DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 2006/14

Epithermal veins in Palaeogene volcanic rocks on Ubekendt Ejland, West Greenland

Including a comparison with epithermal veins at Amdrup Fjord, East Greenland

Stefan Bernstein, Bjørn Thomassen, Dennis K. Bird
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Summary

Hydrothermal quartz-carbonate veins of considerable size and extend occur within mafic volcanic rocks on Ubekendt Ejland, which formed during Palaeogene continental rifting in West Greenland. The mineral assemblage, field occurrence and other geological features of these hydrothermal vein systems are similar to known Au and Ag mineralised epithermal veins found along convergent plate boundaries. This study reports the findings of an exploration programme on Ubekendt Ejland and compares the epithermal veins found here with similar, mineralised epithermal veins occurring at Amdrup Fjord in the Palaeogene rifted continental margin of East Greenland.

Most epithermal vein systems from Ubekendt Ejland have Au and Ag concentrations below detection limit, and significant Au and Ag concentrations are only found in samples of two veins. However, the type of mineralisation and field occurrence of Ubekendt Ejland quartz-carbonate veins are very similar to those of hydrothermal veins from the Amdrup Fjord area. The oxygen and carbon isotope composition of carbonate from the Ubekendt Ejland and Amdrup Fjord vein systems are similar and suggest a strong involvement of meteoric water in the mineralising fluids, just as calculated for the mineralising fluids of known epithermal Au-Ag deposits in western USA. The main differences between the Au-Ag mineralised veins at Amdrup Fjord and the, mostly barren, vein systems on Ubekendt Ejland appear to be the highly altered state of veins from Ubekendt Ejland, and the evidence for multiple episodes of dissolution and reprecipitation of silica in these veins. It is speculated that such episodes have mobilized Au and Ag, perhaps into shallow level or near surface mineral occurrences, which have subsequently been eroded away, exposing the barren lower portions of the vein systems. Although economic precious metal deposits have not been proven, the processes responsible for such mineralisation appear to have been active during the evolution of the igneous provinces of East and West Greenland, and further exploration should be targeted at areas closest to the palaeosurfaces.

1 Introduction

Epithermal veins in volcanic provinces are known to potentially host economic precious metal mineralisation. Such deposits are mainly described from volcanic provinces in plate margins dominated by collision-type plate tectonics. The Palaeogene volcanic provinces of East- and West Greenland host epithermal vein systems of considerable extend. Although the geological setting in the Greenland Palaeogene volcanic provinces is one of *rifted* volcanic margin, the mineral assemblage of the East- and West Greenland vein systems and their occurrence suggest that they may contain precious metal mineralisation as described from similar geological environments in e.g. South America. Indeed, the epithermal veins found at Amdrup Fjord, East Greenland, have proved to contain appreciable mineralisation of Au and Ag. Because of the high abundance and considerable strike length of epithermal, quartz-carbonate veins on Ubekendt Ejland, West Greenland, these were targeted for a systematic exploration for gold in 2003 and 2004. In contrast to the veins in Amdrup Fjord, gold anomalies in Ubekendt Ejland veins were only found in a few places.

This study, jointly financed by the Bureau of Minerals and Petroleum (BMP), Government of Greenland, and the Geological Survey of Denmark and Greenland (GEUS), describes the epithermal vein systems at Ubekendt Ejland and the result of gold exploration in 2003 and 2004. The study further compares the Ubekendt Ejland veins with those of Amdrup Fjord, in order to describe the potential for precious metal deposits in epithermal vein systems at these rifted volcanic margins.

1.1 Geology of Ubekendt Ejland

Ubekendt Ejland is dominated by early Palaeogene volcanics and intrusive rocks and the geology has been described and summarized by Drever & Game (1948), Clarke (1973), Larsen (1977a, b) and Larsen (1983) (Figure 1). Most of the central part of the island is covered with Quaternary moraine deposits, in particularly in the topographically low portions of the island. The eastern part of the island is occupied by thick sequences of picritic basalts, mainly pahoehoe flows, and olivine phyric and aphyric basaltic lavas and hyaloclastites belonging to the early Palaeogene Vaigat Formation (Larsen, 1977a, b; Larsen, 1983). In the south-western portion of the island the Vaigat Formation is overlain by a thick sequence (> 2000 m) of aphyric and plagioclase porphyritic basaltic lavas of the Qeqertalik Member, Maligât Formation (Larsen, 1977b; Tegner *et al.*, in prep.), with age of around 59–60 Ma (Tegner *et al.*, in prep.). Then follows the Illorsuit Formation (tentative name – to be defined in Tegner *et al.,* in prep.) comprising the Tupersuartâta Kûa Member with a 500–750 m thick unit of highly weathered pyroclastic rocks including a few basaltic flows, and the *c*. 700 m thick Nûk Takitsoq Member of basaltic flows and ignimbrites and pitchstones (Thompson, 1975; Larsen, 1977a, b; Tegner *et al.*, in prep.). The Illorsuit Formation has an age of ca. 55 Ma and is in turn overlain by the ca. 53 Ma Erqua Formation (Tegner *et al.*, in prep.) which is exposed on the extreme western corner of the island. The Erqua Formation consists of a minimum of approx. 150 m of relatively primitive, alkaline basaltic lavas which are plagioclase-olivine porphyritic at the base of the formation, and mainly olivine-clinopyroxene porphyritic at the top of the formation (Larsen, 1977b).

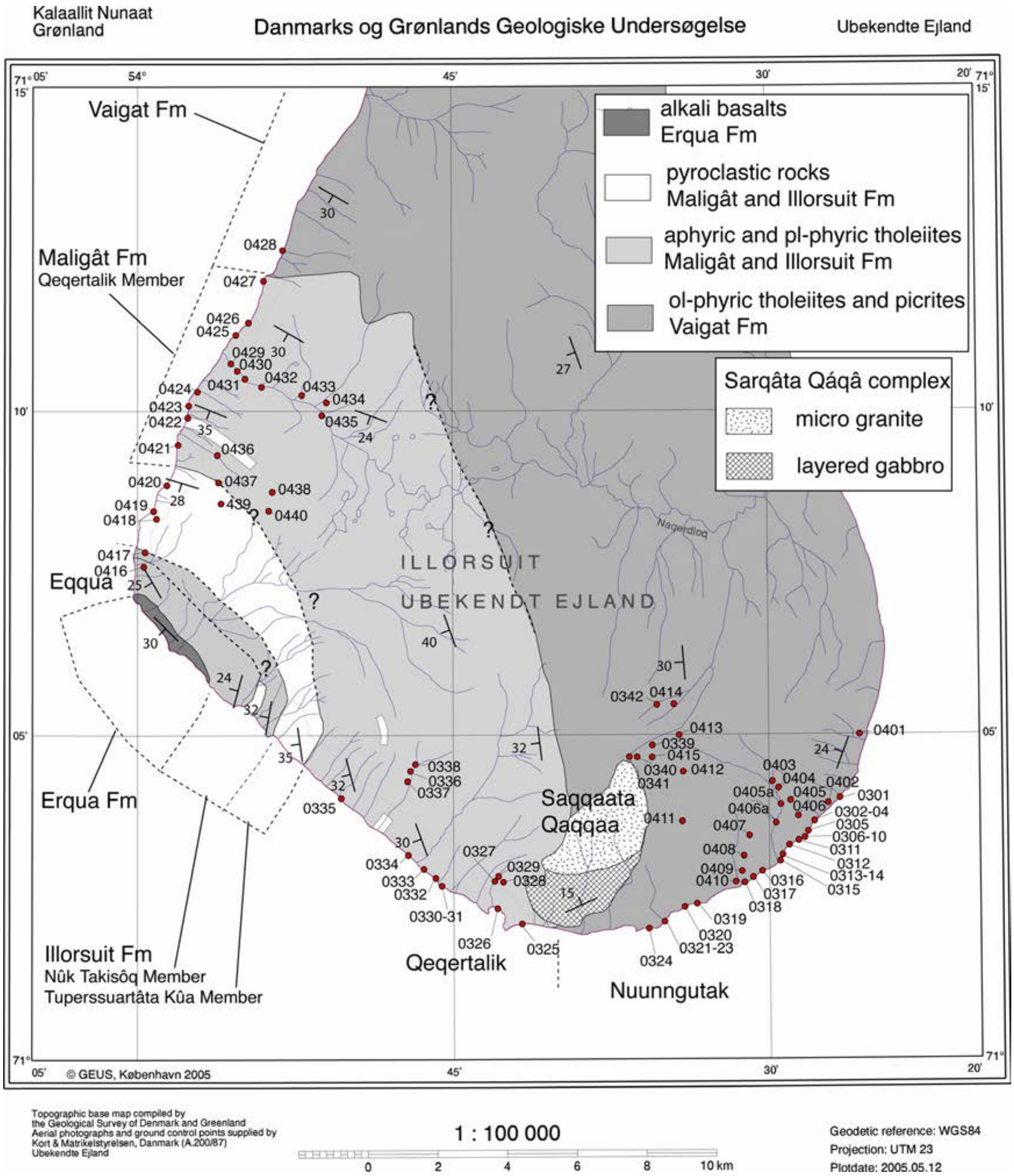

Figure 1. *Geological map of Ubekendt Ejland. Modified after Larsen (1977a, b) and Tegner et al.* (in prep.)*. Sample locations are marked with red dots – refer to Table 1 for relation between sample numbers and sample locations.*

Structurally, the lava packages strike N–S and dip moderately (20°–30°) to the west in the eastern part of the island, but changes gradually to a more NW–SE strike with dips of approx. 25° to the south-west at the western and southern part of the island. Steep faults are found mainly in the northern portion of the island where they typically have an NW–SE trend.

In the south, the transition from Vaigat Formation picrites to Maligât Formation basaltic flows is intruded by the Saqârta Qâqâ complex (see Thompson & Patrick, 1968; Thompson, 1975) which consists of a series of layered, mica-bearing gabbroic rocks in the lower portion (from sea level to about 400 m a.s.l.) and homogeneous fine-grained granite at higher elevations. The gabbros and granite are separated by a horizon rich in metabasaltic slabs. An age of *c.* 56 Ma has been obtained on mica from a sample of the layered gabbros (Tegner *et al.*, in prep.).

Mafic dykes and sheets occur over most of the island. The dykes are often steep or vertical, and along the eastern coastal cliffs, steep dykes can be followed into sub-horizontal sheets or sills for some distance. Along the north-western coast, lamprophyre dykes are abundant. These dykes strike NW–SE and are steep to vertical (see Clarke *et al.*, 1983). Felsic sheets and dykes are abundant in two regions, namely around Saqqaata Qaqqaa and north of Eqqua, along the NW facing coastline and some 3–4 km inland.

1.2 Quartz-carbonate veins

The quartz-carbonate veins that are the main focus of this study are found in many places in the southern half of the island, but they are particularly abundant in the regions where felsic sheets and dykes are observed, namely around and east of the intrusive Sarqâta Qâqâ complex, and N and NE of Eqqua (Figure 1). The main vein systems are indicated on the 1:100.000 geological map sheet 'Illorsuit' as "Fault zone associated with carbonate and/or felsic intrusives" (Larsen, 1983).

The vein systems are developed as relatively well-defined, subvertical, planar structures that extend for some distance along strike, judging from the orange-buff outcrop coloration. In some cases, the veins appear to form complex anastomozing systems, where sets of veins – often four or more – follow irregular trends and join upwards (Figure 2). It is unclear whether the vein systems were formed during one or several events, although at several locations the veins exhibit evidence of distinct stages of brecciation and mineralisation (see below).

The quartz-carbonate veins typically consist of banded carbonates with centres filled by quartz or carbonate. Thin (< 1 mm) crosscutting veins filled with quartz and/or fibrous silica also occur. The banded carbonates are medium- to fine-grained and some veins also have coarse-grained centres with carbonate crystals up to 20 mm across (Figure 3). The outer margins of the veins are often intensely brecciated, showing a mixture of carbonate and quartz crystals and fragments, including fragments of chalcedony, set in a very fine-grained matrix of ground carbonate. Adjacent to the vein systems the basaltic host rock has been bleached, silicified and carbonatized to a variable degree (Bernstein & Knudsen, 2004). The matrix sometimes shows signs of recrystallisation. In some places (particularly in locality 0327), crustiform carbonate form pseudomorphs after large (> 10 cm) euhedral quartz crystals (Figure 4).

Figure 2. *Quartz-carbonate vein systems cutting picritic lava flows of the Vaigat Formation, about 3 km east of Nuunngutak, at location 0318 (Figure 1). Height of cliff is about 150 m. The orange-buff coloured patterns include both the quartz-carbonate vein and their alteration halos, typically 2–10 m wide in total.*

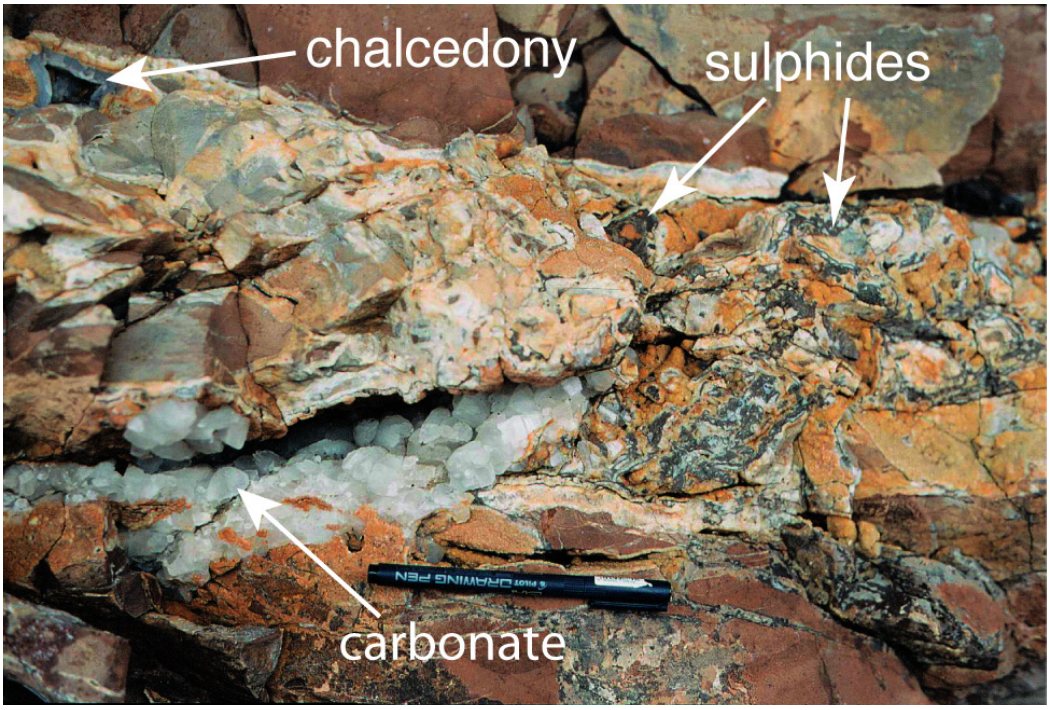

Figure 3. *A 20 cm thick quartz-carbonate vein in an altered dyke, location 0334, 6 km west of Qeqertalik (Figure 1). The vein shows several stages of brecciation, with fragments of banded dolomite overgrown with pyrite. Some cavities are lined with chalcedony, while others are lined with coarse calcite crystals.*

Figure 4. *Pseudo-hexagonal quartz crystal (5 cm wide and > 10 cm long) completely replaced by crustiform carbonate and chalcedony. Location 0327 (Figure 1).*

The carbonate is predominantly dolomite, and grades into ankerite (Bernstein & Knudsen, 2004). Some quartz-carbonate veins exhibit later sulphide mineralisation lining late fractures and veins (Figure 3). Such late fracturing can be extensive and has resulted in brecciation zones within the quartz-carbonate veins. The latest veining and mineralisation stage resulted in the formation of chalcedony veins that are usually 1–2 mm thick. Chalcedony also commonly occurs in cavities and vein centres within massive sulphides. In places, the chalcedony grades into coarser grained quartz (> 0.5 mm). Vugs filled with fibrous quartz, probably replacing amorphous silica, are also common.

The vein systems may contain minor amounts of pyrite and marcasite, typically as disseminated pyrite cubes and marcasite aggregates, as veinlets and as cement in the breccia. A few cm–dm sized lenses of massive pyrite-galena-sphalerite-chalcopyrite-arsenopyrite were found in fresh exposures at sea level. Furthermore, occasional traces of chalcopyrite are revealed by faint malachite staining. Individual vein swarms have been followed for 2.5 km along strike, and according to the geological map they may be up to 7 km long.

In some localities along the SE coast and on the 400 m-elevation plateau NE of the Saqârta Qâqâ complex, quartz-carbonate veins were found to contain pyrobitumen. The occurrence of pyrobitumen is either as dark colorations in some parts of the veins or, more spectacular, as black masses up to 2 cm across in vein centres (Figure 5). Although their formation clearly is a late event in the history of the quartz-carbonate veins, the pyrobitumen masses always show signs of deformation, either in small scale fault breccias, or as dismembered blocks in later, recrystallised carbonate matrix. Pyrobitumen has also been found in porous lava flows, and Bernstein & Knudsen (2004) concluded that it represents invasion of hydrocarbons, most probably oil (see section 4.5). Oil seepage has been found on NE Ubekendt Ejland and elsewhere in the West Greenland Palaeogene province (Bojesen-Koefoed *et al.*, 1999). It is uncertain whether hydrocarbons were present at several or all stages of quartz-carbonate vein formation, or whether it was confined to the later stages. Repeated movements along the vein systems and mineral dissolution and reprecipitation coupled with brecciation would tend to obliterate earlier accumulations of pyrobitumen.

