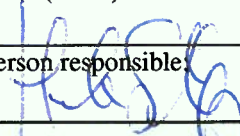


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Report no.: 2013.034		ISSN 0800-3416	Grading: open	
Title: Petrography, mineralogy and whole-rock data of the major lithologies of the Fen Complex				
Authors: Julian Schilling		Client:		
County: Telemark		Commune: Ulefoss		
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<p>Summary:</p> <p>This report documents the petrography of a limited sample set consisting of 12 specimens from the Fen complex, Telemark, South Norway. The samples comprise several, texturally variable calciocarbonatites (søvite), one Fe-rich carbonatite (rauhaugite), two magnetite-rich rødbergites, a silico-carbonate rock ('vipetoite') and a lamprophyre termed damtjernite. Major REE minerals are LREE carbonates and monazite in the søvite and rødbergite and LREE carbonates in the rauhaugite and damtjernite. The LREE are enriched to greater degrees (up to 4000-fold in the rødbergite and an inclusion-rich søvite) and lowest contents for Lu, a HREE, were found in a relatively fine-grained søvite sample, corresponding to a 2-fold enrichment relative to primitive mantle. The sum of all REE is as high as 15950 ppm in the REE-richest sample, a rødbergite, and lowest (715 ppm) in a søvite. The concentrations of Th tend to correlate positively with the sum of the REE and are 1470 ppm in the REE-richest rødbergite and <20 ppm in the søvite. Uranium is as high as 114 ppm in the søvite and 20 ppm or less in the other lithologies. This report and the analyses presented here were produced in the course of the EU-funded EUrare project.</p>				
Keywords: alkaline rocks	REE		Carbonatite	
Fen	Whole rock		Petrography of REE minerals	

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1. INTRODUCTION AND METHODS

The Geological Survey of Norway (NGU) is one of 23 parties contributing to the EUrare project (<http://www.bgs.ac.uk/EuRare/home.html>). EUrare aims at establishing a value creation chain for the rare earth elements (the lanthanides, Y and Sc, in the following abbreviated REE) in the European Union, from a database on the REE deposits and occurrences to the production of tailor-made end products. NGU is involved in elaborating on an online database listing European REE deposits and occurrences, and provides key information on Norwegian REE deposits and occurrences. Most of the required data are compiled from the literature. However, with respect to some occurrences, NGU has active investigations related to the REE potential (e.g. Ihlen et al., *subm.*, Schilling, 2013). Fen is a magmatic complex consisting of both alkaline silicate and carbonatite lithologies. The complex is situated 120 SW of Oslo in the Telemark County in the municipality of Ulefoss west of lake Norsjø. The emplacement of the various lithologies into 1105 Ma old Telemark gneisses took place at 583 ± 15 Ma (^{40}Ar - ^{39}Ar , Meert et al., 1998) and 539 ± 14 Ma (U-Pb, Andersen and Taylor, 1988). Different aspects of the geology of Fen, including alkali-metasomatism of the country rock ('fenitisation'), have been studied in great detail by various authors (e.g. Brøgger, 1921; Sæther, 1957, Bergstøl and Svinndal, 1960; Svinndal, 1961, 1968a, b, 1973; Mitchell and Crocket, 1972; Griffin, 1973; Ramberg, 1973; Støretvedt, 1973; Mitchell and Brunfelt, 1975; Griffin and Taylor, 1975; Andersen, 1984, 1986, 1987a; 1987b, 1988; 1989; Verschure and Majer, 1984, 2005; Kresten and Morogan, 1986; Andersen and Qvale, 1986; Andersen and Sundvoll, 1987; Andersen and Taylor, 1988; Piper, 1988; Andersen and Austrheim, 1991; Dahlgren, 1994). Recently released consultancy reports commissioned by one of the current claim holders can be found at http://www.reeminerals.no/en/ABOUT-US/GEOLOGY_REPORTS/. Different parties own claims in the Fen area and the updated distribution of mining rights is displayed at <http://geo.ngu.no/kart/mineralressurser/?map=Metals:.Metals.and.mineral.rights&lang=English>.

It is the aim of this report to summarise the petrography of a small sample set collected during a one-day field trip to Fen on 12th March 2013, as well as the whole-rock analytical results from the respective samples. Thus, this report presents (i) detailed petrographic observations from optical and electron microscopy on thin sections and (ii) whole-rock compositional analyses with a focus on the REE. Mineral identification was done based on optical properties on a polarisation microscope and the compositional properties were determined through point analyses using energy-dispersive spectroscopy (EDS) operational mode on a LEO 1450 VP SEM, equipped with an Oxford EDS model 7366, with 10 mm² detector area at the Geological Survey of Norway (NGU). During operation the acceleration voltage was 15 kV and point analyses in EDS mode were done in variable pressure mode, which made analyses possible without any coating on the polished thin sections. Whole rock analyses were carried out by ACME labs, Vancouver, Canada, applying the commercially offered programme 4AB2. Samples weighing between 390 and 1100 g were crushed, subsequently milled and major elements were analysed by ICP ES following a lithium borate fusion and dilute acid digestion of a 0.2 g sample pulp. Trace elements were analysed by ICP MS from the same Li borate decomposition pulp.

This report provides key information on the various Fen lithologies in terms of REE mineralogy, documents the REE minerals' textures and presents results of the whole rock analyses of the samples. This information corresponds to the input required for the database to be developed in the course of the EUrare project. Given the limited time frame and the small sample set and the focus on EUrare, no discussion of the results with respect to the petrogenesis of the Fen complex is provided here.

