
Evaluation of the Kaldådalen and Hammarfjell licences, Nordland, northern Norway



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Kaldådalen licence # 0106-1/2016

Acquired 23/06/2016

6 318 688 m²

Hammerfjell licence # 0105-1/2016

Acquired 23/06/2016

6 029 904 m²

Both licences 100 % owned by:

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Frontispiece: overview of the mineralised zone of the Hammarfjell east area, looking east.

Kalsdådalen and Hammarfjell licences

The two licences are located in the Nordland County, in Northern Norway. The Kaldådalen licence lies within Ballangen municipality, while the Hammarfjell licence lies within the Narvik municipality. Both lie on the south side of Ofoten Fjord, respectively west and east of the company's Arnes and Rånkeipen exploration licences. The locations of the two licences are shown in Fig. 1.

The area hosts a large number of base metal prospects, which include the Bjørkåsen iron mine and the Melkedalen Pb-Zn-Cu mine. The Råna intrusion, in between the Kaldådalen and Hammarfjell licences hosts Ni-Cu-Co mineralisations that were exploited in the Bruvann mine.

The two licence areas were selected based on the results of the airborne EM survey flown by the NGU and known mineralisations.

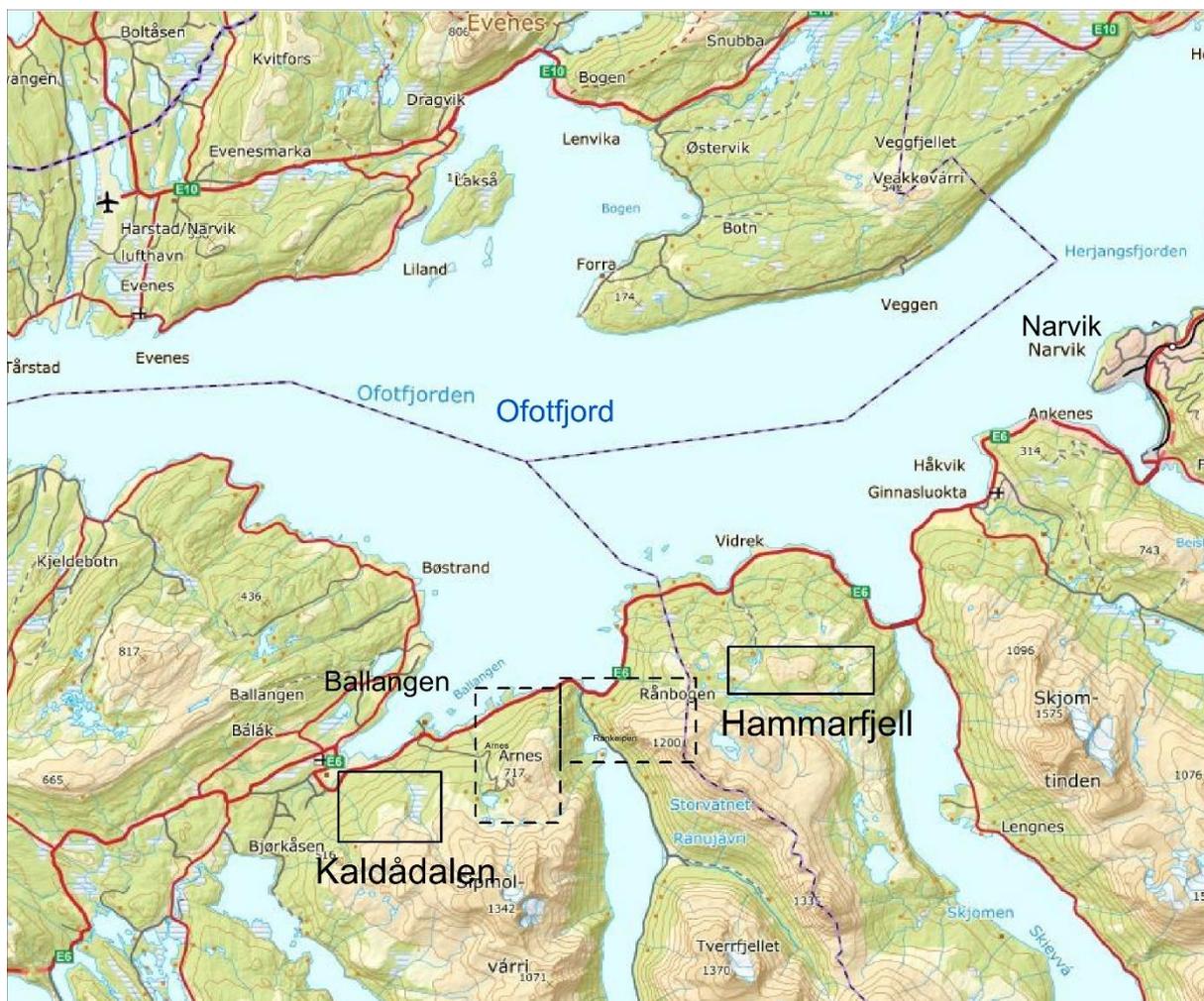


Figure 1 Location of the two licence areas south of Ofotfjord. The dashed lines indicate Ofoten Minerals' Arnes and Rånkeipen licences.

GEOLOGICAL SETTING

The mineralisations are hosted by garnet-biotite schists of the Narvik group in the Caledonian thrust belt. Metamorphic grade is amphibolite facies. The metasedimentary schists are interleaved with thin graphitic-, metavolcanic-, basaltic and marble layers. Base metal mineralisations are commonly associated with graphitic and metavolcanic (keratophyre) layers. The supracrustal sequence is intruded by the syn- orogenic Råna intrusion consisting of mafic and ultramafic rocks.

Kaldådalen

The Kaldådalen showing forms a ca 700 m long, discontinuously exposed zone of schists that contain sphalerite, galena and pyrrhotite, as well as minor chalcopyrite and graphite. The zone is mostly less than a meter wide, rarely up to two meters. Sulphides occur disseminated and in veins in the richer zones. Several other graphite-bearing zones (but no sulphides) occur in the area, all of which yield anomalies in the electromagnetic