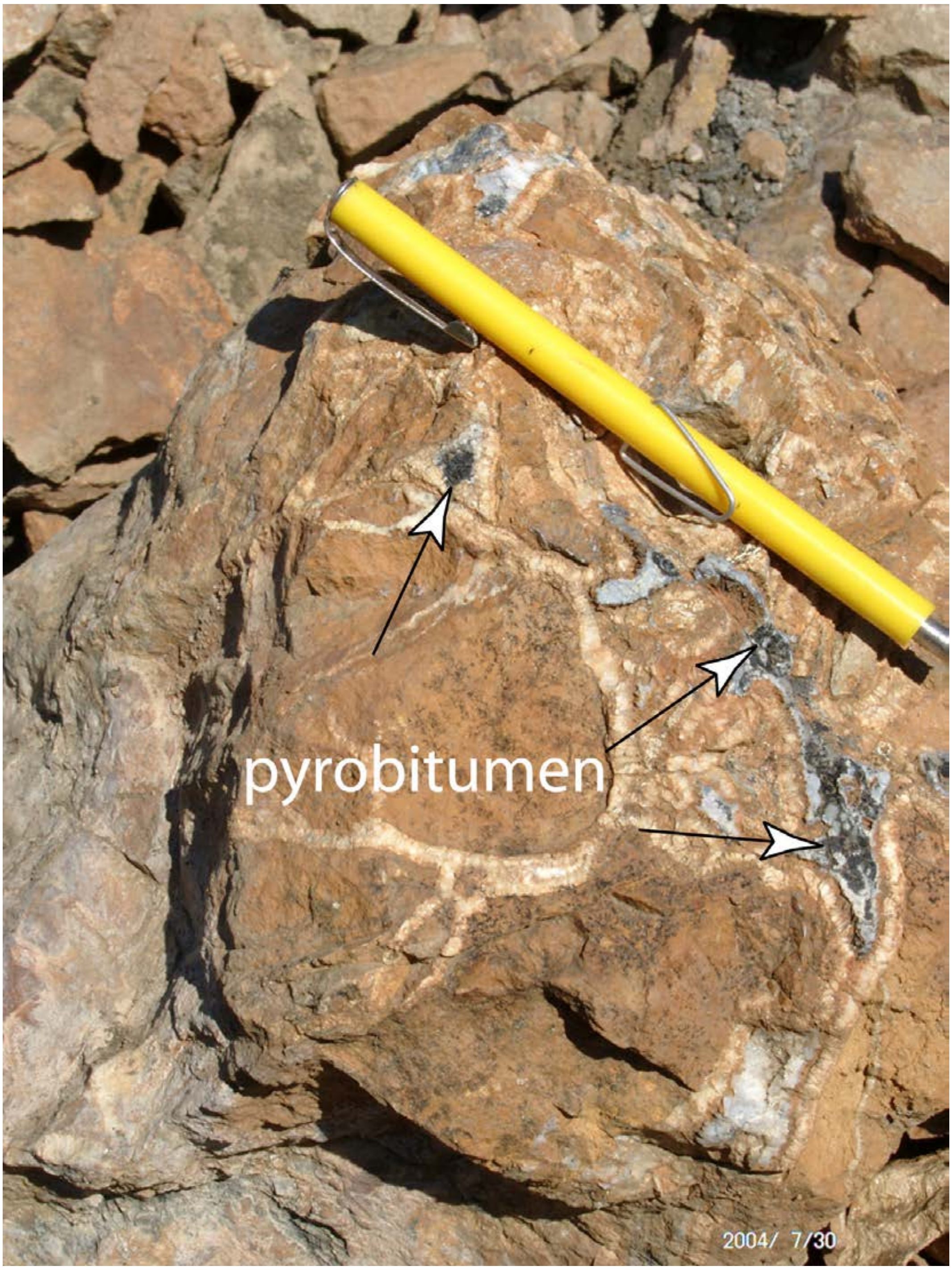

Figure 5. *Quartz-carbonate breccia (samples 482817 and 482855) at location 0404 (Figure 1). Crustiform carbonate and quartz veining silicified basaltic breccia clasts. Fine-grained to massive pyrobitumen fills vugs and vein centres. Magnet is 12 cm long.*

1.3 Results of earlier prospecting projects

Over the last two decades, a few brief prospecting projects have been carried out on Ubekendt Ejland. In 1985, mineral exploration including sampling of heavy mineral concentrates was carried out on south and west Ubekendt Ejland by Greenex A/S as a part of the company's evaluation of the base and noble metal potential of the West Greenland basalt province. Apart from minor sulphide mineralisation in the gabbro on the southern part of the island, no significant results were reported (Christensen, 1986; Gannicott, 1986; Milner, 1986).

In 1990, a GGU team including one of the present authors (B.T.) collected four couplets of heavy mineral concentrates/stream sediment samples with slightly enhanced chromium and nickel concentrations on western and southern Ubekendt Ejland on a passage to Maarmorilik.

Following the Greenlandic public mineral hunting programme 'Ujarassiorit', Nunaoil A/S visited the southern part of the island in 1991 to investigate the occurrence of anomalous antimony and arsenic content in samples found by inhabitants in Uummannaq municipality. A composite sample from 4 m's width of a pyritiferous quartz-carbonate vein returned 169 ppb Au, 110 ppm Sb and 46 ppm As (Nunaoil A/S, 1992).

In 1997, systematic stream sediment sampling was carried out by GEUS and BMP in the Uummannaq region, including Ubekendt Ejland. This revealed no obvious base- or noble-metal anomalies on the island apart from enhanced chromium and nickel concentrations, probably origin from picritic and olivine rich rocks (Steenfelt *et al.,* 1998).

In 2001, an aeromagnetic survey was carried out over the Svartenhuk area by GEUS and BMP. It revealed, among others, a distinct circular magnetic anomaly below western Ubekendt Ejland (Rasmussen, 2002).

Further, in 2001, one of the present authors (S.B.) collected a 0.5 m chip sample from fault gauge in a quartz-carbonate vein at location 0311, which returned 585 ppb Au. This prompted a more thorough investigation in 2003 and 2004, with results reported below.

1.4 Potential for Au mineralisation in hydrothermal systems at Ubekendt Ejland

Economic deposits of gold associated with hydrothermal veins in volcanic fields are well documented (see e.g. Sillitoe *et al.*, 2002). Some of the apparent requirements for the formation of gold and silver mineralisation in epithermal vein systems include the occurrence of extensive, bimodal volcanic activity (i.e. mafic and felsic or sillicic eruptions and/or intrusive episodes), the occurrence of an earlier sedimentary basin, beneath the volcanic centres, and what appears to be of importance in some mineralisation: the trace of hydrocarbons migrating through the epithermal vein systems (Sillitoe *et al.*, 2002). On Ubekendt Ejland all of these requirements appear to be fulfilled. Most of the exposed lavas are of mafic character, and there is ample evidence for concurrent sillicic igneous activity in the later stages of the volcanic history of the island. Examples are: the granite pluton at the top of the Saqârta Qâqâ complex, numerous felsic sheets intruding the basalts on the SE and W part of the island, and a series of felsic pyroclastic rocks interleaved with basaltic flows, exposed along the island's SW coast. Furthermore, the Ubekendt Ejland mafic lavas are supposed to rest on Cretaceous clastic sediments, mainly shales and arkosic sandstones. In addition, the finding of pyrobitumen in several quartz-carbonate veins suggests the presence of hydrocarbons at depth beneath the Palaeogene volcanic cover. The numerous occurrences of quartz-carbonate veins on Ubekendt Ejland, coupled with their dimensions (larger veins have widths of up to 2 metres over lateral distances of > 5 km) provide the tonnage required to make a potential economic gold deposit.

1.5 Other mineralised systems

1.5.1 Felsic rocks with quartz-pyrite veinlets and stockworks

The vent agglomerate complex of felsic rocks at Eqqua on western Ubekendt Ejland hosts bleached zones of highly brecciated, silicified and pyritised rocks. The pyrite occurs disseminated, in stockworks of quartz-pyrite veinlets, in quartz-carbonate veinlets or as cement in breccias. This mineralisation is slightly enhanced in molybdenum (max. 52 ppm Mo). In this western portion of the island, several thin, felsic sheets, largely of granitic composition, are also found (see section 3.3).

1.5.2 Basalt with native copper and chalcocite

In several places, the host basalts on Ubekendt Ejland show minor copper mineralisation, mainly as native copper in quartz-lined vugs in hyaloclastites. One float of malachite-stained basalt from the southern part of the island hosts minor chalcocite and native copper in a quartz-calcite veinlet (482259). It returned 0.27% Cu but only 0.6 ppm Ag. A 7 cm long nugget of native copper found trapped in a crevasse in a nearby streambed represents the same type of mineralisation (482257).

2 Sampling programmes

2.1 2003 sampling programme

In 2003, a two-man field team (S. Bernstein and C. Knudsen) spent four days on Ubekendt Ejland, with the objectives to

- Obtain a systematic collection of chip samples across the quartz-carbonate veins similar to that sampled in 2001, which returned 585 ppb Au.
- Obtain details on field relations.

As illustrated in Figure 1, fieldwork in 2003 (location numbers 03xx) was concentrated in two areas, namely along the SE coast from Saqqaata Qaqqaa in the south to some 10 km to the NE, and along the SW coast from Saqqaata Qaqqaa and about 7 km to the NW. In addition a few samples were taken from an inland occurrence of quartz-carbonate veins, immediately north of Saqârta Qâqâ complex. Along the two coast stretches, nearly all accessible quartz-carbonate vein systems were sampled from rubber dinghy, totalling 108 chip- and grab-samples (Table 1).

2.2 2004 sampling programme

In 2004, a three-man team (S. Bernstein, D.K. Bird and B. Thomassen) visited Ubekendt Ejland, with the objectives of

- Sampling in-land continuations of the quartz-carbonate vein systems visited in 2003 to test possible lateral variations in mineralisation.
- Sampling quartz-carbonate vein systems along the NW coast N of Eqqua.
- Collecting stream sediment samples from both areas.
- Collecting heavy mineral concentrates from both areas.

The field team spent five days at the 400 m-elevation plateau above the SE coast, and about one week at the NW coast N of Eqqua (location numbers 04xx). A total of 138 chip- and grab-samples were collected in addition to 11 stream sediment samples and 11 heavy mineral concentrate samples (Table 1).

3 Field observations and sampling methods

3.1 Quartz-carbonate veins/breccias

On a local scale (5–100 m) the quartz-carbonate vein systems appear to form a complex series of sub-set of veins, which record several mineralisation and brecciation events (see Bernstein & Knudsen, 2004). Structurally, the vein sets may join and bifurcate over some tens of metres. Over a greater distance (500–1000 m) the quartz-carbonate vein systems appear more continuous and several of the larger ones can be followed for up to 5 km along strike. Along the SE coast, and on the 400 m plateau NE of Saqqaata Qaqqaa, where the quartz-carbonate vein systems are well exposed, they mainly have a N–S to NNE–SSW strike, and are subvertical. Along the SW and NW coasts, the exposure is usually restricted to a 2–20 m high cliff, capped by scree or moraine. Here it is difficult to estimate the strikes of the vein systems but they appear to maintain their grossly N–S attitude, and are steep to vertical. One conspicuous set of quartz-carbonate veins occur in the western part of the island, and are arranged with a NW–SE strike, nearly parallel to the SW coastline. Because of poor exposure, and the complicated nature of the quartz-carbonate vein systems, it was not possible to detect distinct vein generations. From the field observations alone, it seems likely that most were active for a longer period and /or during several periods. Also, the finding of large quartz crystals, completely recrystallised into carbonate and the later chalcedony mineralisation (Figure 4) suggest that vein formation took place over at least a series of temperature ranges.

Sampling of the quartz-carbonate veins were normally done along a line perpendicular to the vein. Depending on the thickness and complexity of a given vein, one or more chip samples were taken, with the largest representing about 1 m sections. In the thicker vein systems, chip lines were run into the alteration zones (see next section). The weight of each chip sample is 1 kg on average.

3.2 Alteration zones

A zone of strongly altered wall rock always surrounds the quartz-carbonate vein systems. In a few cases, the alteration zone can be a thin selvage of *c.* 5–10 cm light coloured rock, but most veins present a thick buff- to light-grey coloured alteration zone, with thicknesses from 20–30 cm to several metres. Often the alteration zones contain thin (< 1 mm) carbonate- or quartz-filled veins. Analysis of the altered wall rocks shows that these have undergone strong silicification (Bernstein & Knudsen, 2004). In the more complex quartz-carbonate vein systems where thick alteration zones are developed, the chip lines included such zones.

3.3 Felsic dykes and sheets

Felsic sheets are found throughout the island, but are particularly abundant around the Saqârta Qâqâ complex and at the NW coast, N of Eqqua. Around the Saqârta Qâqâ complex, felsic intrusives are found mainly as sheets, while along the NW coast, they occur mainly as steep dykes. Most of the dykes and sheets are less than 1 m thick, but in the vicinity of the Saqârta Qâqâ complex they may reach 5–10 m in thickness. In fresh samples, the felsic sheets and dykes are found to contain fine-grained pyrite, but many samples are altered to various degree, and disseminated rusty spots are interpreted to be replaced sulphide crystals. The analytical programme includes a few of these felsic sheets and dykes (Table 1).

3.4 Drainage sediment sampling

Selected drainage systems were tested for gold by a combination of heavy mineral and stream sediment sampling. Heavy mineral concentrates were produced by panning of the fine fraction of 8–10 litres of active sediments sieved at 1.0 mm into the pan. Subsequently, the concentrates were submitted to heavy liquid separation (d=2.82 g/cm^3) in the GEUS sediment laboratory. Stream sediment samples of 500–800 g were collected at the same localities as the heavy mineral concentrates. They were dry sieved at 0.1 mm in Copenhagen before analysis of the fine fraction.

3.5 Chemical analysis

A total of 167 rock- and chip-samples were submitted to multi-element analysis (2001: 3 samples, 2003: 77 samples and 2004: 87 samples). The samples were analysed for 49 elements by a combination of instrumental neutron activation and inductively coupled plasma emission spectrometry at Activation Laboratories Ltd., Ontario, Canada. The 22 drainage sediment samples were analysed in the same manner. The analytical results are presented in Table 1.

4 Results and interpretations of Ubekendt Ejland exploration programme

4.1 Au and Ag

Six chip samples contain more than 100 ppb Au (Table 1). The highest value comes from the 2001 chip sample no. 470033 with 585 ppb Au that represents the strongly deformed and faulted centre of a quartz-carbonate vein. Together with this sample, three chip samples with 478, 330, and 158 ppb Au (477886, 477872 and 477885, respectively) come from quartz-carbonate veins along the south-eastern coast line. The Au anomalies in these three chip samples are associated with abundant sulphides, being mainly pyrite, galena, sphalerite, chalcopyrite and arsenopyrite (see Bernstein & Knudsen, 2004), while the sample 470033 contains very little sulphide. This is illustrated in Figure 6, showing that hand specimens with high, visible concentrations of sulphides contain > 20 wt. % S and have variable contents of Au from 1300 ppb in 477872H to about 60 ppb in both 477885H and 477886H. The very low content of sulphide in sample 470033 also holds for the two chip samples 477825 and 477826, which contain 147 and 104 ppb Au, respectively (Figure 6).

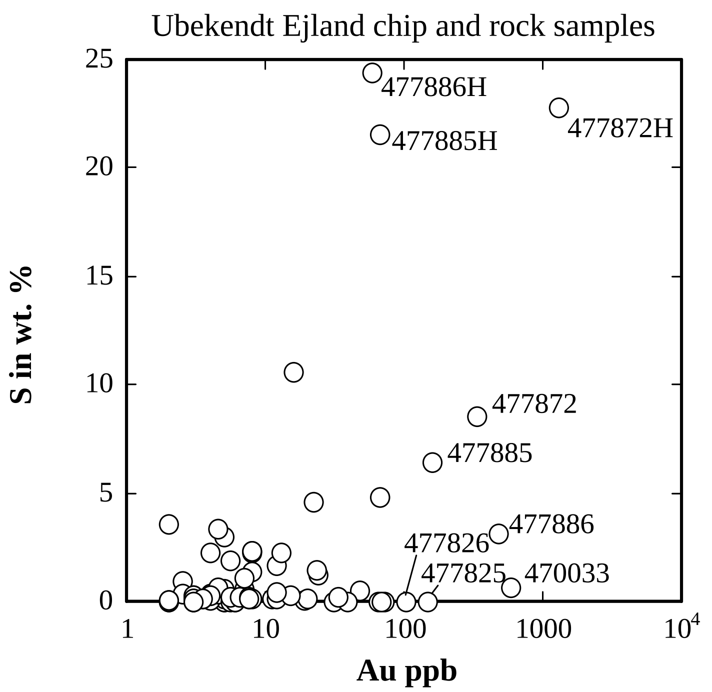

Figure 6. *Chemistry of chip and rock (grab) samples from Ubekendt Ejland in terms of S and Au. Note the logarithmic scale at the x-axis. Sample number followed by a 'H' indicates rock (grab) sample from within the chip section of the given sample number.*

The reason for the main difference between the apparent two types of Au occurrences, that is, associated *with* sulphides and *without* sulphides may be found in the state of surface weathering of a given quartz-carbonate vein. The high sulphide samples all come from fresh outcrops along the coast, and all are taken within few meters of the high tide. Because of the high erosion rate within 0–5 m of high tide, these outcrops contain fresh sulphide while outcrops just 10 m or more away from the high tide contain highly weathered sulphides or signs that sulphide has been removed by weathering. The two samples 477825 and 477826 are from a deeply weathered quartz-carbonate vein, some 1.5 km inland from the coastline and immediately west of the Saqârta Qâqâ complex. This outcrop shows deep weathering, with high contents of clay and limonite. No sulphides were observed. For sample 470033, the outcrop is as close to the high tide as the high sulphide sample sites for 477885, 477886 and 477872, but as noted above, the sample represents an approx. 0.5 m wide fault gauge and is thus intensely weathered. It is therefore likely that the Au anomalous samples without associated sulphides had their sulphide minerals removed by weathering and that all Au anomalies > 100 ppb represent a common primary type of mineralisation where Au was associated with Fe, Pb, Zn, Cu and As sulphide mineralisation.