2. PETROGRAPHY AND RESULTS

The following rock units were included in the study:

- Søvite (locally with inclusions)
- Rauhaugite
- Rødbergite
- Vipetoite
- A lamprophyric dike rock ('damtjernite')

2.1 Søvite

Seven samples of the søvite, a calciocarbonatite, were taken and investigated. The predominant minerals in this carbonatite lithology are calcite and dolomite, which occur in variable proportions (Fig. 1). Other common minerals found in the søvite include apatite, pyrite, phlogopite, pyrochlore, one (or more) LREE carbonate(s), monazite, magnetite, galena, anglesite, perovskite, zircon and rare K-feldspar (Fig. 1). Among these, euhedral to subhedral apatite is the volumetrically most important mineral which occurs locally in cumulate textures (Fig 1 d). Apatite, pyrite, pyrochlore, phlogopite and Fe-Ti oxides are interpreted to have crystallised earlier than calcite and dolomite in the crystallisation sequence. Locally, phlogopite is chloritised (Fig. 1 a and b). Grain sizes are variable and phenocrysts of phlogopite, apatite, pyrochlore and Fe-Ti oxides are locally greater than a few mm whereas twinned calcite and dolomite invariably are < 1mm in grain size.

In some places in the Tuffestollen, the søvite is rich in inclusions and spatially related alteration phenomena (Fig. 1 h). However, based on the limited time in the Tuffestollen and the relatively little sample material investigated, it is unclear whether these inclusions are autho- or xenoliths. The modal mineralogy in inclusion-rich (and altered) portions is characterised by relatively high proportions of barite and by the local presence of (secondary) quartz. A typical replacement texture indicates replacement of quartz after barite. Locally, monazite veins cut the dolomite-rich søvite in zones adjacent to inclusion (Fig. 1 c).

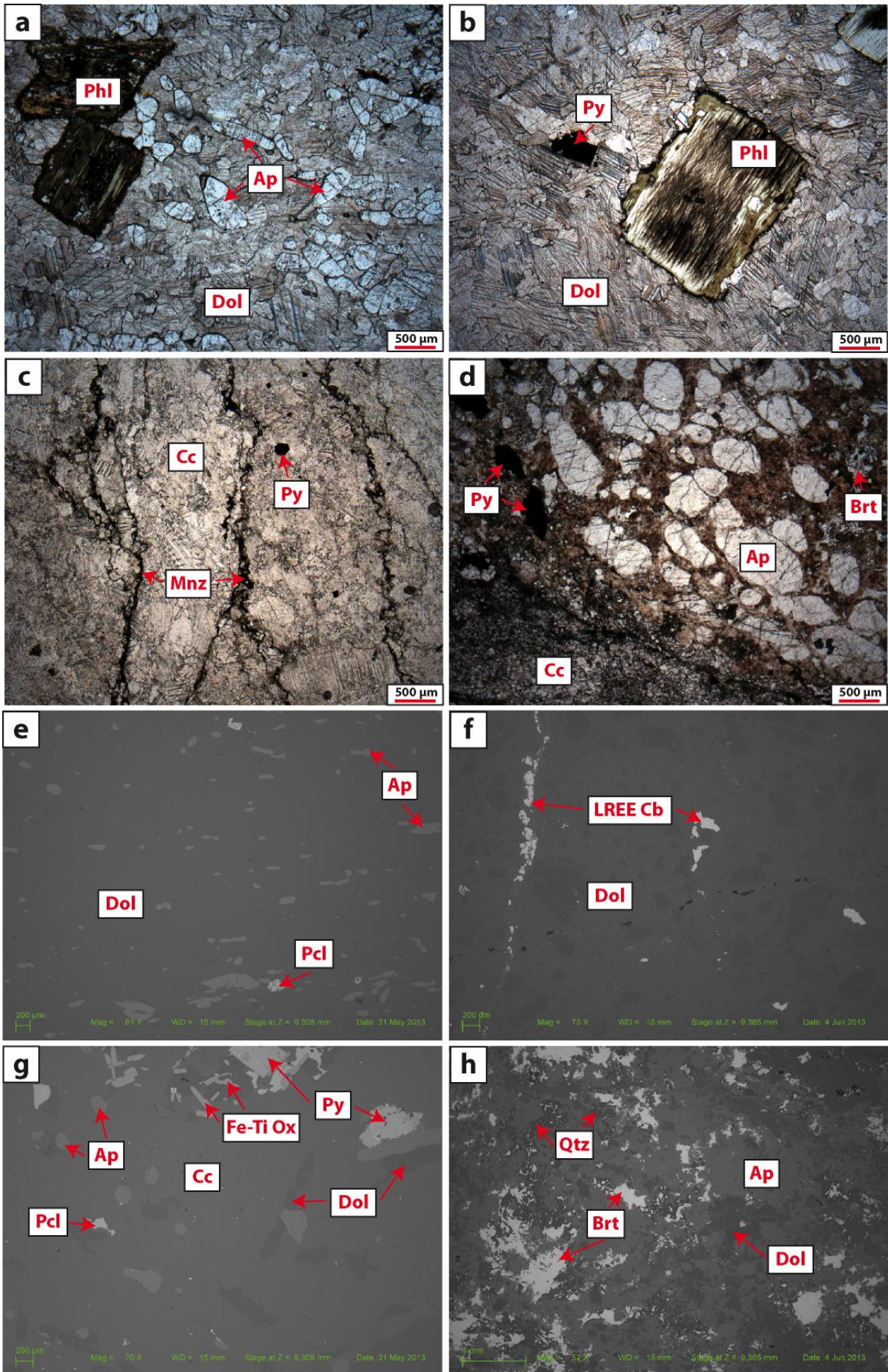


Fig. 1: Microphotographs (a - d) and BSE images (e - h) of søvite from Fen. (a) Apatite and phlogopite phenocrysts found in dolomite; (b) pyrite and phlogopite phenocrysts in dolomite. Note chlorite rim on phlogopite; (c) monazite vein in calcite søvite from sample adjacent to inclusion-rich zone of the søvite; (d) apatite, pyrite, barite and fine-grained mass are associated with calcite; (e) altered pyrochlore and apatite in dolomite-dominated søvite; (f) anhedral LREE carbonates and dolomite; (g) apatite, pyrite and Fe-Ti oxide phenocrysts with anhedral pyrochlore surrounded by minor dolomite and major calcite; (h) inclusion-rich zone of søvite from Tufstollen with dolomite, apatite and barite. Locally, barite is replaced by quartz. Mineral abbreviations are from Whitney and Evans (2010).