survey. The zone strikes to the southwest and dips about 55 degrees to the north-west. Several trenches exist in the area, and 12 drill holes are reported by Foslie (1947). Analytical results in the NGU database of samples from this area include samples with 53.6% Zn and 2.5% Pb; 3.0 % Cu, 8.8% Zn, and 3.6% Pb; 0.3% Cu, 35.7% Zn, and 0.3% Pb. Assay data published by Foslie (1947) include grab sample grades of 23.8% Zn, 1.4% Cu, 18.6% Pb, and 10.4% Zn, 0.1% Cu, 11.7% Pb. One sample with 118 ppm Ag is mentioned. Grades of the samples from the drill holes are rarely higher than 1% combined Zn+Cu+Pb. Drill hole intersections where the three metals combined are over 5% are between and 10 cm long. The best intersection is in drill hole III where a 12 cm intersection at ca. 40 m depth contains 22.2% Zn, 3.9% Cu and 16.1% Pb. Only three intersections (7, 12 and 25 cm long) have combined metals over 20%.

Hammarfjell

A 5-10 meter wide (rarely up to 20 m wide) felsic to intermediate volcanic layer (keratofyr) hosts the mineralisation in the Hammarfjell area. The layer strikes to the west and dips about 35 degrees to the north. The wall rocks are quartz-rich garnet-biotite schists with occasional calc-silicate-bearing layers. The keratophyre is white to light grey and finely laminated. The layer is intermittently mineralised and rusty weathering over a length of almost two kilometres (fronticpiece). Mineralisation is dominated by disseminated pyrite, often well developed cubic crystal shapes and up to 5 mm in size, and locally sphalerite, galena and chalcopyrite. In the most intensely mineralised parts the sulphides occur in veins and breccias.

Several trenches exist, exposing the most intensely mineralised parts of the area. Analytical results of samples from this area in the NGU database include samples with 7.8% Zn, 0.3% Cu, 4.6% Pb, and 8.6% Zn, 4.3% Cu, 3.6% Pb and 1.2 ppm Au.

Geophysics

In the fall of 2015, NGU flew a geophysical survey of the Ballangen-Narvik area (Figure 2; Ofstad 2016). The survey had to be abandoned before it was finished, due to poor weather conditions. Data became available to the public in spring 2015.

In the Hammerfjell area, a marked EM anomaly coincides with the central part of the mineralised zone. In Kaldådalen several anomalies occur, which are slightly more diffuse. One of these anomalies coincides with the known mineralisation.