The Au-bearing chip sample collected in 2001 (470033: running 49 ppb Au by neutron activation analysis and 585 ppb Au by fire assay) was re-chipped in 2003. This sample, 477888, was collected over about 0.75 m and had < 5 ppb Au. To allow for such discrepancy, Au must therefore be unevenly distributed in the rocks (nugget-effect). Because this was the only chip sample, which was taken twice, it is uncertain whether this uneven distribution is only associated with the fault gauge at this locality, or whether it is representative of a more widespread phenomenon.

None of the samples taken in the north-western part of the island carried noticeable amount of Au, the highest is a marcasite-rich sample with 16 Au (482266).

In terms of Ag, seven samples contain more than 2 ppm, and range from 19.5 to 101.8 ppm (Tables 1 and 2). In general the samples that contain Ag, also carry anomalous amounts of gold, which can be appreciated by inspecting Figure 7, showing a good positive correlation between Au and Ag. However, some samples with elevated Au are low in Ag (Figure 7) and indeed the samples 470033, 477825 and 477826 have < 0.3 ppm Ag. This suggests that Ag follows the sulphide minerals and therefore is removed during weathering of sulphides. This interpretation is further substantiated by the good and positive correlation between Ag and Pb (Figure 8) showing that all samples with high Ag also contain high Pb. In this context it is also worth noting that the two heavy mineral concentrate samples with anomalous Au show a similar lack of base metals (see below), probably because sulphides from the mineralisation has been removed during transport of the stream sediments.

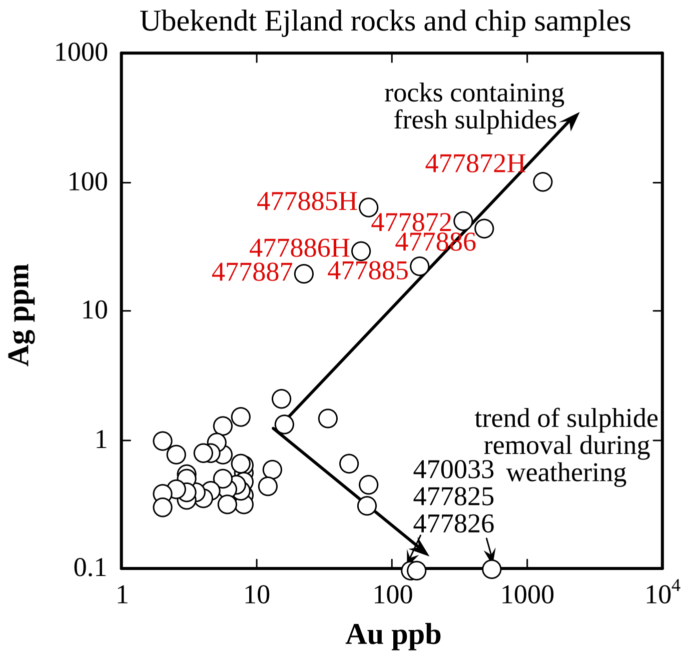

Figure 7. *Chemistry of chip and rock (grab) samples from Ubekendt Ejland in terms of Ag and Au. Note the logarithmic scale at both axes. Sample number followed by an 'H' indicates rock (grab) sample from within the chip section of the given sample number.*

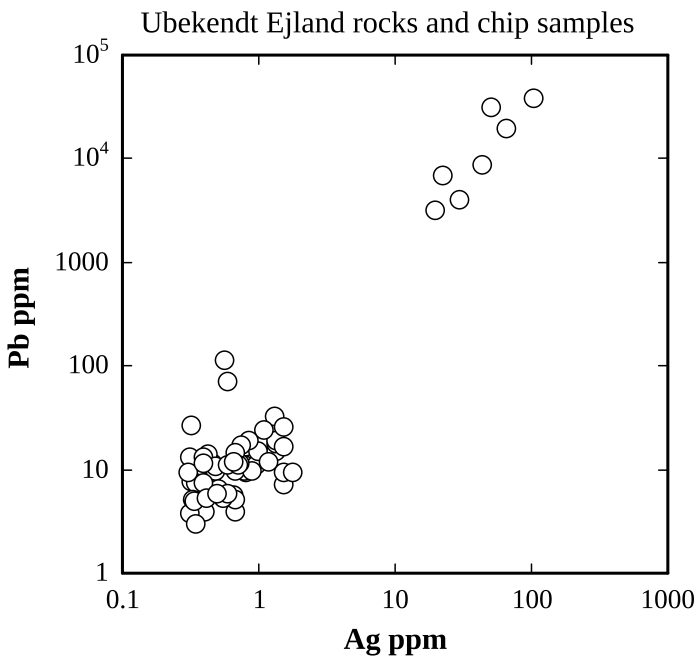

Figure 8. *Chemistry of chip and rock (grab) samples from Ubekendt Ejland in terms of Pb and Ag. Note the logarithmic scale at both axes. The positive correlation suggests that Ag is mainly hosted in sulphides.*

4.2 Base metals

As shown above, some relatively unaltered samples from shorelines on the south-eastern coast of Ubekendt Ejland contain fresh sulphides with high levels of Pb, Zn, As and Cu. In chip samples, the highest values of Pb and Zn are 31798 ppm and 9282 ppm, respectively (Table 2). As reaches values of 15800 ppm, while Cu shows a maximum of 1085 ppm.

Table 2. *Summary of chemistry of samples with high valuable metal concentrations. Full list is given in Table 1.*

	Au	Ag	As	Cu	Pb	Zn	S
Sample no.	ppb	ppm	ppm	ppm	ppm	ppm	pct.
470033	585	< 0.3	4	97	< 3	45	0.7
477872	330	50.7	15800	237	31798	1937	8.6
477886	478	43.5	14800	1085	8937	6490	3.2
477885	158	22.3	1830	575	6980	5372	6.4
477887	22	19.5	63	450	3196	9282	4.6
477872H	1300	101.8	10600	1044	38434	22422	22.8
477885H	67	64.3	202	1765	19957	1511	21.6
477886H	59	29.6	50	5910	4111	70949	24.5

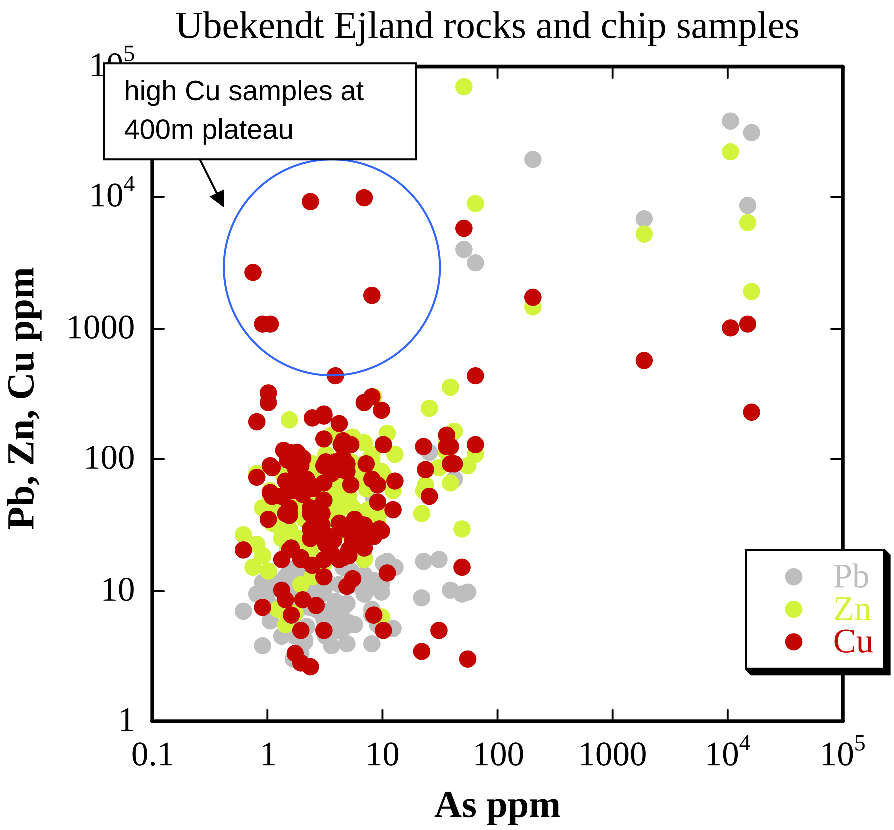

Figure 9. *Chemistry of chip and rock (grab) samples from Ubekendt Ejland in terms of Pb, Zn and Cu against As. Note the logarithmic scale at both axes. The group of samples with elevated Cu but low As reflects the presence of chalcopyrite, which may be more resistant to weathering than other base metal sulphides.*

Hand samples from vein centres return values that often are somewhat higher for Pb, Zn and Cu. In general there is a good correlation between Pb, Zn, Cu and As (Figure 9), confirming that these elements are hosted in a sulphide assemblage. However, the highest values for Cu are found in quartz-carbonate veins inland on the 400 m plateau, east of Saqqaata Qaqqaa in the samples 482251 (10320 ppm) and 482825 (9500 ppm). These samples belong to a group with elevated Cu, but low sulphur, reflecting low contents of sulphides. This is also apparent in the low concentrations of the elements As, Pb, and Zn for these samples, which plot in the high Cu, low As corner in Figure 9. It is possible that this group of high Cu, low Pb-Zn-As samples simply reflects the higher resistance of chalcopyrite to weathering.

4.3 Drainage geochemistry

Couplets of panned heavy mineral concentrates (HMC) and stream sediment samples (SS) were collected at eleven localities in two streams on southern Ubekendt Ejland and in one stream on western Ubekendt Ejland. Analysis shows scattered high gold concentrations in samples from the two streams on southern Ubekendt Ejland: 5.66 ppm Au (HMC 500653), 3.75 ppm Au and 32 ppm Ag (HMC 500657), and 66 ppb Au (SS 506264). These values are clearly anomalous in comparison with values from other surveys in the region, cf. Steenfelt *et al*. (1998) and Thomassen (1993). Furthermore, the samples are relative enhanced in chromium (max. 1.2% Cr) and nickel (max. 889 ppm Ni), probably stemming from olivine-rich basalts. Other elements show no noteworthy concentrations (Table 3).

Although the source of the gold anomalies in the drainage samples remains uncertain, these anomalies indicated that mineralisation less conspicuous than the quartz-carbonate veins exists on southern Ubekendt Ejland.

Table 3. *Geochemical summary of selected elements for drainage samples showing range and median. SS= Stream sediment sample; HMC= Heavy mineral concentrate.*

Type **Area**	**Au ppb**	**Cu ppm**	**Pb ppm**	**Zn ppm**	**S ppm**	**Samples**
SS Southern U.E.	< 2–66 < 2	90–105 100	< 3–7 5	75–97 80	110–200 140	7
HMC Southern U.E.	< 5–5660 < 5	33–402 59	2–11 4	37–51 47	70–320 190	7
SS Western U.E.	< 2	104–118 112	3–8 6	80–86 82	210–370 260	4
HMC Western U.E.	< 5–11 < 5	78–220 93	4–7 7	42–56 54	40–680 270	4

4.4 Stable isotopes of carbonate

Carbonate samples from the Ubekendt Ejland and Amdrup Fjord quartz-carbonate veins were measured for oxygen and carbon isotopic composition at Stable Isotope Biochemistry Laboratory at Stanford University, California, following the method described by Rogers *et al.* (2006). A total of 12 and 15 samples were measured from Ubekendt Ejland and Amdrup

Fjord vein systems, respectively. The data is presented in Table 4 and is discussed in section 6.2.

Table 4. *Carbon- and oxygen-isotopic composition of carbonates from quartz-carbonate veins on Ubekendt Ejland and at Amdrup Fjord.*

Sample no.	**Sample detail**	$\delta^{13}C_{(PDB)}$	$\delta^{18}O_{(SMOW)}$
Ubekendt Ejland veins:		‰	‰
UB1	veins at location UE0311	-2.1	7.6
UB2A	veins at location UE0311	2.0	6.5
UB2B	veins at location UE0311	2.4	7.2
UB2C	veins at location UE0311	2.4	6.5
UB3	veins at location UE0311	-2.0	4.1
UB4A	veins at location UE0311	2.5	7.0
UB4B	veins at location UE0311	-2.1	6.2
477872Vca	vein at location UE0320	0.1	7.2
477833ca	vein at location UE0330	-0.8	10.0
477826ca	vein at location UE0329	2.1	6.0
UB4c	veins at location UE0311	-1.1	5.1
UB5	veins at location UE0311	0.2	3.9
Amdrup Fjord veins:			
456416		-2.1	4.8
456416	duplicate	-2.1	4.8
456417		0.3	8.3
456417	duplicate	0.4	8.1
456419		-4.3	4.9
456419	duplicate	-4.2	4.9
456422		-2.6	3.8
456422	duplicate	-2.6	4.0
456425		-1.3	6.2
456425	duplicate	-1.4	6.1
456441		-0.4	16.7
456441	duplicate	-0.4	16.8
456463		-3.7	6.3
456463	duplicate	-3.9	6.9
456471A		-4.5	5.5
456471A	duplicate	-4.5	5.5
456471B		-1.8	4.5
456471B	duplicate	-1.9	4.5
456501		-0.6	3.9
456501	duplicate	-0.6	3.8
456502		-1.0	3.6
456502	duplicate	-0.9	3.6
456522		-0.9	4.4
456522	duplicate	-1.1	4.6
456527		-5.4	7.6
456527	duplicate	-2.7	7.7
456535		-5.7	12.3
456535	duplicate	-5.8	12.3
56804		-0.3	6.2
456804	duplicate	-0.3	6.2

4.5 Organic matter in quartz-carbonate breccia

Crusts of black amorphous matter from fractures and voids in two samples of mineralised quartz-carbonate vein breccia from Ubekendt Ejland were investigated in GEUS' Laboratory for Organic Geochemistry and Petrology (location 0404, samples 482817, 55). The black material was recovered from the samples by scraping with a surgeon's scalpel and subjected to TOC/Rock-Eval screening analyses, solvent extraction and subsequent gas chromatographic analysis of saturated extract fractions. Moreover, the black material was mounted in epoxy resin, and polished block samples were prepared for visual inspection using incident light microscopy.

4.5.1 Results and discussion

Absolute values of Total Carbon (TC), Total Sulphur (TS) and Total Organic Carbon (TOC) (Table 5) are of little significance, since the method for recovery of the black matter will lead to the presence of varying and unpredictable proportions of minerogenic matter. However, the results clearly show that the black crusts are carbonaceous, probably consisting of highly fused organic matter such as thermally degraded bitumen.

Table 5. *TOC/Rock-Eval*

Sample	TC (%)	TOC (%)	TS (%)	Tmax (°C)	S1 (mg/g)	S2 (mg/g)	Hydrogen Index
482817	76.5	74.4	0.7	518	1.4	38.5	52
482855	22.9	18.2	0.2	604	0	0.9	5

Table 6. *Solvent extraction and gas chromatography*

Sample	Recovery (mg/g TOC)	Asphaltenes (% of extract)	Saturates (% maltenes)	Aromatics (% maltenes)	NSO (% maltenes)
482817	0.08	14.8	22.2	2.8	75
482855	0.4	21.7	54.3	17.1	28.6

Extraction yields are extremely low, but the extract compositions hint at a petroleum origin of the carbonaceous material by containing relatively high proportions of hydrocarbons (Table 6). Gas chromatograms of the saturate extract fractions show a hump of unresolved material, with its apex approximately at the elution position of nC_{21}, and a few recognisable n-alkanes and acyclic isoprenoids riding on the hump, primarily in the carbon number range $< nC_{22}$. Pristane/phytane ratios are low but unreliable due to evaporative losses. Incident light microscopy shows that the organic matter has the appearance of thermally degraded bitumen, showing fairly high reflectivity and often containing abundant minute mineral fragments and numerous vesicles or gas bubbles, sometimes showing alignment as if indicating plastic flow in the medium (Figure 10). Occasionally, flow structures can be directly observed in the particles, and the use of cross-polarised light may enhance clarity of the structures (Figure 11). Moreover, the use of cross-polarised light will sometimes allow the observation of a faint ”mosaic structure”, a feature that is characteristic of cokes. Such structures are usually produced by coking of coal at very high temperatures, i.e. up to several hundred degrees Celsius. No sign of fluorescence whatsoever has been observed in the bitumen, testifying to the high level of thermal degradation.