Major REE minerals in the søvite are anhedral LREE-carbonates (possibly bastnasite and/or parisite), which are intergrown with dolomite (Fig. 1 f), and monazite, a LREE phosphate, that occurs as anhedral crystals associated with LREE-carbonates, intergrown with dolomite, calcite, pyrochlore and pyrite; monazite was observed to occur as fine-grained masses in veinlets (Fig. 1 c, see above). Apatite and pyrochlore did not yield signals for the REE in ED point analyses but apatites in søvite have previously been reported to contain on the order of 0.5 % total REE (Hornig-Kjarsgaard, 1998).

2.2 Rauhaugite

One sample of the Rauhaugite consists of dolomite (< 100 µm in grain size), pyrite and minor amounts of hematite (Fig. 2 a) and barite (Fig. 2 c). Barite is locally intergrown with an unidentified Ba-Al-Si-O phase (possibly a Ba-Feldspar, Fig. 2 c). REE phases in the Rauhaugite are anhedral LREE carbonates (possibly bastnasite or parisite, Fig. 2 b).

2.3 Rødbergite

Two samples of the dark and dense rødbergite display different textures. One sample is considered to represent high-grade Fe ore whereas the other is of the low-grade Fe type. Massive but porous magnetite is the dominant mineral in the high-grade Fe ore sample (Fig. 3 a and b). Calcite and a LREE carbonate (possibly bastnasite or parisite) fill the pore space in the high-grade Fe ore. The low-grade ore is more diverse in terms of mineralogy and consists of distinct grains of magnetite, schlieren of fine-grained magnetite, a mixture of calcite and a Fe-Mg silicate, pseudomorphs of intimately intergrown calcite-quartz after an unknown precursor, zeolites and chlorite. Monazite and pyrochlore occur as relatively fine-grained minerals disseminated in the rock and tend to be enriched along the contact of the calcite-quartz aggregates to magnetite, calcite and the Fe-Mg silicate (Fig. 3 c). REE minerals include carbonates in the high-Fe ore and phosphates in the low-Fe grade rødbergite.

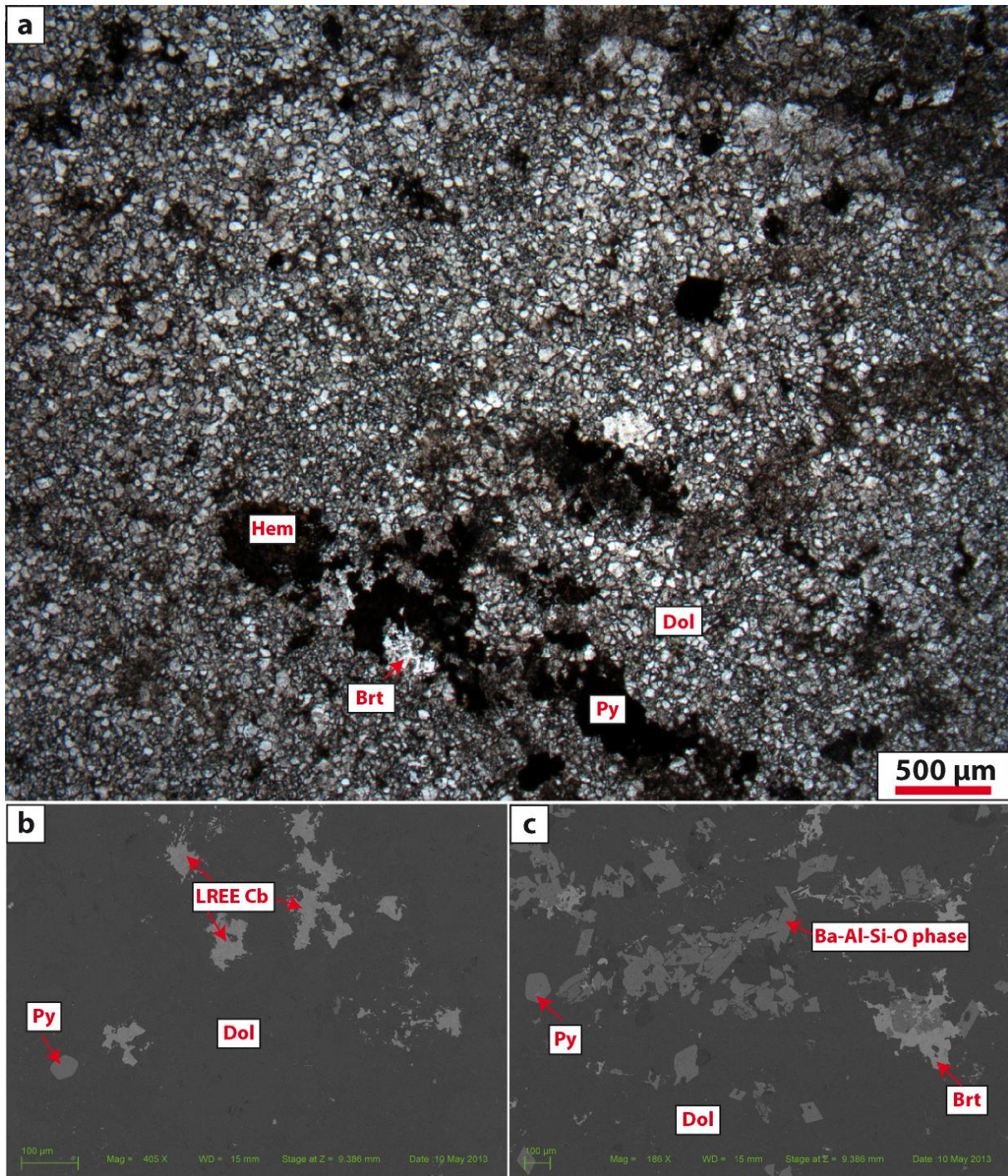


Fig. 2: Photomicrograph (a) and BSE images (b and c) of the rauhaugite. (a) Hematite and barite associated with fine-grained dolomite; (b) euhedral pyrite and anhedral LREE carbonate in dolomite carbonatite; (c) anhedral pyrite and a Ba-Al-Si-O phase in dolomite carbonatite. Locally, the Ba-Al-Si-O phase is rimmed by barite. Mineral abbreviations are from Whitney and Evans (2010).