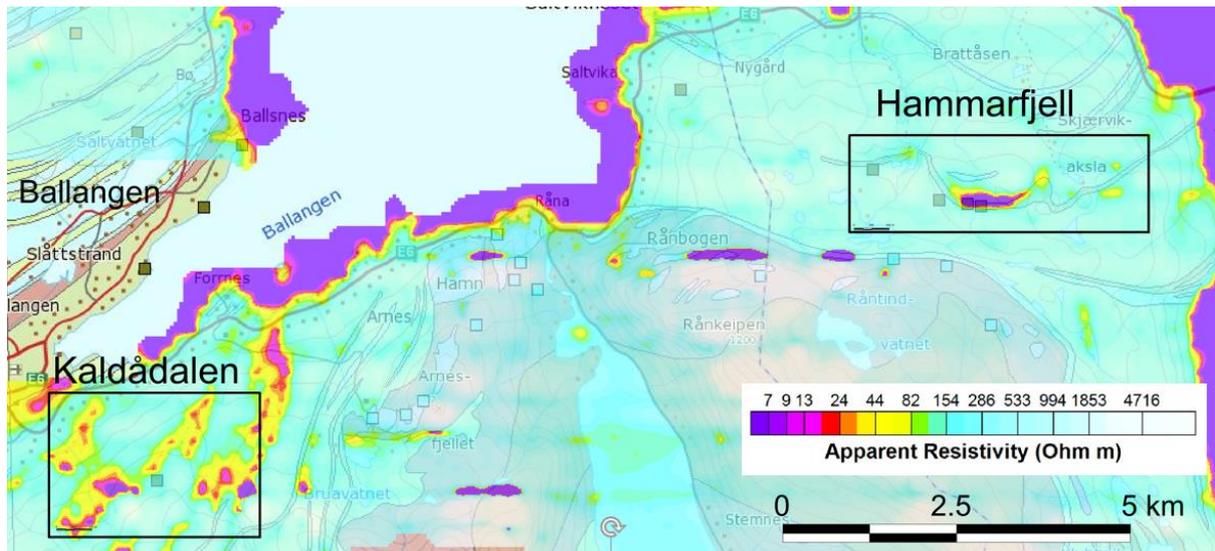


Figure 2 One of the geophysical EM anomaly maps in the report on the geophysical survey (Ofstad, 2016), plotted on top of the geology map. EM map Resistivity 880 Cp.

Field observations

In August 2016 field work was carried out in the area, during which the Kaldådalen and Hammerfjell showings were visited. Field observations were made and samples collected for assaying. In the Kaldådalen area one channel sample was collected in one of the exploration pits.

Kaldådalen

The mineralised zone is stratabound, parallel with the layering of the host gneisses. It is poorly exposed and observations are mainly from the existing trenches. The mineralised rocks are generally quartz- and feldspar- rich, as well as graphite-bearing. The highest grade mineralisation occurs as veins of sphalerite and galena, +/- chalcopyrite. These veins are few cm wide, and occur in zones that are rarely more than 10 cm wide.

Nine grab samples were collected from the exploration pits and trenches (sample locations in the map in Figure 3). Most of these contained over 30% combined Pb and Zn, 500 to > 1000 ppm Cd, and over 100 ppm silver. The best grade samples include one sample with 31.9% Zn, > 1000 ppm Cd, 123 ppm Cu, 12.8% Pb, 139 ppm Ag and one sample with 15.6 % Zn, 939 ppm Cd, 1,35% Cu, 35.1% Pb and 343 ppm Ag.