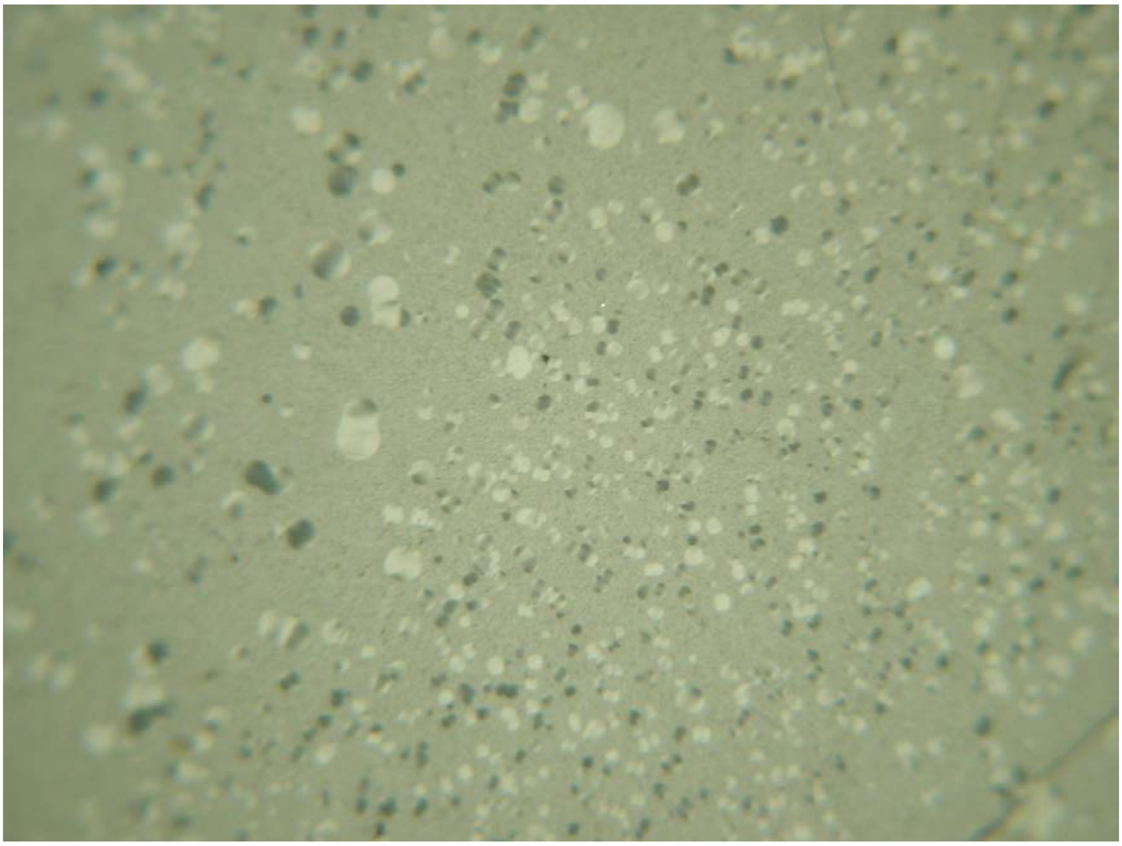

Figure 10. *Grey bitumen with abundant minute mineral-inclusions and vesicles/gas bubbles. Note faint alignment of vesicles diagonally across the field. Sample 482817, polarized white light. Horizontal width of field is approximately 500 microns.*

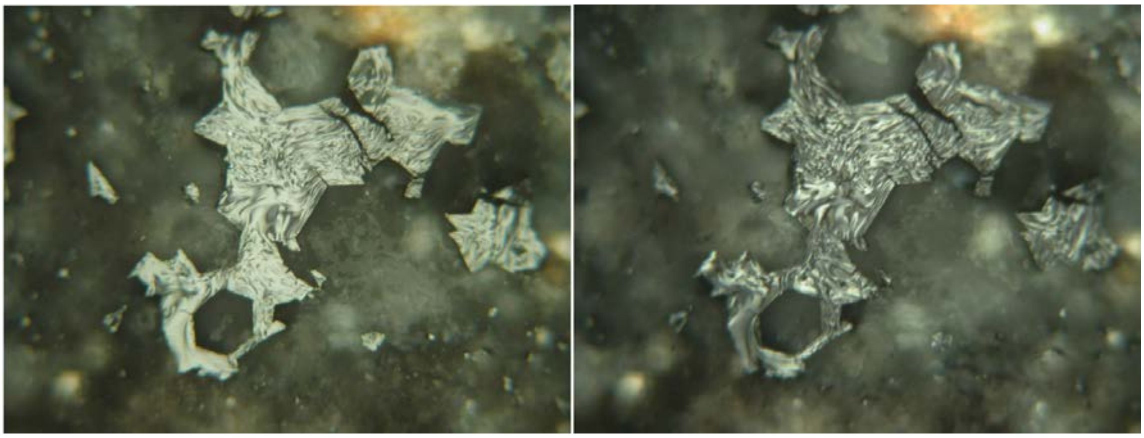

Figure 11. *Flow structures in bitumen, sample 482855. Left, polarised light; right, cross-polarised light. Horizontal width of field is approximately 500 microns.*

The organic matter is identified as pyrobitumen that probably represents a petroleum charge that has been degraded at high temperatures. At present it is not clear whether the petroleum charge was present prior to formation of the mineralisation or emplaced during the process of mineralisation. The structures observed by microscopy, and the highly fused nature of the bitumen point to very high temperatures, probably in the order of several hundred degrees Celsius.

5 Epithermal veins at Amdrup Fjord, southern East Greenland

The epithermal quartz-carbonate veins of Ubekendt Ejland share many characteristics with epithermal veins in the Palaeogene East Greenland basalt province. Quartz-carbonate veins occur over 100–200 km along the coast of southern East Greenland; they are in general poorly known, and have only been investigated at reconnaissance level in a small area north of Amdrup Fjord (Figure 12).

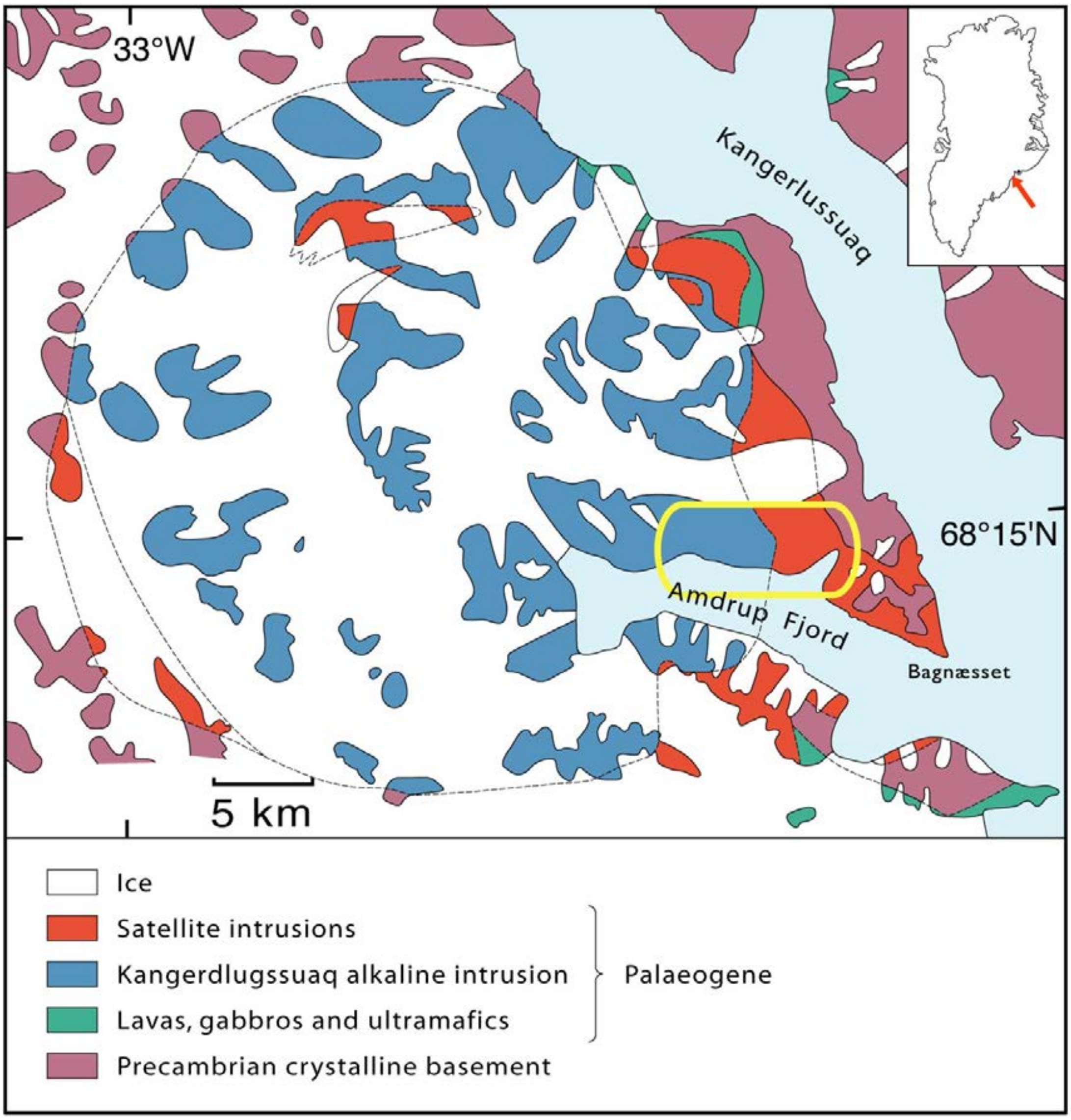

Figure 12. *Location of Amdrup Fjord epithermal vein systems at the south-eastern flank of the Kangerdlugssuaq alkaline intrusion, East Greenland. The sampled area is encircled in yellow. Modified after Thomassen & Krebs (2001b).*

The Amdrup Fjord area is situated at the southern margin of the East Greenland basalt province (Brooks *et al.* 1982; Nielsen 1987). It consists of crystalline basement rocks of late Archaean, mostly quartzo-feldspathic gneisses, and is intruded by the Kangerdlugssuaq complex consisting of the *c.* 50 Ma Kangerdlugssuaq alkaline intrusion and a number of both older and younger satellite intrusions (Kempe *et al.* 1970). The approx. 700 km^2 Kangerdlugssuaq alkaline intrusion consists of concentric zones with gradational contacts of quartz syenite at the outside through syenite to nepheline syenite at the centre. The satellite intrusions include a variety of syenites and granites. The presumed youngest intrusive rocks comprise the 39.6 Ma sub-volcanic Flammefjeld complex that is intruded into quartz syenites at the contact between the Kangerdlugssuaq alkaline intrusion and younger satellite intrusions (Geyti & Thomassen, 1984; Brooks *et al.*, 2004). The Flammefjeld complex comprises a breccia pipe intruded by quartz porphyries and surrounded by a halo of hydrothermal alteration and distal hydrothermal veins.

Stockwork-type molybdenum mineralisation is known from granitic breccia fragments of the Flammefjeld breccia pipe, and the existence of a blind 'Climax-type' porphyry molybdenum deposit at 300–500 m a.s.l. below Flammefjeld has been suggested (Geyti & Thomassen, 1984). Base metal-bearing quartz-carbonate veins with significant gold-silver concentrations occur in both the syenitic and gneissic parts of the area within a distance of 5 km from Flammefjeld; some 40 *in situ* localities with this type of mineralisation have been cursorily investigated by Thomassen and Krebs (2001a, b).

The mineralised veins generally have widths in the cm–dm range. However, a few vein systems have widths in the metre range, and can be followed over distances of several hundreds of metres. The veins are typically located along cross-cutting mafic dykes and developed as breccia fillings and crustifications of epithermal character, often displaying vuggy and colloform structures (cockade structures). Gangue minerals are quartz, Ca-Mg-Mn-Fe-carbonates including rhodochrosite, and occasionally fluorite and barite. Galena is the most common ore mineral, followed by pyrite and sphalerite. Copper minerals (chalcopyrite and tetrahedrite-tennantite) are less common and arsenopyrite occurs sporadically. Gold occurs as electrum in association with the sulphide minerals. The sulphides occur as massive lenses and irregular seams of cm-thickness, and disseminated. Total sulphide concentrations rarely exceed 1% over the full width of the veins. The wall rocks exhibit silicification, carbonatisation, kaolinisation and sericitisation, with propylitic alteration of the mafic dykes.

Analyses of 130 mineralised chip- and grab-samples collected by Thomassen and Krebs (2001b) are reproduced in Table 7 on the enclosed CD. They indicate the following metal concentrations in the veins: Gold concentrations above 1 ppm are recorded in 12% of the samples with a maximum value of 38 ppm Au. Enhanced gold values are often associated with copper, arsenic and bismuth. The Ag/Au ratio is about 200, and the overall distribution of gold and silver indicates that elevated values occur within a distance of 3–4 km from Flammefjeld. Silver concentrations above 100 ppm occur in 15% of the samples; the maximum value recorded is 1193 ppm Ag. Silver correlates well with lead. The frequency of base metals is Pb > Zn > Cu. Lead values above 1% were returned from 25% of the samples, zinc values above 1% were returned from 17%, and copper values above 1% were returned from 5%. The mineralisation is also characterized by relatively high manganese concentrations, and occasionally elevated arsenic, antimony, molybdenum and bismuth.

Although veins are distributed over a vertical distance of 800–900 m, no general hydrothermal zoning centred on Flammefjeld has been observed for the vein-type mineralisation, apart from proximal copper–distal lead-zinc indicated in some veins. This may be due to insufficient data or to telescoping of ore zones. The mineralisation appears to be epithermal gold-silver veins of low-sulphidation type and a genetic relationship with the porphyry-type molybdenum deposits below Flammefjeld has been proposed by Thomassen and Krebs (2001a, b).

6 Discussion

6.1 Chemical correlation between Ubekendt Ejland and Amdrup Fjord mineralisation

It is useful to consider the mineralisation on Ubekendt Ejland and at Amdrup Fjord in terms of their chemical characteristics (data from Ubekendt Ejland samples in Table 1, and from Amdrup Fjord in Table 7). In Figures 13 and 14 it is evident that Au anomalies correlate positively with both As and Ag. The exception is a set of highly weathered samples from Ubekendt Ejland that, as discussed above, probably suffered from complete decomposition of their primary sulphide assemblage. The considerably lower base levels of As and Ag in Ubekendt Ejland vein samples are probably due to the discussed weathering process, and reflect leaching of their primary sulphide assemblages.

Pyrite is a main sulphide phase in the Amdrup Fjord quartz-carbonate veins. This is reflected in the correlation of Fe against S (Figure 15) while pyrite, marcasite and pyrrhotite are only common in the relatively few unaltered vein samples from Ubekendt Ejland. The lower sulphur content in most Ubekendt Ejland samples for a given Fe value thus again shows the altered nature of these quartz-carbonate veins. Samples with high Fe and low S (less than 0.1 wt. %) combine contributions of Fe from limonite and other Fe-bearing phases after breakdown of Fe-sulphides, and contributions from carbonates such as ankerite.