2.4 Vipetoite

One vipetoite sample investigated (Fig. 4) is strongly altered and carbonised. Fine-grained mineral aggregates form pseudomorphs after Fe-Mg silicates and the former magnetite portion of oxy-exsolved ulvöspinel is replaced by calcite while lamellae of ilmenite still reveal signals for Ti and Fe in qualitative EDS (Fig. 4 a and c). Apatite is most likely a primary mineral and is mostly intact. Calcite forms an interconnecting network through the

rock and surrounds both apatite and the fine-grained Fe-Mg aggregates. Given the fact that no REE minerals were identified in the vipetoite, it is likely that the REE are incorporated into apatite; however, the concentration of REE in apatite is below the detection limit of the ED point analyses.

2.5 Damtjernite

The damtjernite is a variety of a lamprophyre consisting of embayed K-Feldspar phenocrysts in a relatively fine-grained groundmass (Fig. 5). The groundmass is a mixture of Fe-Mg silicates (amphibole and biotite), quartz and calcite. Locally, zircon is found to be associated with the groundmass. REE are incorporated in LREE carbonates (bastnasite or parisite) which are also part of the groundmass.

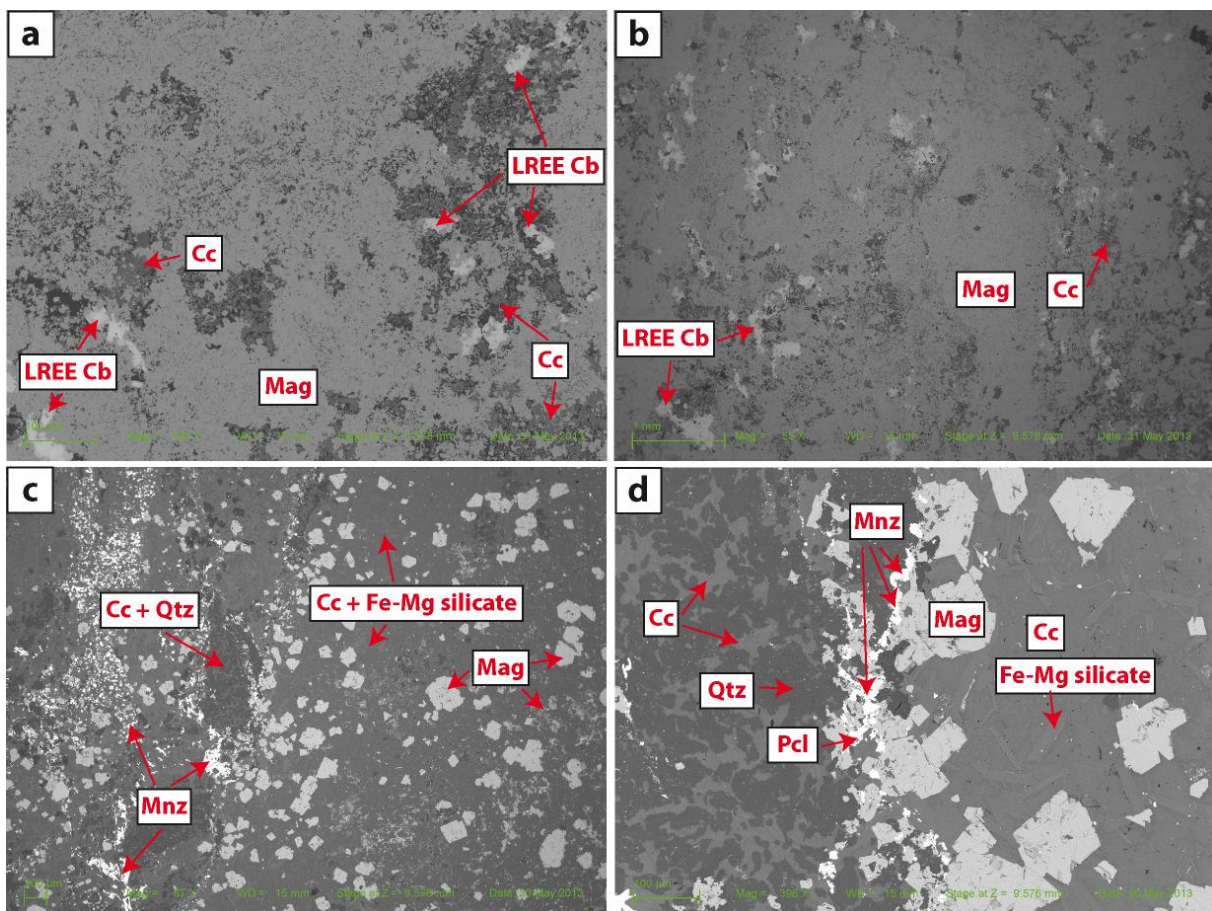


Fig. 3: BSE images of rødbergite high-grade Fe ore (a and b) and low-grade Fe ore (c and d). (a and b) Calcite and LREE carbonates fill open spaces in massive magnetite; (c) pseudomorphs of calcite and quartz after an unknown precursor are associated with magnetite, calcite, a Fe-Mg silicate, monazite and rare pyrochlore; (d) is a close-up of (c) and shows details of the monazite and pyrochlore textures. Mineral abbreviations are from Whitney and Evans (2010).