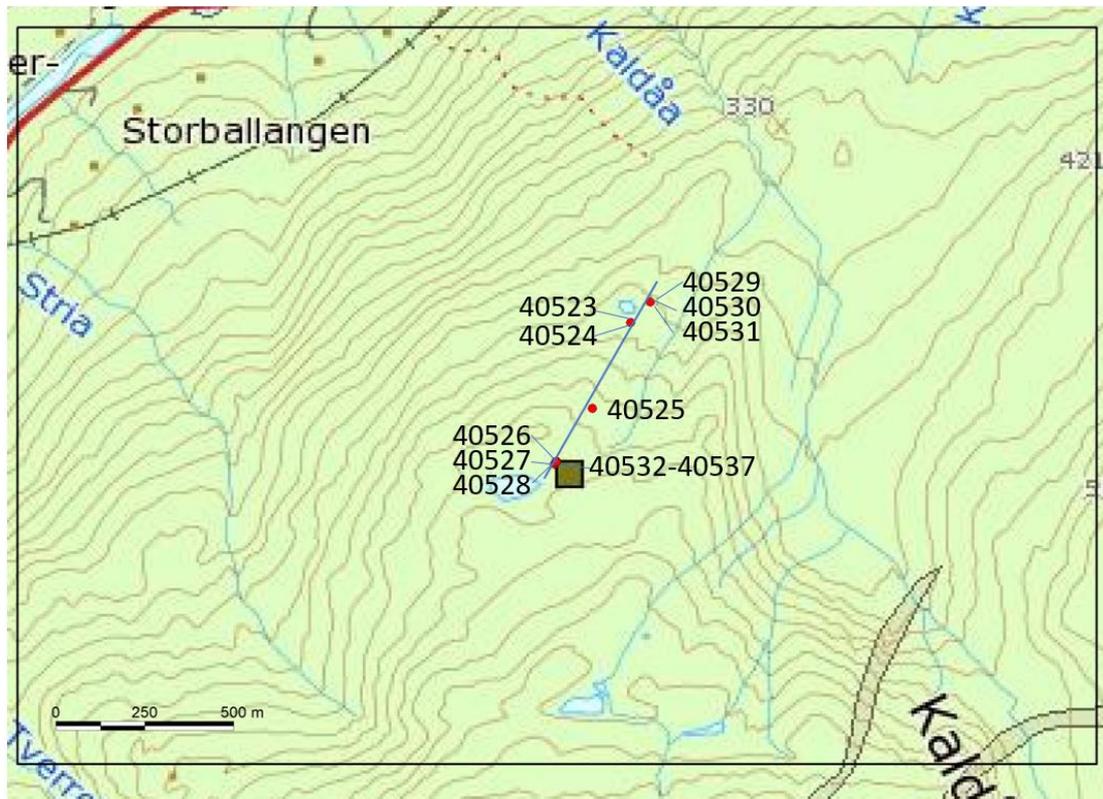


Figure 3 Sample locations in the Kaldådalen licence plotted in the geological map. The blue line indicates the approximate location of the mineralised zone. The green square marks the location of the mineralisation in the NGU database. The dominant rock type is a “garnet-mica gneiss with layers of quartzo-feldspathic gneiss”. The greyish green bands in the south-east corner are described as “sulphide-/graphite-bearing schist, in part quartzitic schist. Map from NGU database.



Figure 4 Channel samples 40532 (top) to 40537 (bottom) cut at Kaldådalen. The complete trace is 2,5 m long

A 2.5 m long channel sample was collected (Figure 4). Sample length is 0.5 m, with the exception of the sample collected of the most mineralised layer which is 30 cm long (Figure 5). This layer contains 2.7% Zn, 0.6% Cu and 1.6% Pb



Figure 5 The most intensely mineralised 30 cm intersected by the channel sample is a quartz-biotite schist with ca 10% sulphide impregnation. The zone also contains graphite and chalcopyrite. Sample nr 40536.

The mineralised zone is assumed not to be continuous (therefore the many barren drill hole intersections) and on average less than half a meter (usually only 10-20 cm) has grades with more than 10% Pb+Zn. But in these thin zones, grades can be very high.

West of the southern end of the known mineralised zone is an E-W-trending EM anomaly of higher intensity. The area around this anomaly was investigated. It is very poorly exposed, but the outcrops in the area show no signs of mineralisation.

Hammarfjell

Field investigations were carried out in the area covered by the c. 900 m long EM anomaly that coincides with the mineralised layer. The mineralised keratophyre layer is well exposed and stands out clearly in the terrane as a string of rust-coloured, gossanous outcrops. The quartzo-feldspathic rocks are finely layered/laminated. Pyrite is the dominant sulphide, occurring often as fairly large idiomorphic crystals disseminated through the host rock, but locally also as semi-massive in veins, together with other sulphides. Galena and chalcopyrite are most common after pyrite, galena the least. These sulphides occur most commonly in veins and schlieren. In the western end of the exposed zone chalcopyrite occurs on the margins of quartz veins. Brecciated zones with pyrite and sphalerite occur locally up to 20 cm wide.