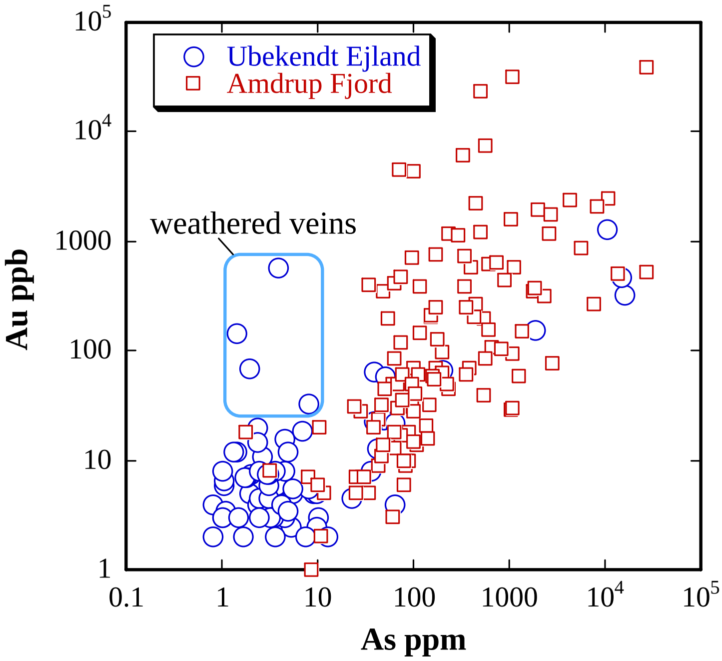

Figure 13. *Chemistry of chip and rock (grab) samples from Ubekendt Ejland and Amdrup Fjord in terms of Au against As. Note the logarithmic scale at both axes.*

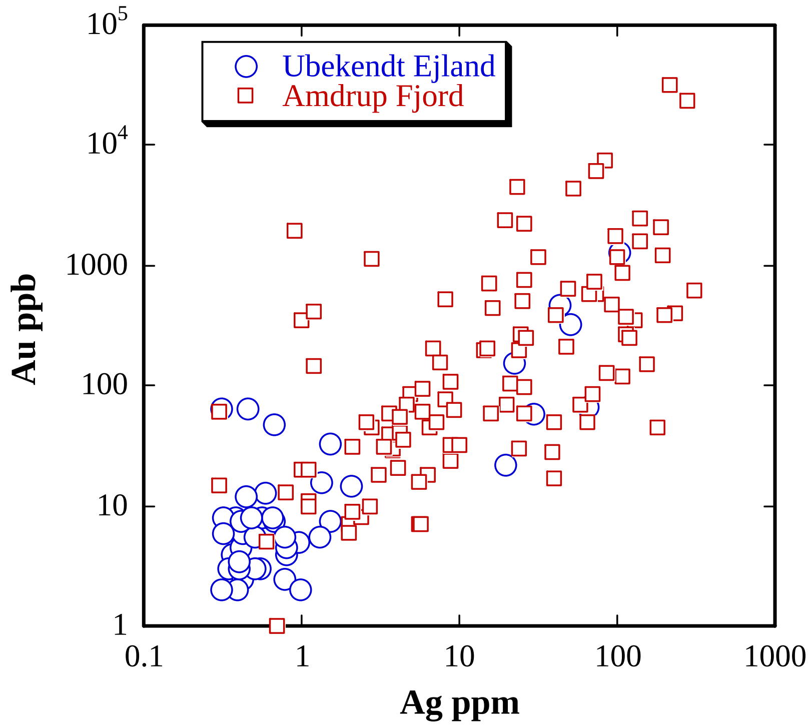

Figure 14. *Chemistry of chip and rock (grab) samples from Ubekendt Ejland and Amdrup Fjord in terms of Au against Ag. Note the logarithmic scale at both axes,*

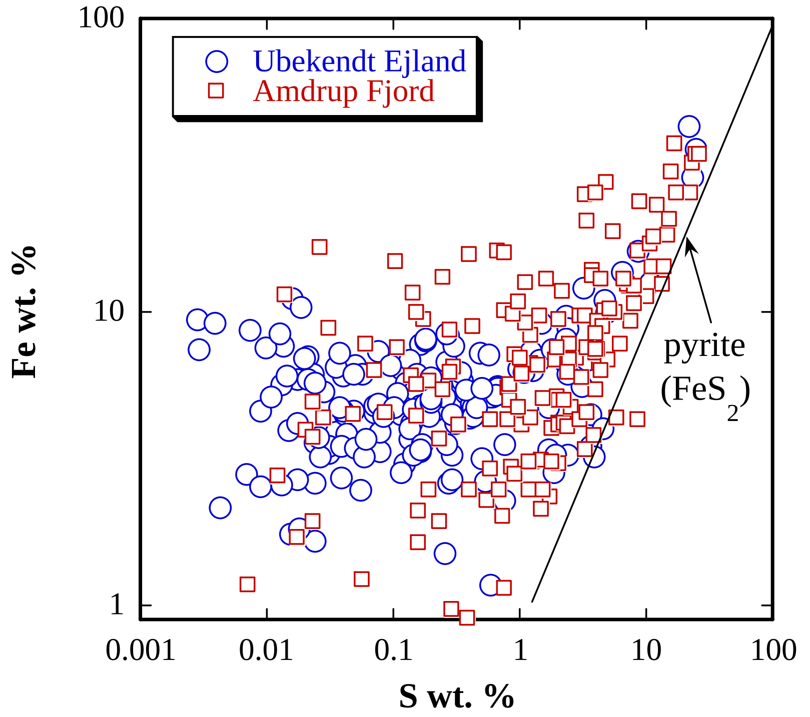

Figure 15. *Chemistry of chip and rock (grab) samples from Ubekendt Ejland and Amdrup Fjord in terms of Fe against S. Note the logarithmic scale at both axes. Samples of Amdrup Fjord mineralisation are rich in fresh pyrite while Ubekendt Ejland is dominated by altered sulphides (low S) and remaining iron present mostly as limonite and in carbonate.*

Unaltered samples from Ubekendt Ejland are very similar to samples from Amdrup Fjord with respect to Pb, Zn and Cu against As (Figures 16–18, respectively), with the highest values of Ubekendt Ejland samples (unaltered) falling amongst the high values from Amdrup Fjord veins. The group of high Cu and low As in Ubekendt Ejland vein samples is again attributed to their altered nature and the higher resistance of chalcopyrite to weathering. With respect to Mo, Amdrup Fjord veins are different from Ubekendt Ejland veins in having high As with high Mo values (Figure 19). Samples from Ubekendt Ejland with high As have low to very low Mo. A few samples from Ubekendt Ejland have elevated Mo (some tens of ppm Mo) but always with very low As (1–10 ppm) while samples with similarly high Mo from Amdrup Fjord have As from 70–> 10000 ppm. The group of samples from Ubekendt Ejland with elevated Mo comes from the brecciated volcanic neck of Ivnaa, north of Eqqua (482284, locality 0418, Figure 1) and from quartz-carbonate veins close to the Sarqâta Qaqqâ complex in the south of the island. The higher level of Mo in Amdrup Fjord samples most likely reflects the proximity of the Flammefjeld porphyry Mo deposit, and the availability of this element in the mineralising hydrothermal fluids.

With the exception of Mo, the chemical data presented and discussed above suggests that the base metal sulphide mineralisation in Ubekendt Ejland and Amdrup Fjord are very similar. This also suggests that the associated Au mineralisation in Ubekendt Ejland and in Amdrup Fjord originate from hydrothermal fluids that were associated with the emplacement of granitoid complexes.

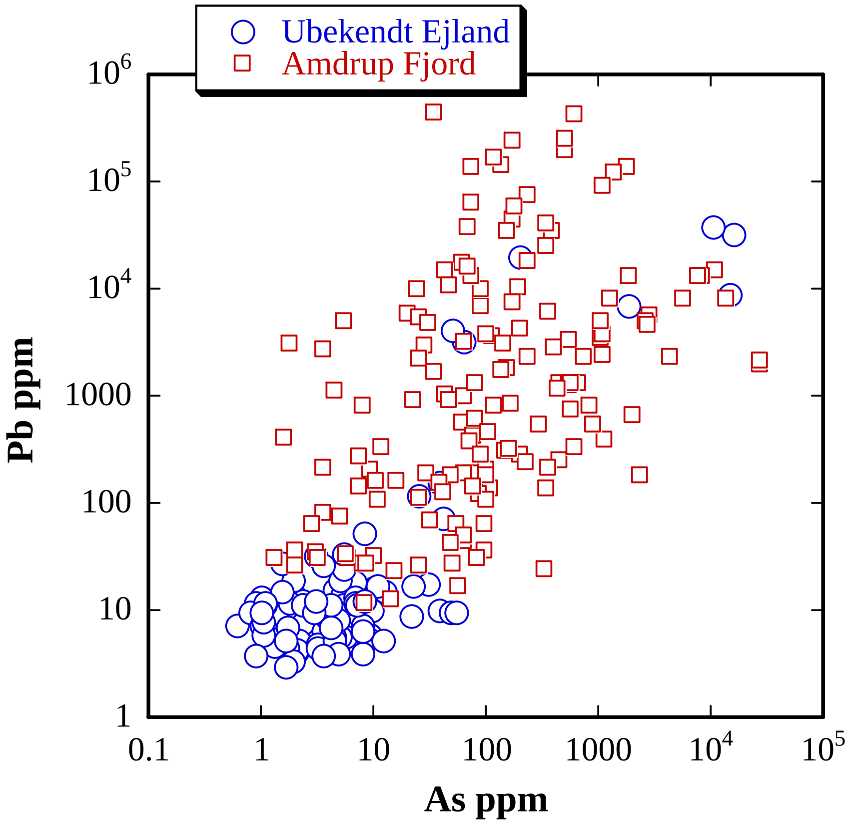

Figure 16. *Chemistry of chip and rock (grab) samples from Ubekendt Ejland and Amdrup Fjord in terms of Pb against As. Note the logarithmic scale at both axes.*

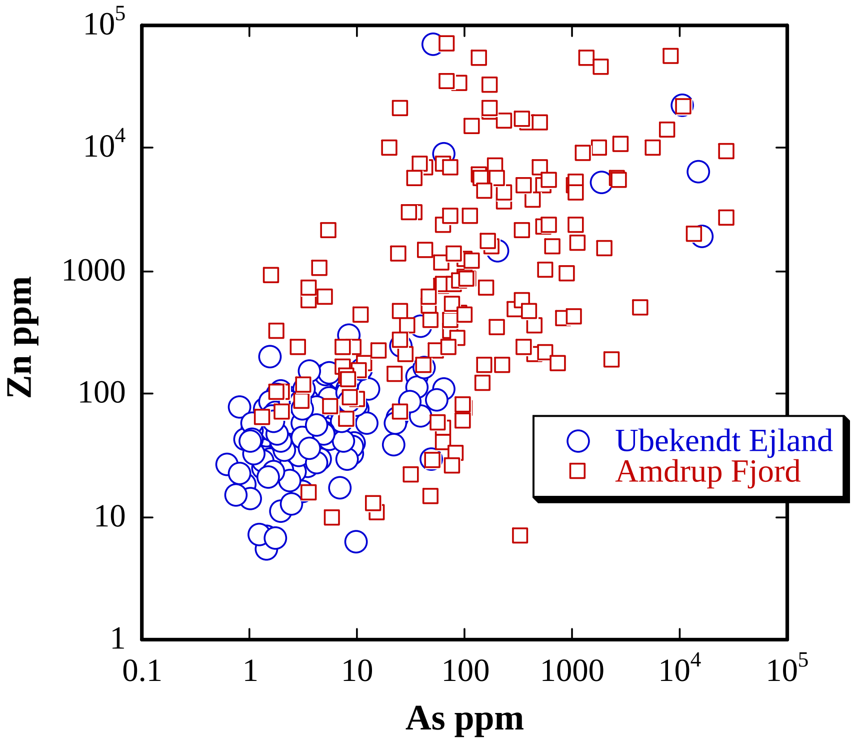

Figure 17. *Chemistry of chip and rock (grab) samples from Ubekendt Ejland and Amdrup Fjord in terms of Zn against As. Note the logarithmic scale at both axes.*

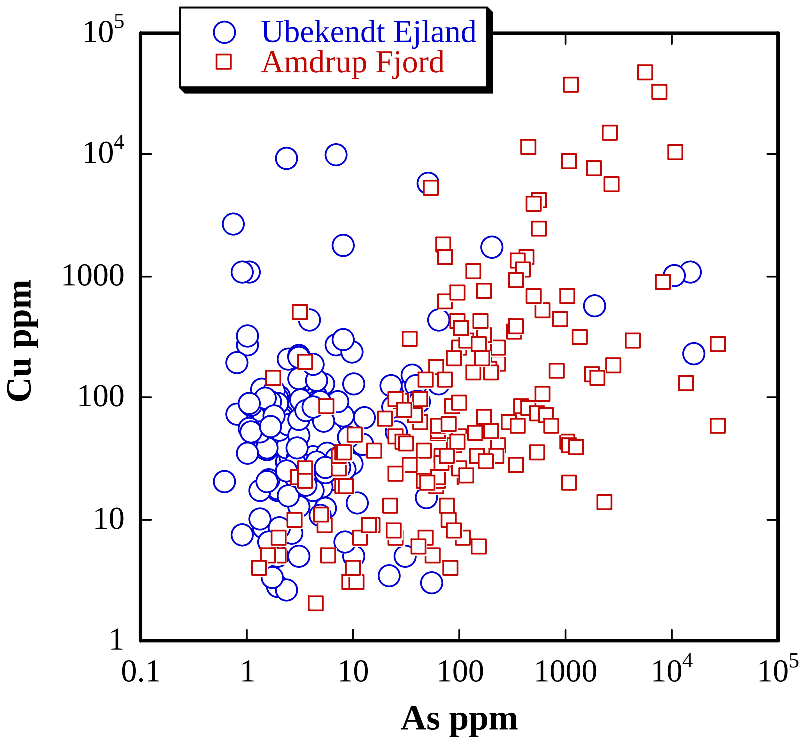

Figure 18. *Chemistry of chip and rock (grab) samples from Ubekendt Ejland and Amdrup Fjord in terms of Cu against As. Note the logarithmic scale at both axes.*

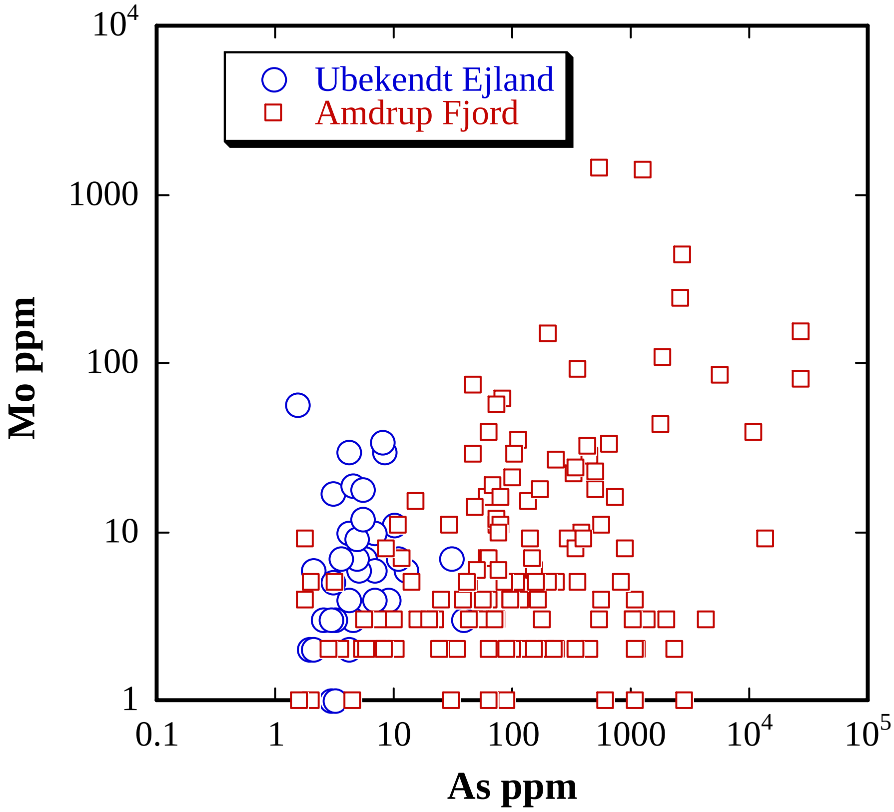

Figure 19. *Chemistry of chip and rock (grab) samples from Ubekendt Ejland and Amdrup Fjord in terms of Mo against As. Note the logarithmic scale at both axes. Ubekendt Ejland samples are invariably low in Mo compared to samples from Amdrup Fjord.*

6.2 Oxygen and carbon isotopes

Oxygen and carbon isotopic composition for carbonates from Ubekendt Ejland and Amdrup Fjord quartz-carbonate veins are presented in Table 4 and Figure 20 in terms of ‰ $\delta^{18}O_{(SMOW)}$ and $\delta^{13}C_{(PDB)}$. Veins from Ubekendt Ejland have $\delta^{13}C_{(PDB)}$ of ≈ 0‰±2 and $\delta^{18}O_{(SMOW)}$ of 3.9–10.0‰, while the measured veins from Amdrup Fjord have slightly lower $\delta^{13}C_{(PDB)}$ (0.4 to –5.8‰) and similar $\delta^{18}O_{(SMOW)}$ of between 3.8 and 8.3‰. Two Amdrup Fjord samples are exceptions to this, namely samples 456535 and 456441 with markedly heavier $\delta^{18}O_{(SMOW)}$ of 12.3‰, and 16.8‰, respectively.