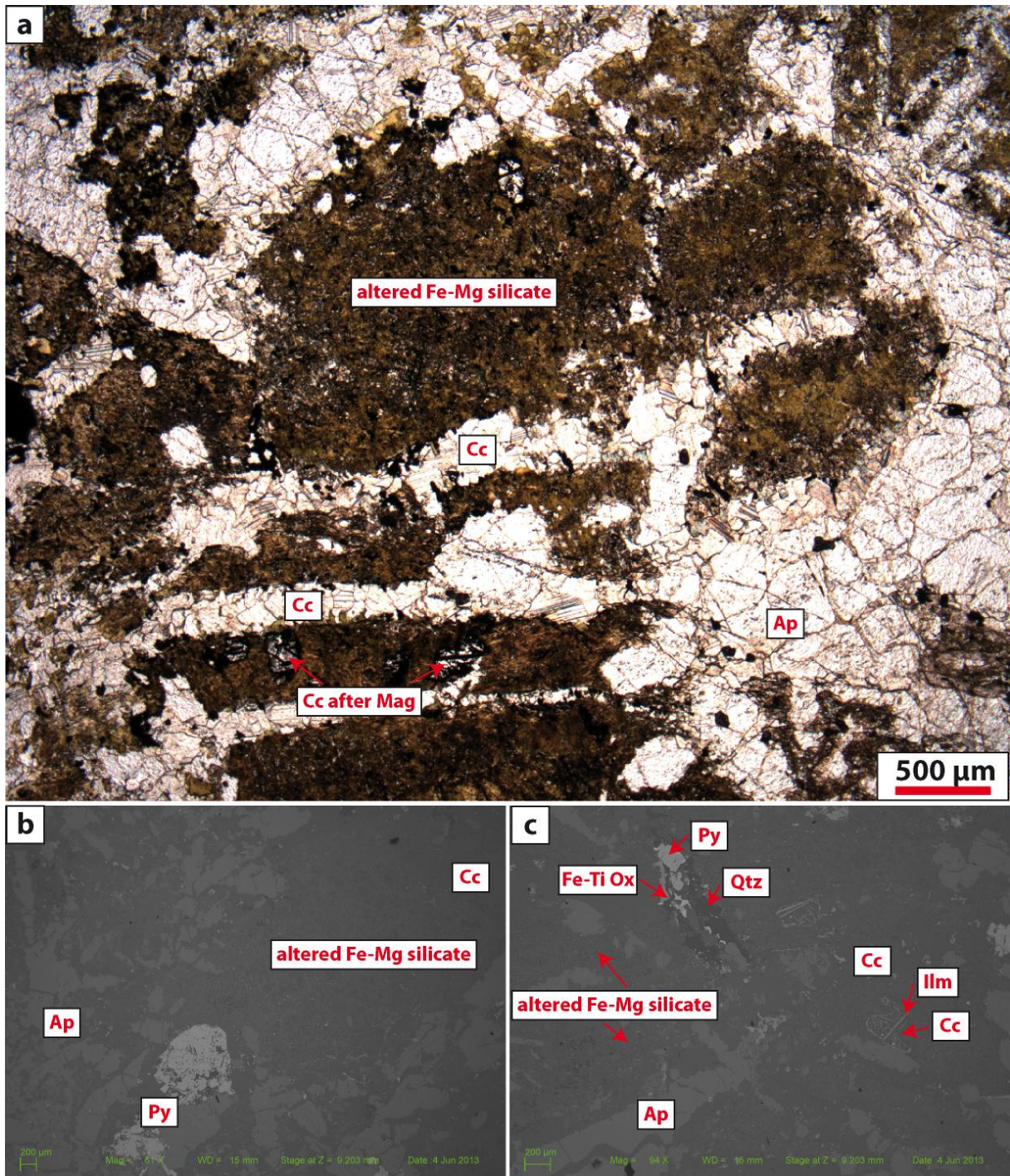


Fig. 4: Photomicrograph (a) and BSE images (b and c) of vipetoite. (a) Fe-Mg silicates are altered to fine-grained masses and calcite replaces precursor magnetite of oxy-exsolved Fe-Ti oxides. Calcite forms a vein-like network in vipetoite; (b) altered Fe-Mg silicate, pyrite and apatite in vipetoite; (c) BSE image showing replacement of magnetite from oxy-exsolved Fe-Ti oxides, altered pyrite associated with quartz, apatite with calcite-veins and altered Fe-Mg silicates. Mineral abbreviations are from Whitney and Evans (2010).