Six samples were collected for assaying. They were all collected from the waste piles next to pre-existing exploration pits and trenches. Sample locations are shown in Figure 6. Results of

the assays are shown in the appendix. The highest grade sample contains 8.% Zn, 0.3% Cu; 8.1% Pb.

In between the pits and trenches no significant amounts of sphalerite, galena or chalcopyrite were found, in spite of fairly good exposure. Pyrite is common everywhere.

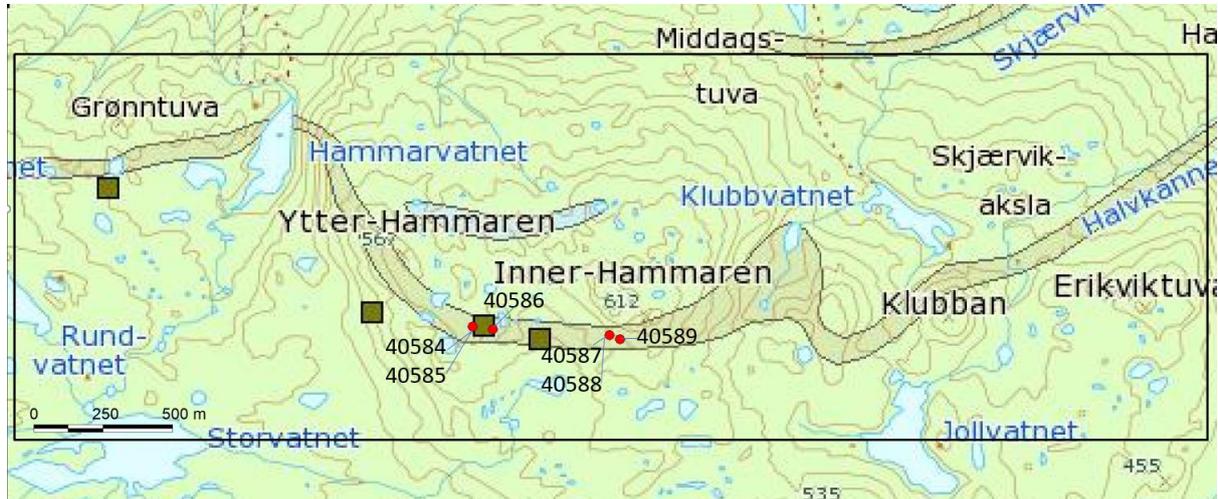


Figure 6 Sample locations of the Hammarfjell licence area plotted in the geological map. The green squares mark the locations of the mineralisations in the NGU database. The dominant rock type is a “garnet-mica gneiss with layers of quartzo-feldspathic gneiss”. The greyish green band is described as “sulphide-/graphite-bearing schist, in part quartzitic schist”, but also referred to as keratophyre.. Map from NGU database.

Conclusions

Mineralisation occurring in the two licence areas is in places of very high grade and can look very attractive. But the high grades are confined to very thin zones (Kaldå dalen) and not laterally extensive (Hammarfjell). The strong geophysical signature of the mineralised zones is assumed to be caused predominantly by graphite (Kaldå dalen) and pyrite (Hammarfjell).

With the presently available information, it looks unlikely that these two areas will yield economic deposits.

The licences were abandoned again in 2017.