Overall, the two occurrences of hydrothermal quartz-carbonate veins on Ubekendt Ejland and in Amdrup Fjord area have surprisingly similar stable isotopic compositions considering the differences in the local geology. As described in detail above, Ubekendt Ejland veins are hosted by altered mafic lavas, which in turn rest on Cretaceous clastic sediments, being mainly shales and probably arkosic sandstones. Amdrup Fjord veins are hosted by Archaean basement gneisses and Palaeogene syenitic intrusives (see section 5). The similarity in stable isotope composition for calcite from Ubekendt Ejland and Amdrup Fjord veins suggests that the source of the mineralising fluids was of similar origin. In a study of the

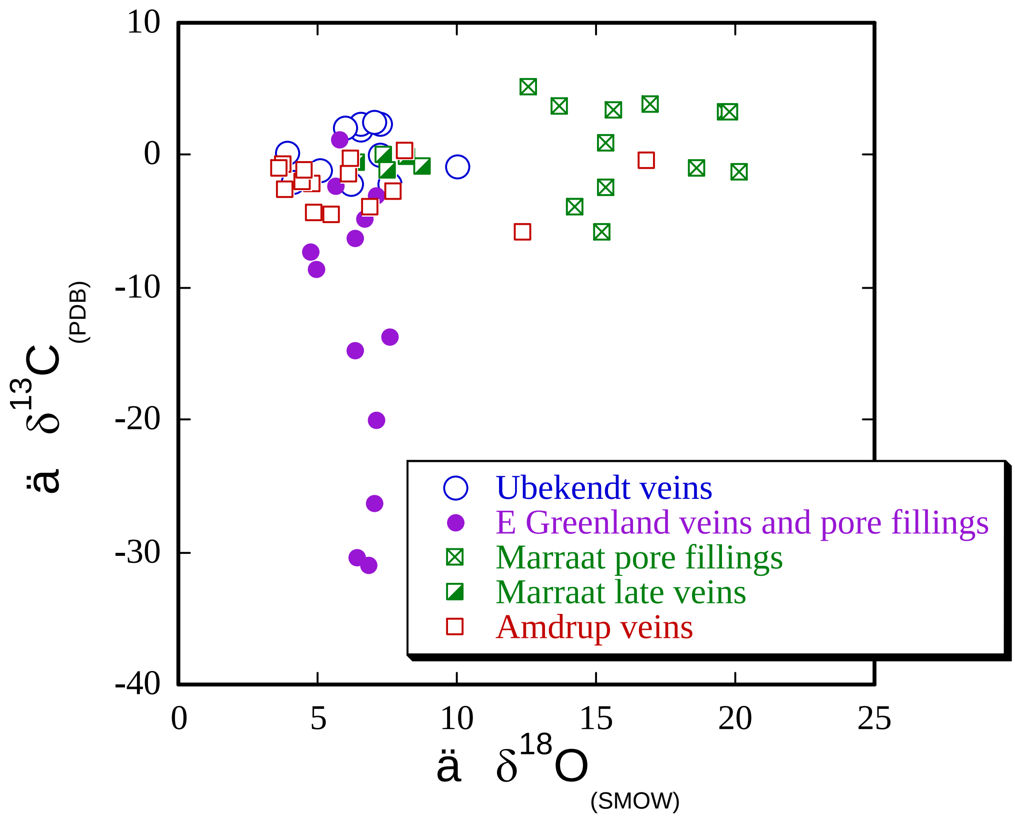

Figure 20. *Isotopic compositions of oxygen and carbon in carbonates from quartz-carbonate veins on Ubekendt Ejland and in Amdrup Fjord area. Precision is about 0.2‰ for both $\delta^{18}O_{(SMOW)}$ and $\delta^{13}C_{(PDB)}$. For comparison is also shown isotopic compositions of carbonates from early pore fillings and veins at Marraat (displaced towards more heavy oxygen) and late veins from Marraat which are similar to samples of vein carbonates from Ubekendt Ejland and from Amdrup Fjord. Purple circles represent carbonates from Lower Lava Formation in the East Greenland flood basalt province (data from Rogers et al., 2006).*

low-grade metamorphism of basalts from Marraat on Nuussuaq peninsular south of Ubekendt Ejland, Rogers *et al.* (2006) identified late generations of carbonate veins with $\delta^{18}O_{(SMOW)}$ and $\delta^{13}C_{(PDB)}$ values largely identical of those of Ubekendt Ejland and Amdrup Fjord (Figure 20). Rogers *et al.* (2006) interpreted these veins from Marraat to have formed at temperatures around 100°C from fluids originating from meteoric water which interacted with basalts. The $\delta^{13}C_{(PDB)}$ of around 0‰ of the veins is considered due to equilibration with atmospheric CO_2. In the Amdrup Fjord area there are only a few remnants of a former basaltic cover, but considering the abundant basaltic xenoliths in the roof zone of the Kangerdlugssuaq alkaline complex at least 1000 m of basaltic lava flows were overlying the highest elevations at Amdrup Fjord. It is therefore plausible that quartz-carbonate veins from Ubekendt Ejland and Amdrup Fjord formed from fluids with similar histories as those forming late hydrothermal veins at Marraat. Alternatively, if the Ubekendt Ejland and Amdrup Fjord veins originated from magmatic fluids (with $\delta^{18}O_{(SMOW)}$ of around 5.5‰) the quartz-carbonate veins formed at considerably higher temperatures, requiring > 300°C.

The higher $\delta^{18}O_{(SMOW)}$ values for early carbonate pore fillings associated with bitumen for Marraat (Figure 20) are thought to reflect fluids originating in brines from the underlying sedimentary basin. The lack of an underlying sedimentary basin at Amdrup Fjord area suggests that the two Amdrup Fjord carbonate samples that plot within this field of elevated (> 10‰) $\delta^{18}O_{(SMOW)}$ values must have formed from fluids with a different history than the Marraat pore fillings with similarly high $\delta^{18}O_{(SMOW)}$. If the two Amdrup Fjord samples with elevated $\delta^{18}O_{(SMOW)}$ were to form from fluids of meteoric origin, a temperature as low as 50°C is required, whereas if formed from magmatic fluids, at least 200°C is required (Rogers *et al.*, 2006).

The large negative $\delta^{13}C_{(PDB)}$ values for carbonates from veins and pore fillings from the Lower Lava Formation in East Greenland are probably a sign of oxidative biodegradation of hydrocarbons in the source of these mineralising fluids (Rogers *et al.*, 2006). Carbonates from Ubekendt Ejland show $\delta^{13}C_{(PDB)}$ values around 0‰, and therefore no obvious link to possible migrating hydrocarbons.

Since temperature constraints from fluid inclusion studies are not available, our conclusion is that quartz-carbonate veins on Ubekendt Ejland and in Amdrup Fjord area probably formed from fluids with a similar history either as low-temperature (50–100°C) precipitation from fluids of largely meteoric origin, or at elevated temperatures (> 2–300°C) from fluids of magmatic origin. The latter is in accordance with the findings of highly degraded hydrocarbons in some Ubekendt Ejland veins, reflecting temperatures in excess of 200°C. However, studies of hydrothermal alteration of Early Palaeogene igneous rocks, including lavas and intrusives suggest that the main source for hydrous fluids was H_2O of meteoric origin (Fehlhaber & Bird, 1991; Nevle *et al.*, 1994).

Large, economic Au-Ag epithermal mineral occurrences such as the extensive Carlin-type mineralisation in Nevada, USA, commonly show evidence for a meteoric origin of the mineralising fluids (e. g. John *et al.*, 2003; Emsbo *et al.*, 2003). Some of these large occurrences appear to have formed in very shallow systems, often within the top few hundred meters of the surface (John *et al.*, 2003), in zones dominated by amorphous silica and carbonate and at temperatures < 200°C.

6.3 Comparison between the veins at Ubekendt Ejland and Amdrup Fjord

Epithermal veins are of shallow crustal origin (< 1–2 km), generally associated with subduction-related magmatism, and often show vertical zoning of alteration and ore minerals as the result of a thermal gradient. In many epithermal deposits, the Ag/Au ratio changes with depth (Ag/Au increases) and there is a spatial separation of noble and base metals. Furthermore, epithermal lead-zinc ores may be zoned from deeper copper mineralisation, as seen in proximal to distal porphyry environments. Epithermal and porphyry ore deposits are generally separated by barren gaps ranging from tens to several hundred metres, but epithermal deposits may be telescoped over intrusion-hosted mineralisation. A marked ^{18}O depletion of wall rocks is characteristic for epithermal deposits.

Epithermal deposit can be subdivided in two or three principal types (and several subtypes), based on the sulphidation states of their hypogene sulphide assemblages: high-sulphidation and low-sulphidation deposits; or high-sulphidation, intermediate-sulphidation and low-sulphidation deposits, see overview in Sillitoe and Hedenquist (2003). Due to our restricted data set, we shall stick to the twofold division.

High-sulphidation deposits are formed by low pH ore-forming fluids and characterised by enargite-pyrite +/- covellite and quartz-(kaolinite)-alunite alteration. Low-sulphidation deposits are formed by near neutral pH ore-forming fluids and characterised by chalcopyrite-tetrahedrite-pyrite and adularia-sericite alteration.

In low-sulphidation deposits, gold typically occurs as electrum or more rarely as tellurides in association with acanthite, silver-sulfosalts, base metal sulphides, and pyrite. Low-sulphidation precious metal deposits characterised by the presence of appreciable molybdenum contents may overlie porphyry molybdenum systems (Sillitoe, 1993). This seems to be the case at Amdrup Fjord. Low-sulphidation deposits may be related to bimodal volcanism and rifting generated by hot-spot (possibly mantle-plume) activity, e.g. the northern Nevada rift, a product of back-arc extension related to the Yellowstone hot-spot. Another example is Patagonian Argentina, where northwest-striking half-grabens presaging the opening of the south Atlantic Ocean can be related to mantle-plume activity (Sillitoe & Hedenquist, 2003).

Most epithermal deposits are spatially related to convergent plate boundaries and the preferred association is with andesitic, dacitic and rhyolitic centres rather than basaltic. According to Sillitoe and Hedenquist (2003), most low-sulphidation epithermal deposits are confined to bimodal magmatic suites (basalt-rhyolite) in and around rifts generated during intra-, near-, and back-arc extension, as well as in post-collisional settings. However, these authors stress that there are many types of extensional settings, some of which appear to be unrelated to subduction environments and the generation of high-alumina basalt. Such settings instead point to regions of oceanic spreading (e.g. Iceland-type), or plume-related volcanism with unrecognised potential for high-grade, low-sulphidation vein gold deposits. The epithermal veins of Ubekendt Ejland and Amdrup Fjord occur in such a setting and thus may represent examples of potential Au deposits in epithermal veins related to rifted continental margins.

Based on a lead isotopic study of the East Greenland basalt province, Jensen (1998) concluded, that both igneous rocks and sulphide deposits acquired their lead isotope characteristics by contamination of North Atlantic MORB mantle- or Iceland mantle plume-derived magmas with lead remobilised from local continental crust. Jensen (1998) also states that more than one-half or so of the well-homogenized lead from mineralised Amdrup Fjord samples appears to be derived from local Archaean crust.

Some characteristic epithermal features from the two Palaeogene basalt provinces of Greenland are summarised in Table 8. It appears that the veins are similar in many respects and fit in with most of the epithermal low-sulphidation characteristics, but some deviations are evident:

- The plate tectonic setting - a rifted continental margin - is the same for the two provinces. It thus differs from the subduction-related settings of typical epithermal deposits, as known from Au-Ag mines in e.g. South America, but is perhaps similar to Carlin-type Au-Ag deposits in western USA.
- Host rocks differ between the two provinces.
- The kaolinite wall-rock alteration occurring at Amdrup Fjord could indicate a high-sulphidation environment, but it is probably due to supergene alteration (acid leaching).
- The gangue at Amdrup Fjord carries rhodochrosite, fluorite and barite, which is not the case on Ubekendt Ejland.
- The amount and variation of ore minerals are larger at Amdrup Fjord than on Ubekendt Ejland.
- Concentrations of precious- and base-metals are larger at Amdrup Fjord than on Ubekendt Ejland. However, this may in part be accounted for by the larger degree of alteration of the veins at Ubekendt Ejland.
- Stable isotope compositions are similar in carbonates from Ubekendt Ejland and Amdrup Fjord vein systems, with mineralising fluids likely of meteoric origin.
- Evidence of several stages of quartz-precipitation and dissolution in Ubekendt Ejland vein systems suggests a long and complex history with fluids of contrasting temperatures and likely contrasting pH. It suggests that possible Au-Ag occurrences have been mobilized, perhaps to more shallow levels, and subsequently eroded away.

Table 8. *Summary of geological characteristics for the epithermal veins of Ubekendt Ejland and Amdrup Fjord (Thomassen & Krebs, 2001b). Geological parameters characterising low-sulphidation deposits selected from Sillitoe (1993) and Taylor (1996).*

	Ubekendt Ejland	**Amdrup Fjord**	**Low-sulphidation deposits**
Geological setting	Rifted continental margin. Spatially related to intrusive centre; veins in major faults	Rifted continental margin. Spatially related to intrusive centre; veins in faults	Ark and back-ark settings. Spatially related to intrusive centre; veins in major faults
Host rocks	Mafic to ultramafic lavas	Quartz syenite, mafic dyke, quartzo-felspatic gneiss	Intermediate to sillicic intrusive/extrusive rocks
Principal gangue structures	Crustiform, colloform; open- space filling	Crustiform, colloform, cockade; open- space filling	Crustiform, colloform, bladed, cockade; open-space filling
Carbon isotopes in carbonates	Equilibrated with atmospheric CO_2?	Equilibrated with atmospheric CO_2?	C typically indicate a magmatic source
$^{18}O/^{16}O$-shift in wall rocks	Large	Unknown	Moderate to large
Alteration minerals	Quartz, carbonates, sericite	Quartz, carbonates, kaolinite, sericite	Sericite/illite, adularia, roscoelite
Quartz gangue	Quartz, chalcedony	Quartz, chalcedony	Chalcedony, quartz
Carbonate gangue	Ca-Mg carbonates	Ca-Mg-Mn-Fe carbonates	Ubiquitous, commonly manganoan
Other gangue	Pyrobitumen	Fluorite, anhydrite, barite present locally	Barite, fluorite present locally
Ore mineral-gangue relations	Disseminated, veinlets, massive	Massive bands, disseminated, colloform, veinlets	Disseminated, massive bands
Ore mineral abundance	< 5 vol.%	< 1–20 vol.%	1–20 vol.%, but typically < 5 vol.%
Main ore minerals	Pyrite, marcasite	Electrum, galena, pyrite, sphalerite, chalcopyrite, tetrahedrite	Electrum, gold, pyrite, sphalerite, galena, chalcopyrite, tetrahedrite
Minor ore minerals	Chalcopyrite, galena, sphalerite, arsenopyrite	Arsenopyrite	Arsenopyrite
Metals present		Ag, Au, Pb, Zn, Cu	Au, Ag (Zn, Pb, Cu)
Metals present locally	Au, Ag, Cu, Pb, Zn, As, Sb, Bi, (Mo), (Hg)	As, Sb, Bi, Mo, W	Mo, Sb, As (Te, Se, Hg)

References

Bernstein, S. & Knudsen, C. 2004: Epithermal gold and massive sulphide mineralisation in oil impregnated Palaeogene volcanic rocks of Ubekendt Ejland, West Greenland. Review of Survey Activities Geological Survey of Denmark and Greenland Bulletin **4**, 77–80.

Bojesen-Koefoed, J.A., Christiansen, F.G., Nytoft, H.P. & Pedersen, A.K. 1999: Oil seepage onshore West Greenland: evidence of multiple source rocks and oil mixing. In: Fleet, A.J., & Boldy, S.A.R. (eds): Petroleum geology of Northwest Europe: Proceedings of the 5th conference, 305–314. London: Geological Society.

Brooks, C.K. & Nielsen, T.F.D. 1982: The Phanerozoic development of the Kangerdlugssuaq area, East Greenland. Meddelelser om Grønland Geoscience **9**, 30 pp.

Brooks, C.K., Tegner, C., Stein, H. & Thomassen, B. 2004: Re-Os and $^{40}Ar/^{39}Ar$ ages of porphyry molybdenum deposits in the East Greenland volcanic-rifted Margin. Economic Geology **99**, 1215–1222.

Clarke, D.B. 1973: New mapping in the western part of Ubekendt Ejland. Rapport Grønlands Geologiske Undersøgelse **53**, 5–9.

Clarke, D.B., Muecke, G.K. & Pe-Piper, G. 1983: The lamprophyres of Ubekendt Ejland, West Greenland: products of renewed partial melting or extreme differentation. Contributions to mineralogy and petrology **83**, 117–127.

Christensen, K. 1986: WEG projektet 1985, 4 pp. Unpublished report, Greenex A/S (in archives of Geological Survey of Denmark and Greenland, GEUS Report File 20169).

Drever, H.I. & Game, P.M. 1948: The geology of Ubekendt Ejland, West Greenland. Meddelelser om Grønland **134**(8), 34 pp.

Emsbo, P., Hofstra, A.H., Lauha, E.A., Griffin, G.L. & Hutchinson, R.W. 2003: Origin of the high-grade gold ore, source of ore fluid components, and genesis of the Meikle and neighboring Carlin-type deposits, Northern Carlin Trend, Nevada. Economic Geology **98**, 1069–1105.

Fehlhaber, K. & Bird, D.K. 1991: Oxygen-isotope exchange and mineral alteration in gabbros of the Lower Layered Series, Kap Edvard Holm Complex, East Greenland. Geology **19**, 819–822.

Gannicott, R.A. 1986: Greenex W.G.E. project, interim summary report, 5 pp. Unpublished report, Greenex A/S (in archives of Geological Survey of Denmark and Greenland, GEUS Report File 20170).

Geyti, A. & Thomassen, B. 1984: Molybdenum and precious metal mineralisation at Flammefjeld, Southeast Greenland. Economic Geology **79**, 1921–1929.

Jensen, S.M. 1998: Tertiary mineralisation and magmatism, East Greenland: lead isotope evidence for remobilization of continental crust. Chemical Geology **150**, 119–144.

John, D.A., Hofstra, A.H., Fleck, R.J., Brummer, J.E. & Saderholm, E.C. 2003: Geologic setting and genesis of the Mule Canyon low-sulphidation epithermal gold-silver deposits, North-Central Nevada. Economic Geology **98,** 425–463.

Kempe, D.R.C., Deer, W.A. & Wager, L.R. 1970: Geological investigations in East Greenland. Part VIII. The petrology of the Kangerdlugssuaq intrusion, East Greenland. Meddelelser om Grønland **190**(2), 49 pp.