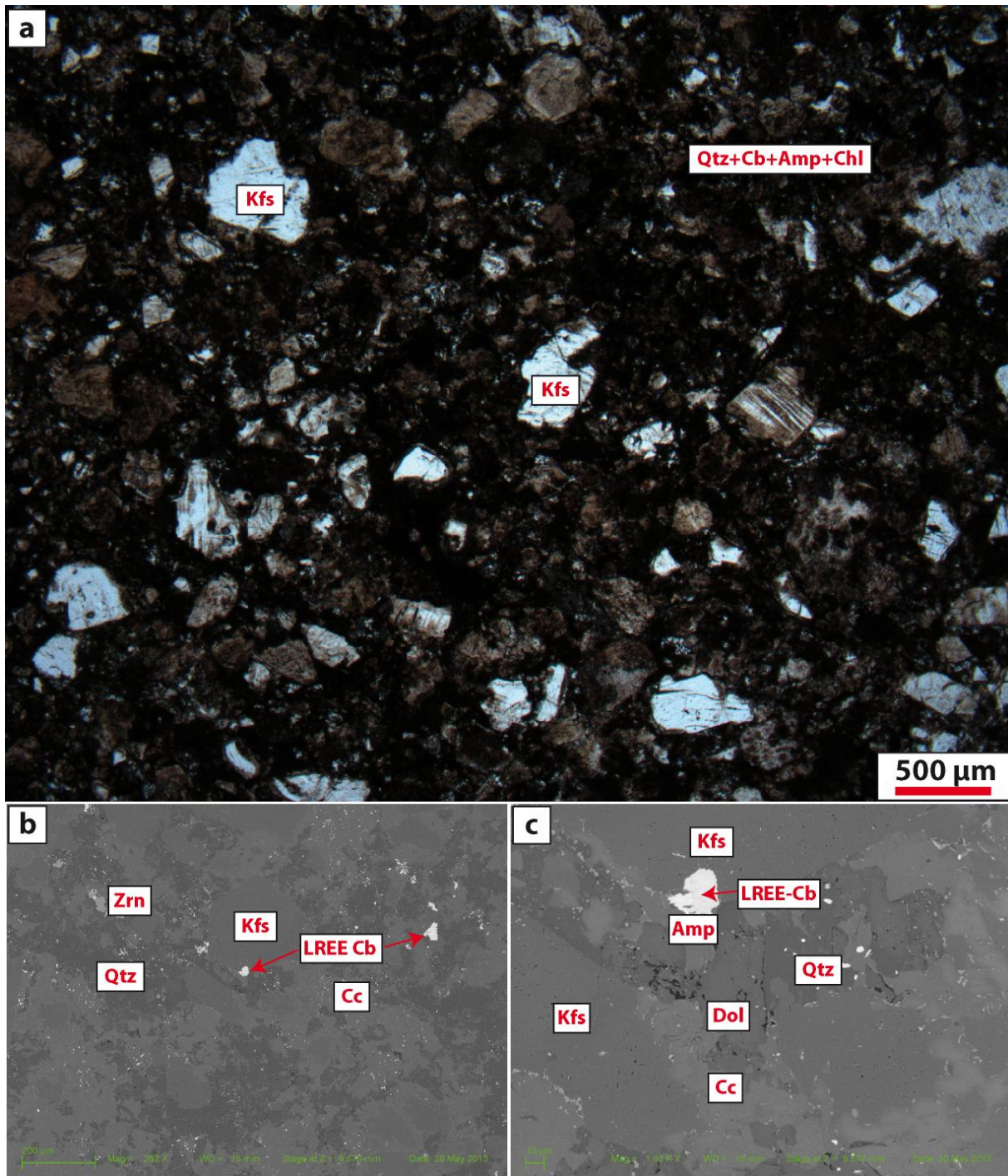


Fig. 5: Photomicrograph (a) and BSE images (b and c) of the damtjernite. (a) Resorbed K-Feldspar phenocrysts show locally exsolution textures and are associated with a fine-grained ground mass; (b and c) LREE carbonates occur in the contact zone of K-Feldspar phenocrysts to and in the ground mass associated with quartz, dolomite, calcite and Fe-Mg silicate(s). Mineral abbreviations are from Whitney and Evans (2010).

2.6 REE IN WHOLE ROCKS

Figure 6 displays the REE contents of the 12 samples investigated. The REE concentrations are normalised to primitive mantle (Palme and O'Neill, 2003) and the LREE are invariably more enriched than the HREE, resulting in steeply dipping patterns for the søvite, inclusion-rich søvite, rauhaugite, vipetoite and damtjernite. The REE distribution of the two rødbergite samples differ slightly from the other samples as relative enrichment for La, Ce, Pr and Nd occur to similar degrees. This results in a more or less flat line in the spider diagram for the lighter elements. However, the rare earths that are heavier than Nd form a steeply dipping pattern for the rødbergite. La is 4000-fold enriched relative to primitive mantle in the søvite breccias and lowest La concentration corresponds to a 200-fold enrichment in a søvite sample. Highest concentrations for Ce, Pr and Nd were found to occur in the rødbergite (see above) and the same rødbergite that is most enriched in LREE is characterised by highest Lu contents (100-fold enrichment relative to primitive mantle). Overall lowest concentrations of Lu were found in a søvite sample and correspond to a 2-fold enrichment relative to primitive mantle. Non-normalised, total concentrations of the REE range between 714 and 1322 ppm in the søvite and 2769 and 10234 ppm in the inclusion-rich søvite. The rauhaugite sample has a total of 6713 ppm REE and the rødbergite sample considered to represent high-grade Fe ore was analysed to contain the overall highest total content of REE (15847 ppm) whereas the low-grade Fe rødbergite sample was analysed to contain 3503 ppm. The damtjernite has a total of 3455 ppm REE, and the vipetoite sample was found to contain 2489 ppm total REE. Distribution patterns for the REE of the rocks analysed in the course of the present study overlap with the results presented by Mitchell and Brunfelt (1975) and Andersen (1986) in terms of REE abundance and distribution.

The radioactive elements Th and U were included in the analyses. In the søvite, Th and U range from 18 to 64 ppm and from 1 to 114 ppm, respectively. The søvite breccia was found to contain between 67 and 107 ppm Th and 6 to 105 ppm U. The rauhaugite yielded 782 ppm Th and 4 ppm U. The highest Th concentrations were found to be associated with the rødbergite. The high-grade Fe ore contains 1471 ppm Th and 3 ppm U whereas the low-grade Fe ore was found to have Th contents as high as 1080 ppm and 23 ppm U. The vipetoite and damtjernite samples contain 77 ppm Th and 6 ppm U and 383 ppm Th and 5 ppm U, respectively. Thus, with the exception of one søvite sample, all samples are characterised by $Th > U$. In the sample set investigated the rødbergite, the rauhaugite and one of the søvite breccias are characterised by both, relatively high total REE and Th concentrations. The raw data are given in the appendix.

