+Zn-Pb deposits	Tallinn-, Tapa- and Jõhvi zones

Re-investigation of drill cores

- Geotek XRF, elements from Mg-U
- ASD LabSpec spectrometer (400-2600 nm)
- Magnetic susceptibility sensor
- Hi-res Line-scan camera

Re-investigation of drill cores



- Main rock types:
  - Aluminium rich gneisses (graphite bearing)
  - Amphibolite and biotite gneisses
  - Pyroxene gneisses
  - Pyroxenites and marbles
  - Mafic and ultramafic rocks
  - Granitic intrusions

Re-investigation of drill cores

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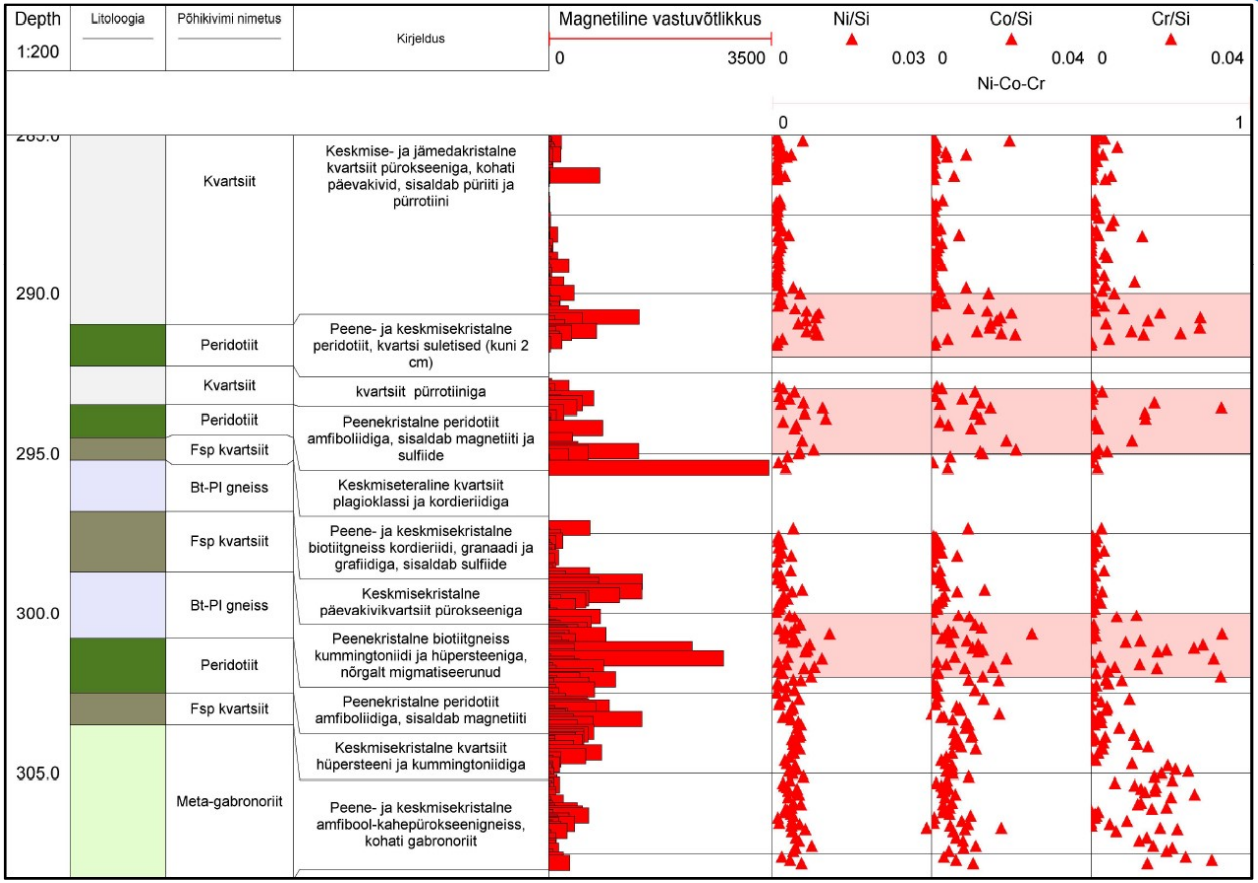
- Studied element associations
  - Ni-Co-Cr
  - Mo-W-Bi
  - Sn-Zn-Cd (In)
  - Cu-Ni (PGM)
  - Nb-Y-P (REE)
  - K-Sn-Rb-Ga (Li)
  - As-Sb-Bi-W-Se-Sn (Au-Ag)

Drillhole	Name	Scanned metres	Measurements	Measurements per m	Photos
F107	Pillapalu	61.7	349	5.66	45
F110	Jägala	170.82	1140	6.67	151
F112	Suru	86.82	576	6.63	65
F116	Kemba	336.6	2982	8.86	363
F132	Lehtsesoo	65.25	547	8.38	73
F136	Sakusaare	73.16	491	6.71	59
F142	Karkuse	94.14	817	8.68	95
F149	Vanamõisa	82.19	777	9.45	78
F152	Lasila	123.78	656	5.3	75
F154	Toolse	92.59	545	5.89	48
F160	Kirikuküla	85.495	528	6.18	62
F190	Erra	75.43	570	7.56	65
F201	Miila	197.74	1228	6.21	152
F224	Viru-Nigula	82.76	540	6.52	70
F233	Uhtna	158.32	1461	9.23	163
F235	Uljaste	246.88	2227	9.02	305
F253	Kadila	64.3	266	4.14	37
F268	Vanamõisa	186.7	1515	8.11	184
F269	Vanamõisa	153.99	1310	8.51	165
F270	Vanamõisa	138.01	947	6.86	139
F274	Kurevere	95.99	472	4.92	69
F535	Maardu	68.32	264	3.86	40
Kokku:		2741	20208	-	2503