Larsen, J.G. 1977a: Fieldwork on Ubekendt Ejland in the Tertiary basalt province of West Greenland, 1971 and 1973. Rapport Grønlands Geologiske Undersøgelse **79**, 35–44.

Larsen, J.G. 1977b: Transition from low potassium olivine tholeiites to alkali basalts on Ubekendt Ejland. Meddelelser om Grønland **200**(1), 42 pp.

Larsen, J.G. 1983: Geological map of Greenland, 1:100 000 Igdlorssuit 71 V.1 Syd. Copenhagen: Geological Survey of Greenland.

Milner, M.W. 1986: Draft copy report on the geology and geomorphology of heavy mineral exploration on the Disko project 1985, 24 pp. Unpublished report, Greenex A/S (in archives of Geological Survey of Denmark and Greenland, GEUS Report File 20389).

Nevle, R.J., Brandriss, M.E., Bird, D.K., McWilliams, M.O., & O'Neill, J.R. 1994. Tertiary plutons monitor climate change in East Greenland: Geology **22**, 775–778.

Nielsen, T.F.D 1987: Tertiary alkaline magmatism in East Greenland: a review. In: Fitton, J.G. & Upton, B.G.J. (eds): Alkaline igneous rocks. Geological Society Special Publication (London) **30**, 489–515.

Nunaoil A/S 1992: Ujarassiorit 1991, årsrapport. Public report prepared by Nunaoil A/S, 8 pp. (in archives of Geological Survey of Denmark and Greenland, GEUS Report File 21542).

Rasmussen, T.M. 2002: Aeromagnetic survey in central West Greenland: project *Aeromag 2001*. Geology of Greenland Survey Bulletin **191**, 67–72.

Rogers, K.L., Neuhoff, P.S., Pedersen, A.K. & Bird, D.K. 2006: CO_2 metasomatism in a basalt-hosted petroleum reservoir, Nuussuaq, West Greenland. Lithos **in press**.

Sillitoe, R.H. 1993: Epithermal models: genetic types, geometrical controls and shallow features. In: Kirkham, R.V. *et al*. (eds): Mineral deposit modelling. Geological Association of Canada Special Paper **40**, 403–417.

Sillitoe, R.H., Cooper, C., Sale, M.J., Soechting, W., Echavarria, D. & Gallardo J.L. 2002: Discovery and geology of the Esquel low-sulphidation epithermal gold deposit, Patagonia, Argentina. Society of Economic Geologists, Special Publication **9**, 227–240.

Sillitoe, R.H. & Hedenquist, J. W. 2003: Linkages between volcanotectonic settings, ore-fluid compositions, and epithermal precious metal deposits. Society of Economic Geologists Special Publication **10**, 315–343.

Steenfelt, A., Dam, E. & Kyed, J. 1998: Geochemical mapping of the Uummannaq region (70°30’ to 72°30’N, 50° to 56°W), central West Greenland. Danmarks og Grønlands Geologiske Undersøgelse Rapport **1998/40**, 25 pp.

Tegner, C., Bernstein, S. & Duncan, R. A. in prep.: Ar-Ar chronology of lavas and intrusions of Ubekendt Ejland, West Greenland.

Taylor, B.E. 1996: Epithermal gold deposits. In: Eckstrand, O.R., Sinclair, W.D. & Thorpe, R.I. (eds): Geology of Canadian mineral deposit types. Geology of Canada **8**, 329–350. Ottawa: Geological Survey of Canada (also The geology of North America **P-1**, Geological Society of North America).

Thomassen, B. 1993: Update on the gold and base metal potential of the Íngia area, central West Greenland. Open File Series Grønlands Geologiske Undersøgelse **93/7**, 66 pp.

Thomassen, B. & Krebs, J.D. 2001a: Reconnaissance for noble metals in Precambrian and Palaeogene rocks, Amdrup Fjord, southern East Greenland. Geology of Greenland Survey Bulletin **189**, 76–82.

Thomassen, B. & Krebs, J.D. 2001b: Palaeogene gold- and silver-bearing epithermal veins at Amdrup Fjord, southern East Greenland. Danmarks og Grønlands Geologiske Undersøgelse Rapport **2001/133**, 78 pp.

Thompson, R.N. 1975: Palaeocene ignimbrites from Ubekendt Ejland, West Greenland. Lithos **8**, 9–14.

Thompson, R.N. & Patrick D.J. 1968: Folding and slumping in a layered gabbro. Journal of Geology **6**, 139–146.

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Locality	Lat.	Long.	Elev. in metres	Orientation	Lithology	Field description
470031	UE0311	71.0528	53.4723	0		fault gauge	fault gauge
470032	UE0311	71.0528	53.4723	0		fault gauge	fault gauge
470033	UE0311	71.0528	53.4723	0		fault gauge	fault gauge
472921	UE0317	71.0420	53.5090	0		quartz-carbonate vein	much leached basaltic host rock in chips
472922	UE0317	71.0420	53.5088	0		quartz-carbonate vein	much leached basaltic host rock in chips
472923	UE0317	71.0420	53.5085	0		quartz-carbonate vein	much leached basaltic host rock in chips
472924	UE0317	71.0420	53.5083	0		quartz-carbonate vein	much leached basaltic host rock in chips
472925	UE0317	71.0420	53.5080	0		quartz-carbonate vein	much leached basaltic host rock in chips
472926	UE0317	71.0420	53.5078	0		quartz-carbonate vein	much leached basaltic host rock in chips
472927	UE0317	71.0420	53.5075	0		quartz-carbonate vein	much leached basaltic host rock in chips
472928	UE0317	71.0420	53.5073	0		quartz-carbonate vein	much leached basaltic host rock in chips
472929	UE0317	71.0420	53.5070	0		quartz-carbonate vein	much leached basaltic host rock in chips
472930	UE0317	71.0420	53.5068	0		quartz-carbonate vein	much leached basaltic host rock in chips
472931	UE0317	71.0420	53.5065	0		quartz-carbonate vein	much leached basaltic host rock in chips
472932	UE0317	71.0420	53.5063	0		quartz-carbonate vein	much leached basaltic host rock in chips
472933	UE0317	71.0420	53.5060	0		quartz-carbonate vein	much leached basaltic host rock in chips
472934	UE0317	71.0418	53.5058	0		quartz-carbonate vein	much leached basaltic host rock in chips
472935	UE0317	71.0418	53.5058	0		hand samples of 472924	hand samples of 472924
472936	UE0317	71.0418	53.5058	0		hand samples of 472924	hand samples of 472924
472937	UE0317	71.0418	53.5058	0		hand samples of 472924	hand samples of 472924
472938	UE0317	71.0418	53.5058	0		dark bands in lava	dark bands in lava
472939	UE0317	71.0418	53.5058	0		dark bands in lava	dark bands in lava
472940	UE0324	71.0315	53.5958	0		micro granite	micro granite
472941	UE0324	71.0315	53.5958	0		micro granite	micro granite
472942	UE0324	71.0315	53.5958	0		micro granite	micro granite
472943	UE0325	71.0334	53.6937	0		quartz-carbonate	quartz-carbonate
472944	UE0325	71.0334	53.6937	0		quartz-carbonate	quartz-carbonate
477817	UE0326	71.0393	53.7094	0	13/72W	altered basalt	altered basalt
477818	UE0326	71.0393	53.7094	0	13/72W	Clay	clay

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Locality	Lat.	Long.	Elev. in metres	Orientation	Lithology	Field description
477819	UE0326	71.0393	53.7094	0	13/72W	quartz-carbonate vein	quartz-carbonate vein
477820	UE0326	71.0393	53.7094	0	13/72W	quartz-carbonate vein	quartz-carbonate vein
477821	UE0326	71.0393	53.7094	0	40/65NW	felsite dyke	felsite dyke
477822	UE0328	71.0446	53.7092	110	15/90	quartz-carbonate vein	quartz-carbonate vein
477823	UE0328	71.0446	53.7092	110	15/90	quartz-carbonate vein	quartz-carbonate vein
477824	UE0329	71.0452	53.7122	90		quartz-carbonate vein	quartz-carbonate vein
477825	UE0329	71.0452	53.7122	90		Clay	clay
477826	UE0329	71.0452	53.7122	90		quartz-carbonate vein	quartz-carbonate vein
477827	UE0338	71.0752	53.7810	370		quartz-carbonate vein	quartz-carbonate vein
477828	UE0338	71.0752	53.7810	370		quartz-carbonate vein	quartz-carbonate vein
477829	UE0338	71.0752	53.7810	370		quartz-carbonate vein	quartz-carbonate vein
477830	UE0338	71.0752	53.7810	370		quartz-carbonate vein	quartz-carbonate vein
477831	UE0336	71.0732	53.7833			quartz-carbonate vein	quartz-carbonate vein
477832	UE0337	71.0705	53.7865		160/75E	quartz-carbonate vein	quartz-carbonate vein
477833	UE0330	71.0449	53.7573	0		quartz-carbonate vein	quartz-carbonate vein
477834	UE0332	71.0469	53.7630	0		quartz-carbonate vein	quartz-carbonate vein
477835	UE0333	71.0493	53.7704	0		quartz-carbonate vein	quartz-carbonate vein
477836	UE0334	71.0533	53.7844	0		quartz-carbonate vein	quartz-carbonate vein
477837	UE0335	71.0552	53.7844	0	145/80E	quartz-carbonate vein	quartz-carbonate vein
477838	UE0335	71.0674	53.8372	0		quartz-carbonate vein	quartz-carbonate vein
477839	UE0331	71.0452	53.7543	0		quartz-carbonate vein	quartz-carbonate vein
477840	UE0339	71.0772	53.5922	640		quartz-carbonate vein	quartz-carbonate vein
477841	UE0340	71.0754	53.6083	745		quartz-carbonate vein	quartz-carbonate vein
477842	UE0341	71.0754	53.6143	784		quartz-carbonate vein	quartz-carbonate vein
477843	UE0327	71.0448	53.7141	85		quartz-carbonate vein	quartz-carbonate vein
477844	UE0342	71.0905	53.5864	620		quartz-carbonate vein	quartz-carbonate vein
477845	UE0301	71.0648	53.4352	0	150/70E	quartz-carbonate vein	quartz-carbonate vein
477846	UE0302	71.0590	53.4517	0	170/55E	quartz-carbonate vein	quartz-carbonate vein
477847	UE0303	71.0585	53.4538	0	0/90	quartz-carbonate vein	quartz-carbonate vein
477848	UE0304	71.0581	53.4568	0	170/45E	quartz-carbonate vein	quartz-carbonate vein

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Locality	Lat.	Long.	Elev. in metres	Orientation	Lithology	Field description
477849	UE0304	71.0581	53.4568	0	170/45E	quartz-carbonate vein	quartz-carbonate vein
477850	UE0305	71.0554	53.4599	0	175/80W	quartz-carbonate vein	quartz-carbonate vein
477851	UE0305	71.0554	53.4599	0		basaltic dyke	basaltic dyke
477852	UE0305	71.0554	53.4599	0		green dyke	green dyke
477853	UE0305	71.0554	53.4599	0		amygdular (altered basalt dyke?)	amygdular (altered basalt or dyke?)
477854	UE0306	71.0536	53.4649	0	170/50E	quartz-carbonate vein	quartz-carbonate vein
477855	UE0307	71.0533	53.4673	0	145/60E	quartz-carbonate vein	quartz-carbonate vein
477856	UE0308	71.0529	53.4696	0	170/60E	quartz-carbonate vein	quartz-carbonate vein
477857	UE0309	71.0528	53.4706	0	162/53E	quartz-carbonate vein	quartz-carbonate vein
477858	UE0310	71.0528	53.4720	0		quartz-carbonate vein	quartz-carbonate vein
477859	UE0312	71.0506	53.4797	0		quartz-carbonate vein	quartz-carbonate vein
477860	UE0313	71.0471	53.4839	0		quartz-carbonate vein	quartz-carbonate vein
477861	UE0314	71.0470	53.4847	0	160/70E	quartz-carbonate vein	quartz-carbonate vein
477862	UE0315	71.0464	53.4868	0	170/65E	quartz-carbonate vein	quartz-carbonate vein
477863	UE0316	71.0431	53.5026	0		quartz-carbonate vein	quartz-carbonate vein
477864	UE0317	71.0425	53.5070	0	5/50E	quartz-carbonate vein	quartz-carbonate vein
477865	UE0317	71.0425	53.5070	0		quartz-carbonate vein	quartz-carbonate vein
477866	UE0317	71.0425	53.5070	0		altered felsite	altered felsite
477867	UE0318	71.0409	53.5171	0		quartz-carbonate vein	quartz-carbonate vein
477868	UE0318	71.0409	53.5171	0		quartz-carbonate vein	quartz-carbonate vein
477869	UE0319	71.0359	53.5551	0		altered felsite	altered felsite
477870	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite
477871	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite
477872	UE0320	71.0350	53.5636	0	0/70W	fractured felsite	fractured felsite
477872 H	UE0320	71.0350	53.5636			hand sample of 477872	
477873	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite
477874	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite
477875	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite
477876	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Locality	Lat.	Long.	Elev. in metres	Orientation	Lithology	Field description
477877	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite
477878	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite
477879	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite
477880	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite
477881	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite
477882	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite
477883	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite
477884	UE0320	71.0350	53.5636	0		fractured felsite	fractured felsite
477885	UE0321	71.0310	53.5752	0	5/85W	fractured felsite	fractured felsite
477885 H	UE0321	71.0310	53.5752			hand sample of 477885	
477886	UE0322	71.0310	53.5791	0		fractured felsite	fractured felsite
477886 H	UE0322	71.0310	53.5791			hand sample of 477886	
477887	UE0323	71.0309	53.5816	0	175/75E	fractured felsite	fractured felsite
477888	UE0311	71.0528	53.4723	0	0/90	quartz-carbonate vein	quartz-carbonate vein
477889	UE0311	71.0528	53.4723	0		basaltic dyke	basaltic dyke
477890	UE0311	71.0528	53.4723	0		altered dyke	altered dyke
477891	UE0311	71.0528	53.4723	0		fault gauge	fault gauge
477892	UE0311	71.0528	53.4723	0		altered hyaloclastite w pyrobitumen	altered hyaloclastite w pyrobitumen
477893	UE0311	71.0528	53.4723	0		altered hyaloclastite	altered hyaloclastite
477894	UE0311	71.0528	53.4723	0		unaltered hyaloclastite	unaltered hyaloclastite
477895	UE0311	71.0528	53.4723	0		altered hyaloclastite w pyrobitumen	altered hyaloclastite w pyrobitumen
477896	UE0311	71.0528	53.4723	0		unaltered hyaloclastite	unaltered hyaloclastite
477897	UE0311	71.0528	53.4723	0		pyrobitumen 'dyke'	pyrobitumen 'dyke'
482246	UE0411	71.0595	53.5755	767		Scree block	Rusty granite
482247	UE0415	71.0775	53.5928	626		Scree block	Qtz.-carbonate breccia w. tr. sulphides
482248	UE0415	71.0775	53.5928	626		Scree block	do
482249	UE0407	71.0576	53.5162	322		Chip 8 m	Qtz.-carbonate vein zone
482250	UE0407	71.0576	53.5162	322		Chip 5 m	do

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Locality	Lat.	Long.	Elev. in metres	Orientation	Lithology	Field description
482251	UE0408	71.0519	53.5208	295		Composite	Qtz.-carbonate vein w. minor cpy.
482252	UE0410	71.0460	53.5272	326		Grab	Qtz.-carbonate vein w. tr. sulphides
482253	UE0410	71.0451	53.5277	320		Chip 10 m	Qtz.-carbonate vein zone
482254	UE0409	71.0472	53.5233	265		Scree block	Siliceous rock w. tr. sulphides
482255	UE0409	71.0482	53.5222	231		Scree block	Altered rock w. minor sulphides
482256	UE0408	71.0662	53.5070	365		Grab	Qtz.-carbonate vein zone w. py.?
482257	UE0408	71.0506	53.5201	229		Scree block	8 cm nugget of native copper
482258	UE0408	71.0507	53.5209	235		Chip 2.5 m	"Hornfels" with disseminated py.
482259	UE0408	71.0510	53.5195	248		Scree block	Calcite vein w. mal. in basalt
482260		71.1760	53.9184	28		Grab	Qtz.-carbonate breccia w. sulphides
482261	UE0430	71.1761	53.9191	48		Chip 4.0 m	Qtz.-carbonate breccia w. sulphides
482262	UE0430	71.1761	53.9191	48		Chip 1.0 m	Basaltic dyke
482263	UE0430	71.1761	53.9191	48		Chip 1.5 m	Qtz.-carbonate breccia w. sulphides
482264	UE0430	71.1761	53.9191	48		Chip 0.7 m	Altered basalt w. minor sulphides
482265	UE0430	71.1761	53.9191	48		Grab	Qtz.-carbonate breccia w. sulphides
482266	UE0430	71.1768	53.9214	31		Comp. block	Qtz.-carbonate breccia w. marc. or py.
482267	UE0429	71.1781	53.9243	12		Stream block	Qtz.-carbonate breccia w. sulphides
482268	UE0419	71.1411	53.9875	2		Composite	Agglomerate w. vqz., vcarb., py.
482269	UE0430	71.1761	53.9191	48		Composite	Qtz.-carbonate breccia w. tr. sulphides
482270	UE0420	71.1474	53.9749	11		Grab	Siliceous rock w. vqz., calcite, py.
482271	UE0420	71.1468	53.9762	10		Scree block	Altered breccia w. py.
482272	UE0420	71.1462	53.9777	2		Grab	Qtz.-carbonate veinlet w. minor py.
482273	UE0420	71.1457	53.9791	2		Scree block	Siliceous breccia w. py.
482274	UE0420	71.1460	53.9780	2		Scree block	do
482275	UE0420	71.1470	53.9749	11		Scree block	Granophyre w. py.
482276	UE0420	71.1474	53.9749	11		Scree block	Qtz.-carbonate breccia w. py.
482277	UE0420	71.1474	53.9749	11		Scree block	Qtz.-carbonate breccia w. sulphides
482278	UE0420	71.1488	53.9731	5		Scree block	Siliceous rock w. vqz., vcalc., py.
482279	UE0420	71.1474	53.9745	50		Comp. Scree	Felsite w. py.-veinlets
482280	UE0420	71.1474	53.9745	50		Scree block	do