Appendix – sample descriptions

sample nr	Lat	Lon	type	description	licence
40523	68.3286	16.8729	Rock grab from pit	Bt-schist with up to 5% diss cp and f-gnd sp(?), with minor fuchsite in matrix	Kaldådalen
40524	68.3286	16.8729	Rock grab from pit	Bt-schist with gr and cp veins + garnet, up to 10% sulphides	Kaldådalen
40525	68.3265	16.8701	Rock grab from pit	Q-graphite schist with 2-5% sulphides located in graphide rich bands. Possible up-consentrated due to local fold.	Kaldådalen
40526	68.3252	16.8676	Rock grab from pit	(semi-)massive sp ore with up to 1% cp	Kaldådalen
40527	68.3252	16.8676	Rock grab from pit	qtz-rich rock with semi-massive gn veins, ca 15 cm wide. Minor cp in interstitially	Kaldådalen
40528	68.3251	16.8674	Rock grab from pit	massive sp ore, f-m-gnd with minor quartz	Kaldådalen
40529	68.3291	16.8743	Rock grab from pit	highly leached graphite-galena rock, full of cavities. Gn forms network around holes. + qtz + fsp + gr	Kaldådalen
40530	68.3291	16.8743	Rock grab from pit	4 cm wide ca massive galena layer	Kaldådalen
40531	68.3291	16.8743	Rock grab from pit	4 cm wide ca massive sp layer with cp + gn on edges of sample	Kaldådalen
40532	68.3252	16.8675	Channel sample	50 cm. Q-bt-grt schist	Kaldådalen
40533	68.3251	16.8675	Channel sample	50 cm. Q-bt-grt schist	Kaldådalen
40534	68.3252	16.8675	Channel sample	50 cm. Q-fuchsiteschist with thin bands of bt. - /+amph.	Kaldådalen
40535	68.3252	16.8675	Channel sample	50 cm. Q-mica-grt schist 1-2% chalcopryrite mineralisation associated with 1cm Q-siliminite-amph pegmatite vein.	Kaldådalen
40536	68.3252	16.8675	Channel sample	30cm. Q-bt schist with 5-10% sulphides impregnated 1 cm. Pegmatite vein with 1mm musk? And graphite. 2 cm below, bands of chalcopryrite in a 1 cm. Q vein. Rounded Q blebs in a Q-sphalerite matrix.	Kaldådalen
40537	68.3252	16.8675	Channel sample	Amphibole zone with a granitic pegmatite at the bottom. Phlocopte/rusty mica at amph-peg contact.	Kaldådalen
40584	68.3573	17.1532	Rock grab from pit	keratophyre, banded, with thin schlieren (<1mm) of dis py and possibly sp. Overall 2-3% sulphides in rock	Hammarfjell
40585	68.3573	17.1532	Rock grab from pit	Gossan with breccia-like texture	Hammarfjell
40586	68.3572	17.155	Rock grab from pit	sp + cp in gossanous breccia	Hammarfjell
40587	68.3568	17.1652	Rock grab from pit	quartz keratophyre with sp + cp veins. Semi-massive, ca 60% sulphides	Hammarfjell
40588	68.3568	17.1652	Rock grab from pit	sp + py ore, massive veins + some cp. Ca 40% of rock is sulphide	Hammarfjell
40589	68.3567	17.1661	Rock grab from pit	Qtz vein with ca 10% sp + cp in veins	Hammarfjell

Appendix – Assay results (main elements only)

sample nr	ME- ICP61	ME- ICP61	ME- ICP61	ME- ICP61	ME- ICP61	Pb- OG62	ME- ICP61	ME- ICP61
	Ag ppm	Cd ppm	Cu ppm	Fe %	Pb ppm	Pb %	S %	Zn %
40523	1.6	4.3	4830	6.11	512	0.05	2.21	0.17
40524	24.1	102.5	8640	5.52	>10000	2.14	4.65	2.39
40525	15.5	127	4420	4.44	3790	0.38	2.38	2.3
40526	139	>1000	123	13.05	>10000	12.75	>10.0	31.9
40527	208	796	1370	5.4	>10000	15.95	>10.0	16.75
40528	237	>1000	321	12.85	>10000	21.3	>10.0	26.6
40529	343	939	5460	5.01	>10000	35.1	>10.0	18.6
40530	89.2	548	832	8.34	>10000	10.45	>10.0	9.61
40531	144	>1000	13500	7.66	>10000	14.95	>10.0	21.6
40532	<0.5	1.8	55	6.27	357	0.04	0.05	0.04
40533	<0.5	0.6	33	5.94	127	0.01	0.03	0.02
40534	<0.5	1.1	461	3.54	401	0.04	0.36	0.03
40535	1.3	2.2	1650	6.97	1150	0.12	1.29	0.05
40536	20.7	126	6460	6.7	>10000	1.56	5.87	2.76
40537	<0.5	1.8	319	4.59	521	0.05	0.16	0.05
40584	18	10.6	2330	3.79	9710	0.97	2.8	0.35
40585	2.2	<0.5	1710	38.6	1430	0.14	0.74	0.02
40586	79.2	212	3090	3.84	>10000	8.08	6.84	8.54
40587	8	15.7	7740	18.5	3420	0.34	>10.0	0.51
40588	10.5	26.2	6110	23.2	4510	0.45	>10.0	0.83
40589	<0.5	1.5	297	5.69	88	0.01	3.46	0.02