Results

- Studied element associations
  - Ni-Co-Cr
  - Mo-W-Bi
  - Sn-Zn-Cd (In)
  - Cu-Ni (PGM)
  - Nb-Y-P (REE)
  - K-Sn-Rb-Ga (Li)
  - As-Sb-Bi-W-Se-Sn (Au-Ag)



Results – example of Ni-Co-Cr

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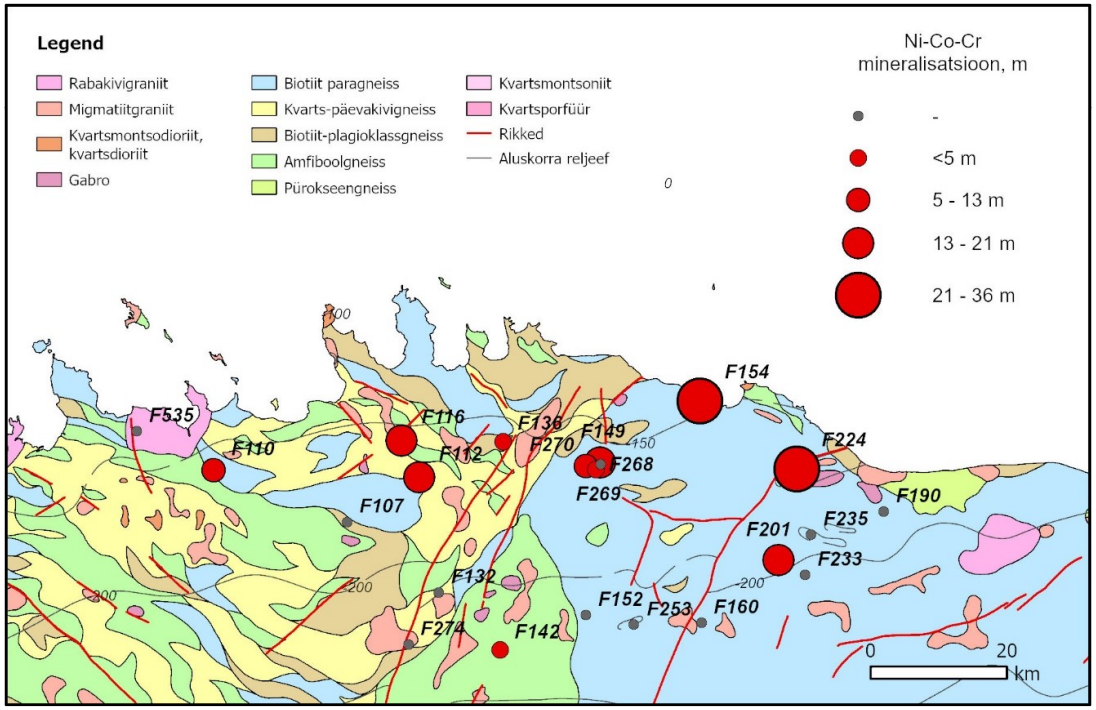
Drill hole	Interval, m	Rock types	Highest Ni concentrations
F142	334–439	Amphibolites, Bt-Amp gneisses with iron sulphides.	900 ppm (375–380 m and 394–400 m)
F149	273–276 290–292 293–295 300–302 325–327 343–345	Peridotites, pyroxenites, meta-gabbronorites	500–1500 ppm
F224	225–261	Weathered gabbros	1500–2400 ppm (230–234 m, 249–251 m and 256–257 m)
F112	258–267 287–290 330–332	Weathered amphibole gneisses	300–1000 ppm
F201	323–329 333–335 410–412 417–427 436–437	Cataclased Al-rich biotite gneisses	1600 ppm (411,3 m)
F110	217–221 233–237	Granitised graphite bearing Bt-Fsp gneisses	2700 ppm (218,34 m) and 1280 ppm (220,48 m)
F116	261–262 309–310 331–332 341–343 468–477 533–536	Bt-Amp gneisses	1250 ppm (342,68 m), 760 ppm (472,5 m) and 600 ppm (534,3 m)
F269	357–362	Amp-Px gneisses	400–700 ppm
F136	258–261	Contact zone of Bt-Fsp and Grt-Amp-Mag gneisses	<650 ppm
F270	289–297 318–320	Amp-Px and Bt-Px gneisses	600 ppm (289-297 m), <500 ppm (318–320 m)
F268	370–374 385–388	Bt-Px and Gf-Bt gneisses	<400 ppm
F154	156–160 176–184 210–215 236–244	Grt-Crd-Bt gneisses	<450 ppm (10 cm zones)



Goals

- Detect perspective CRM occurrences in the crystalline basement (NE Estonia)
- Collect comprehensive data from historical drill cores and make it available to use for applied and academical purposes.

Conclusions

- Historical drill cores appeared to be more heterogeneous than previously described
- Ni-Co-Cr and Cu-Ni associations were found mainly in mafic and ultramafic rocks
- All the other studied element associations occur in different rock types and within different structural blocks

Next steps

- To define perspective areas, drill cores from nearby of successful findings should be investigated
- Results of this study should be validated with more precise geochemical analysis
- Put all the new important drill cores in the scanner

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Thank you!

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