2.7 Acknowledgements

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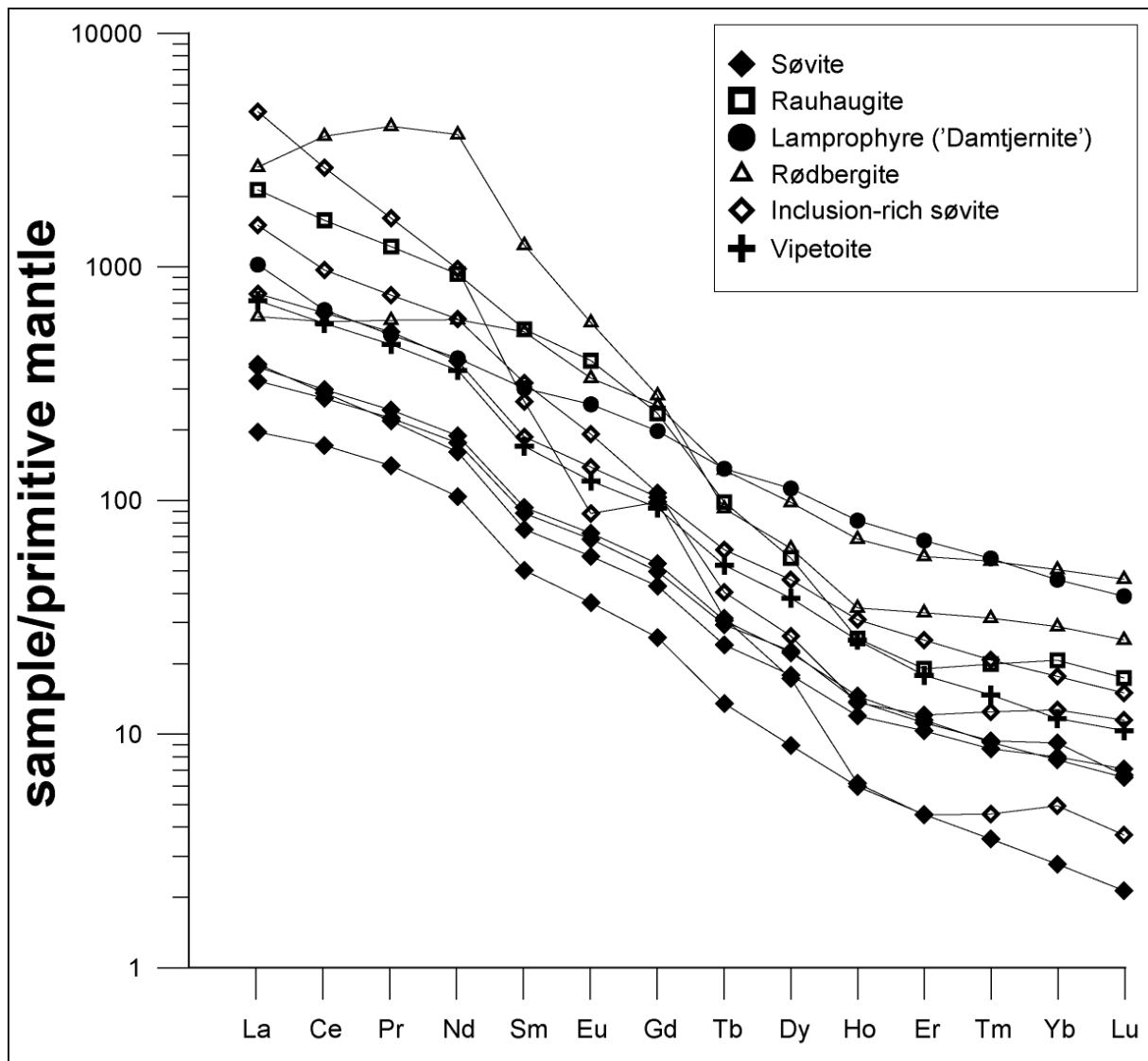


Fig. 6: Whole rock REE distribution, normalised to primitive mantle (Palme and O'Neill, 2003).

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4. APPENDICES

Appendix 1: Whole rock analyses of the Fen complex

Sample	coordinates	Method	WGHT	4A-4B	4A-4B	4A-4B	4A-4B
		Analyte	Wgt	SiO2	Al2O3	Fe2O3	MgO
		Unit	KG	%	%	%	%
		MDL	0.01	0.01	0.01	0.04	0.01
		Type					
JS FEN 1	32 V 515912 6569983	Søvite	0.7	2.08	0.32	6.3	2.8
JS FEN 2	32 V 517010 6571085	Rauhaugite	0.81	5.02	1.67	16.49	10.36
JS FEN 3	32 V 517490 6570942	Damtjernit	1.11	48.87	8.07	5.54	3.31
JS FEN 4	32 V 517647 6570577	Rødbergite	1.04	18.35	4.01	15.16	2.6
JS FEN 5	32 V 517446 6570662	Rødbergite	1	2.05	0.71	90.39	0.54
JS FEN 6	(Tuftestollen)	Søvite	0.72	0.65	0.27	5.61	2.03
JS FEN 7	(Tuftestollen)	Søvite	0.39	0.75	<0.01	3.42	17.06
JS FEN 8	(Tuftestollen)	Søvite	0.78	1.39	0.52	4.1	2.96
JS FEN 9	(Tuftestollen)	Søvite with incl.	0.52	9.73	2.47	5.58	6.09
JS FEN 10	(Tuftestollen)	Søvite with incl.	0.84	0.98	0.38	8.4	7.49
JS FEN 11	(Tuftestollen)	Søvite with incl.	0.77	1.47	0.58	1.98	0.84
JS FEN 12	unknown	Vipetoite	0.42	24.44	5.36	9.69	7.61

Sample	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B
	CaO	Na2O	K2O	TiO2	P2O5	MnO	Cr2O3	Ni	Sc
	%	%	%	%	%	%	%	PPM	PPM
	0.01	0.01	0.01	0.01	0.01	0.01	0.002	20	1
JS FEN 1	47.85	0.13	0.06	0.18	4.26	0.22	0.003	<20	4
JS FEN 2	24.22	0.11	0.07	0.71	0.24	1.83	0.015	<20	48
JS FEN 3	12.14	0.11	5.24	1.01	0.13	0.34	0.019	<20	41
JS FEN 4	32.74	0.05	0.01	0.54	0.63	0.34	0.018	53	77
JS FEN 5	2.17	<0.01	0.02	0.07	0.67	0.54	0.017	<20	48
JS FEN 6	49.73	0.03	0.03	0.17	3.35	0.18	<0.002	<20	7
JS FEN 7	32.33	0.01	<0.01	0.02	4.16	0.6	<0.002	<20	3
JS FEN 8	47.83	0.03	0.2	0.25	3.67	0.23	<0.002	<20	7
JS FEN 9	36.52	0.08	1.52	0.56	15.7	0.35	<0.002	<20	10
JS FEN 10	41.56	0.03	0.04	0.02	11.26	0.73	0.003	<20	17
JS FEN 11	52.52	<0.01	<0.01	0.01	0.35	0.32	0.006	<20	12
JS FEN 12	27.58	1	1.85	1.86	9.57	0.2	<0.002	<20	5

Sample	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B
	LOI	Sum	Ba	Be	Co	Cs	Ga	Hf	Nb
	%	%	PPM	PPM	PPM	PPM	PPM	PPM	PPM
	-5.1	0.01	1	1	0.2	0.1	0.5	0.1	0.1
JS FEN 1	35	99.21	730	1	10.2	0.3	4.4	2	59.5
JS FEN 2	35.7	96.43	17301	2	10.5	0.8	8.4	3.1	706.3
JS FEN 3	13.4	98.17	8448	2	3.8	0.5	20.3	12.6	1991
JS FEN 4	24.7	99.17	212	24	28.9	<0.1	11.8	9.4	840.8
JS FEN 5	0.3	97.46	2073	9	16.3	0.1	10.4	2.3	667.8
JS FEN 6	37.2	99.26	581	<1	13.5	<0.1	1.8	0.5	46
JS FEN 7	40.7	99.04	62	<1	3.6	<0.1	0.5	0.9	2735.9
JS FEN 8	37.8	99.01	916	<1	7.7	0.2	0.6	0.5	328.6
JS FEN 9	19.8	98.36	6941	<1	6.8	0.2	6.9	3.5	421.5
JS FEN 10	27.6	98.51	642	<1	13.1	0.3	1.6	0.9	821.5
JS FEN 11	40.9	98.98	83	<1	4.7	<0.1	2.8	<0.1	302.9
JS FEN 12	9.7	98.89	2875	5	36.8	6.9	14.1	15.5	123.2

Sample	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B
	Rb	Sn	Sr	Ta	Th	U	V	W	Zr
	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM
	0.1	1	0.5	0.1	0.2	0.1	8	0.5	0.1
JS FEN 1	3	1	3920.7	6.9	17.8	1.3	133	<0.5	259.1
JS FEN 2	3.2	7	1885.1	12.4	782.3	3.7	89	5.4	115.9
JS FEN 3	107.4	8	230.6	13	383	4.5	55	9.9	431.9
JS FEN 4	1	5	304	3.7	1080.1	22.9	151	11.9	177.2
JS FEN 5	0.5	1	140.2	0.4	1470.6	3.4	134	10.8	174.9
JS FEN 6	1	2	3789.7	4.6	19.3	0.9	121	<0.5	73.9
JS FEN 7	0.3	<1	3800.9	10.7	63.7	0.8	11	0.6	50.4
JS FEN 8	6	<1	4523.4	81.3	28.6	113.6	83	<0.5	17.2
JS FEN 9	27.8	<1	2938.1	58.3	67	104.8	77	1.2	365.2
JS FEN 10	1.3	<1	5147.8	6	98.2	18.7	18	0.7	63.8
JS FEN 11	0.5	2	430.8	3.1	106.8	5.7	28	1.2	13.1
JS FEN 12	77.4	3	1814.3	3.6	76.6	5.9	178	1.5	1090.9

Sample	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B
	Y	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb
	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM
	0.1	0.1	0.1	0.02	0.3	0.05	0.02	0.05	0.01
JS FEN 1	58.3	269.5	527.2	60.24	218.5	32.87	9.36	24.83	2.68
JS FEN 2	116.8	1516.2	2906.3	338.52	1269.7	237.85	64.87	137.05	11
JS FEN 3	341.5	722.2	1197.9	141.35	551.8	132.52	42.06	115.17	15.29
JS FEN 4	366.5	432.4	1066.5	163.27	808.7	231.68	54.55	148.03	15.09
JS FEN 5	263.6	1897.6	6680.9	1111.09	5046.4	546.73	94.51	163.71	10.31
JS FEN 6	69.3	262.6	544.4	67.23	256.6	40.83	11.77	31.02	3.41
JS FEN 7	24.8	137.8	313.4	38.75	140.5	21.92	5.92	14.93	1.5
JS FEN 8	66.3	228.8	500	61.95	239	38.52	11.1	28.68	3.27
JS FEN 9	138.9	541.9	1163.5	145.48	537.1	82.08	22.62	59.8	6.87
JS FEN 10	83.6	1066.7	1778.8	209.41	813.2	139.91	31.32	62.38	4.51
JS FEN 11	46.1	3289.6	4894.6	448.13	1334.3	116.53	14.3	56.96	3.49
JS FEN 12	107.6	507.2	1049	128.39	490.7	74.62	19.74	53.83	5.89

Sample	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B
	Dy	Ho	Er	Tm	Yb	Lu	total REE
	PPM	PPM	PPM	PPM	PPM	PPM	PPM
	0.05	0.02	0.03	0.01	0.05	0.01	
JS FEN 1	12.82	1.93	4.89	0.61	3.7	0.5	1231.93
JS FEN 2	40.77	4.15	9.04	1.41	9.63	1.23	6712.52
JS FEN 3	81.3	13.32	32.14	4.01	21.36	2.76	3455.68
JS FEN 4	70.77	11.1	27.45	3.9	23.59	3.27	3503.8
JS FEN 5	44.92	5.62	15.73	2.22	13.43	1.79	15946.56
JS FEN 6	15.96	2.35	5.44	0.65	3.59	0.46	1322.61
JS FEN 7	6.4	0.96	2.14	0.25	1.28	0.15	713.7
JS FEN 8	16.29	2.23	5.3	0.66	4.25	0.47	1213.82
JS FEN 9	32.95	5	12	1.47	8.21	1.06	2768.94
JS FEN 10	18.87	2.2	5.72	0.88	5.89	0.81	4241.2
JS FEN 11	12.41	0.99	2.13	0.32	2.28	0.26	10234.4
JS FEN 12	27.46	4.08	8.48	1.04	5.41	0.73	2489.17



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