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Locality	Lat.	Long.	Elev. in metres	Orientation	Lithology	Field description
482281	UE0420	71.1478	53.9733	50		Scree block	Felsite w. qtz.-py.-veinlets
482282	UE0416	71.1267	53.9947	57		Grab	Lava w. qtz.-carb.-py.-veinlets
482283	UE0417	71.1303	53.9942	129		Scree block	Basalt w. hem.-jasper-qtz-calc.-veinlets
482284	UE0418	71.1391	53.9851	127		Grab	Pyritised volcanic rock w. vqz., vcalc.
482285		70.7986	53.8642	2		Chip 5.0 m	Sandstone w. vqz.
482286		70.7858	53.8858	216		Scree block	Carbonate-calcedone rock
482287		70.7852	53.8813	154		Grab	Altered basalt w. minor sulphides
482288		71.2146	52.4281	295		Comp. bould.	Vqz. w. pyrrh., cpy.
482289		71.2151	52.4268	307		Comp. bould.	Pelitic schist w. pyrrh., gal.
482801	UE0411	71.0616	53.5689	690		picrite	hornfelsed with relict ol
482802	UE0411	71.0620	53.5750	684		granite	altered w jasper and qz along veins
482803	UE0412	71.0735	53.5682	568		c-q vein	subcrop, pink alteration-slicified part of vein
482804	UE0412	71.0735	53.5682	568		c-q vein	subcrop, pink alteration-carbonate rich part of vein
482805	UE0412	71.0743	53.5682	564		c-q vein	pebble breccia, silicified; 3-5cm of centre; along strike of 482804
482806	UE0412	71.0743	53.5682	564		c-q vein	silicified host rock (basalt)
482807	UE0413	71.0830	53.5710	567		tephra	basaltic, in epidote altered basalt
482808	UE0413	71.0830	53.5710	550		c-q vein	50-60cm wide finegr. sulphide and malachite; small vein E of 482809+10
482809	UE0413	71.0830	53.5710	556		c-q vein	carbonate rich part of vein
482810	UE0413	71.0830	53.5710	556		c-q vein	sillica(quartz) rich part of vein
482811	UE0403	71.0712	53.4977	335	158/90	c-q vein	0.5m wide with carbonate veinlets and breccias to 10cm width
482812	UE0403	71.0712	53.4977	335		basalt	unaltered basaltic lava
482813	UE0404	71.0700	53.4927	316		c-q vein	20cm thick silicified basalt with abundant finegr. sulph
482814	UE0404	71.0700	53.4927	316		c-q vein	silicified basalt with green qz vesicle filings 20cm wide, on top of 482813
482815	UE0404	71.0700	53.4927	316		basalt	taken 15cm below vein in 482813+14
482816	UE0404	71.0700	53.4927	316		basalt	taken 30cm below vein in 482813+14
482817	UE0404	71.0693	53.4906	285		c-q vein	abundant vug fillings of pyrobitumen. impregnation of oil was last event

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Locality	Lat.	Long.	Elev. in metres	Orientation	Lithology	Field description
482818		71.0693	53.4906	285	28/25W	tephra	5-10cm thick irregular, in picrite lavas
482819		71.0693	53.4906	285	28/25W	tephra	5-10cm thick irregular, in picrite lavas
482820	UE0406	71.0640	53.4803	252	float	c-q vein	with finegr sulphide stringers
482821	UE0406	71.0623	53.4777	272		c-q vein	finegr sulphide (mostly pyrite) in veins
482822	UE0406	71.0613	53.4779	276		c-q vein	same vein as 482821, disseminated sulphides, mainly in silicified host basalt
482823	UE0406	71.0576	53.4767	274		c-q vein	same vein as 482821+22; top 1m many rust bands of weathered sulphides
482824	UE0406	71.0576	53.4767	274		c-q vein	lower portion of vein, immediately below 482824
482825	UE0406	71.0576	53.4767	274		c-q vein	high grade sample with malachite and chalcopyrite
482826	UE0406	71.0557	53.4760	271		tephra	20-50cm thick- well developed. sampled at cliff edge
482827	UE0406	71.0557	53.4760	271		tephra	altered flowtops - very oxidized
482828	UE0406	71.0557	53.4760	271		tephra	altered flowtops - very oxidized
482829	UE0406	71.0557	53.4760	271		tephra	altered flowtops - very oxidized
482830	UE0402	71.0647	53.4540	316		c-q vein	part of large c-q system. next last to the E along cliff edge
482831	UE0402	71.0647	53.4540	316		c-q vein	part of large c-q system. next last to the E along cliff edge; blue chalcedony in centre
482832	UE0402	71.0650	53.4489	320		c-q vein	30cm wide breccia
482833	UE0402	71.0650	53.4489	320		basalt	altered basalt near breccia 482832. white vesicle fillings
482834	UE0402	71.0650	53.4489	320		c-q vein	sample for C-isotope
482835	UE0402	71.0650	53.4489	320		c-q vein	silicified breccia, from large system sampled in 482836-39
482836	UE0402	71.0650	53.4489	320		c-q vein	1/4 5m rough samples across large system from W to E at cliff edge
482837	UE0402	71.0650	53.4489	320		c-q vein	2/4 5m rough samples across large system from W to E at cliff edge
482838	UE0402	71.0650	53.4489	320		c-q vein	3/4 5m rough samples across large system from W to E at cliff edge
482839	UE0402	71.0650	53.4489	320		c-q vein	4/4 5m rough samples across large system from W to E at cliff edge
482840	UE0401	71.0832	53.4284	306		c-q vein	6-7m wide vein, continuation to N of that sampled in 482832-39

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Locality	Lat.	Long.	Elev. in metres	Orientation	Lithology	Field description
482841	UE0401	71.0838	53.4256	267		tephra	20-30cm thick very well deined upper and lower contacts to host picrite flows
482842	UE0401	71.0838	53.4256	267		basalt	vesicular flowtop from flow immediately above 482841; taken about 4m above base
482843	UE0401	71.0838	53.4256	267		tephra	ca. 20m strat. above 482841, 10cm thick
482844	UE0401	71.0832	53.4284	306		tephra	take close to c-q vein 482840
482845	UE0401	71.0832	53.4284	306		vug	quartz-carbonate for isotope in vug fillings in picrite
482846	UE0414	71.0900	53.5748	488		basalt	zeolite altered basalt
482847	UE0414	71.0900	53.5748	488	160/70E	c-q vein	3m wide rough chip; top of vein; large vein system; series of smaller vein?
482848	UE0414	71.0900	53.5748	488		c-q vein	1m wide; lowermost part of this vein
482849	UE0414	71.0900	53.5748	488		c-q vein	3m wide rough chip; this vein 10m west of vein sampled at 482847+48
482850	UE0414	71.0911	53.5751	528		tephra	irregular tephra - altered flowtop?
482851	UE0414	71.0911	53.5751	528		tephra	irregular tephra - altered flowtop?
482852	UE0414	71.0911	53.5751	528		tephra	irregular tephra - altered flowtop?
482853	UE0414	71.0911	53.5751	528		tephra	irregular tephra - altered flowtop?
482854	UE0414	71.0915	53.5630	445		c-q vein	1m wide sulphides in stringers (veins?)
482855	UE0404	71.0693	53.4906	285		bitumen	sample with pyrobitumen from c-q vein
482856		71.0863	53.6440	920		basalt	zeolite altered basalt
482857		71.0863	53.6440	920		shale-tuff?	Gutzon marked tuff on map. Unsure what the sample represents?
482858		71.0863	53.6440	920		basalt	epidote altered basalt
482859	UE0428	71.2081	53.8849	0		c-q vein	brecciated c-q veins with disseminated sulph
482860	UE0428	71.2081	53.8849	0		c-q vein	2m wide with center carbonate breccia 1m wide. Sulphide (pyrite) disseminated finegr
482861	UE0428	71.2081	53.8849	0		c-q vein	1m wide; piece of float (but likely from this vein) w rhodochrosite (?)
482862	UE0428	71.2081	53.8849	0		lamprophyre	with ultramafic xenoliths (float, but similar dyke found in outcrop)
482863	UE0428	71.2081	53.8849	0		c-q vein	thin (<20cm) E of 482861
482864	UE0427	71.2002	53.9012	0		tephra	from altered flowtop, with distinct contacts

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Locality	Lat.	Long.	Elev. in metres	Orientation	Lithology	Field description
482865	UE0427	71.2002	53.9012	0		c-q vein	silicified breccia, with pyrite specs sparsely distributed
482866	UE0427	71.2002	53.9012	0		tephra	30cm tuff, with well developed and distinct contacts
482867	UE0426	71.1892	53.9114	0		c-q vein	brecciated in sillicified and altered flowtops, greenish alteration
482868	UE0426	71.1892	53.9114	0		lamprophyre	1m thick, cuts c-q vein sampled in 482867 and 69
482869	UE0426	71.1892	53.9114	0		c-q vein	silicified breccia - N portion of system sampled in 482867
482870	UE0426	71.1892	53.9114	0		tephra	sampled 100m SW of above location
482871	UE0426	71.1883	53.9147	0		c-q vein	silicified breccia with possible pyrobitumen in vein centre
482872	UE0426	71.1883	53.9147	0		c-q vein	silicified breccia with possible pyrobitumen in vein centre
482873	UE0426	71.1883	53.9147	0		basalt	altered flowtop
482874	UE0425	71.1865	53.9224	0		c-q vein	zone of silicified breccias 15m wide w several sets of veins
482875	UE0425	71.1865	53.9224	0	160/62E	c-q vein	replaced and silicified felsic dyke
482876	UE0432	71.1736	53.9139	64		tephra	tuff in gorge
482877	UE0432	71.1731	53.9073	90		tephra	15-20cm thick, red with green centre. Sharp upper and lower contacts
482878	UE0432	71.1729	53.9023	98		basalt	hydrothermally altered basalt, vesicular
482879	UE0432	71.1729	53.9023	98		dyke	felsic dyke, qz phenocrysts
482880	UE0435	71.1659	53.8536	130		c-q vein	talus blocks at foot of cliff, where river forks
482881	UE0434	71.1690	53.8501	180		c-q vein	thin (<1m) vein at N-fork of river
482882	UE0433	71.1709	53.8687	160		c-q vein	2m wide strongly silicified host basalts. at northern tributary
482883	UE0421	71.1571	53.9702	0		c-q vein	thin (1cm) veins with 1m silicification halo in basalts. Abundant sulph in host basalts
482884	UE0421	71.1579	53.9686	0	150/72E	dyke	2m wide qz porphyry with sulphide disseminated
482885	UE0421	71.1583	53.9676	0		tephra	15cm thick tuff
482886	UE0421	71.1583	53.9676	0	170/28W	geopetal	in basalt (134/28W)
482887	UE0422	71.1657	53.9577	26		basalt	regionally altered (zeolite) basalt
482888	UE0422	71.1650	53.9600	0		c-q vein	4-5m wide silicified wall rock to carbonate-qz vein - 3 hand samples
482889	UE0421	71.1594	53.9642	20	0/70W	dyke	0.5-1m wide felsic sheets - parrallel with abundant pyrite

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Locality	Lat.	Long.	Elev. in metres	Orientation	Lithology	Field description
482890	UE0423	71.1682	53.9597	0	0/70W	c-q vein	1m silicification zone around a series of 1cm thick cq veins, pyrite disseminated and in small veins
482891	UE0423	71.1682	53.9597	0		tephra	10cm thick tuff. Irregular lower contact to rubbly vesicular flowtop
482892	UE0424	71.1717	53.9523	0		c-q vein	large alteration zone - 10m wide (probably Gutzons vein on map S of canyon)
482893	UE0436	71.1559	53.9384	190		basalt	epidote altered basalt
482894	UE0436	71.1555	53.9368	200	104/90	dyke	1.5m wide felsic dyke
482895	UE0436	71.1555	53.9368	200	158/90	dyke	0.8m wide felsic dyke, or silicification zone in basalts; cut by dyke 482894
482896	UE0438	71.1459	53.8932	389	70/90	dyke	2m wide felsic dyke
482897	UE0440	71.1412	53.8958	350	70/90	dyke	one of several sets of felsic dykes; rubblecrop quartz phenocrysts?
482898	UE0440	71.1412	53.8958	350	70/90	dyke	second sample of several sets of felsic dykes. feldspar phenocrysts?
482899	UE0439	71.1428	53.9336	337		basalt	altered basalt close to contact to felsic sheet complex
482901	UE0437	71.1483	53.9359	280		c-q vein	1m wide silicified vein with sparse disseminated sulphide
482902		71.1557	53.9459	173		basalt	epidote altered basalt
500651	UE0406a	71.0586	53.4844	184		HMC	Heavy Mineral Concentrate
500652	UE0406a	71.0587	53.4834	161		HMC	Heavy Mineral Concentrate
500653	UE0405a	71.0610	53.4801	220		HMC	Heavy Mineral Concentrate
500654	UE0405	71.0665	53.4834	278		HMC	Heavy Mineral Concentrate
500655	UE0403	71.0693	53.4910	287		HMC	Heavy Mineral Concentrate
500656	UE0407	71.0575	53.5156	320		HMC	Heavy Mineral Concentrate
500657	UE0408	71.0506	53.5201	229		HMC	Heavy Mineral Concentrate
500658	UE0430	71.1761	53.9191	48		HMC	Heavy Mineral Concentrate
500659	UE0431	71.1746	53.9161	65		HMC	Heavy Mineral Concentrate
500660	UE0430	71.1768	53.9217	27		HMC	Heavy Mineral Concentrate
500661	UE0429	71.1786	53.9264	29		HMC	Heavy Mineral Concentrate
506251	UE0406a	71.0586	53.4844	184		SS	Stream Sediment
506252	UE0406a	71.0587	53.4834	161		SS	Stream Sediment

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Locality	Lat.	Long.	Elev. in metres	Orientation	Lithology	Field description
506253	UE0405a	71.0610	53.4801	220		SS	Stream Sediment
506254	UE0405	71.0665	53.4834	278		SS	Stream Sediment
506255	UE0403	71.0693	53.4910	287		SS	Stream Sediment
506256	UE0407	71.0575	53.5156	320		SS	Stream Sediment
506257	UE0408	71.0506	53.5201	229		SS	Stream Sediment
506258	UE0430	71.1761	53.9191	48		SS	Stream Sediment
506259	UE0431	71.1746	53.9161	65		SS	Stream Sediment
506260	UE0430	71.1768	53.9217	27		SS	Stream Sediment
506261	UE0429	71.1786	53.9264	29		SS	Stream Sediment

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Au ppb	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe %	Hf	Hg	Ir	Mo	Na %	Ni	Rb	Sb	Sc	Se	Sn	Sr	Ta
470031	0	0	2.3	330	0	9	28	501	0	4.94	2	0	0	0	0.6	36	0	0.7	26.6	0	0	0	0
470032	0	0	4.1	300	0	9	22	420	0	4.55	2	0	0	0	0.12	0	50	2.2	23.5	0	0	0	0.7
470033	585	0	3.8	300	0	12	33	242	0	5.63	1	0	0	0	0.11	75	37	1.4	27.5	0	0	0	0
472921	3	0	10.1	100	5.3	5	76	471	0	8.43	2	0	0	0	0.2	200	0	1	39.6	0	0	0	0
472922	0	0	0	80	1.8	5	51	554	0	7.82	2	0	0	0	0.2	177	0	0	44.3	0	0	0	0
472923	0	0	4.3	70	0	6	63	507	0	8.08	2	0	0	0	0.08	186	0	0.4	42.9	0	0	0	0.7
472924	0	0	4.9	70	0	10	44	438	0	6.79	1	0	0	0	0.04	117	0	0.7	37	0	0	0	0
472925	0	0	3	50	0	10	53	416	0	7.69	1	0	0	0	0.07	139	0	0.7	36.4	0	0	0	0
472926	0	0	5.3	180	1	8	45	481	0	7.3	0	0	0	0	0.34	181	5	0.5	34.3	0	0	0	0
472927	5	0	0	0	9.4	8	59	962	0	8.53	3	0	0	0	0.22	208	0	0	32.7	0	0	0	0
472928	6	0	2.1	0	4.8	8	61	965	0	8.12	1	0	0	6	0.28	191	30	0.4	33.3	0	0	0	0
472929	0	0	2.5	0	11.5	15	41	643	0	6.49	0	0	0	3	0.19	137	0	1.1	30.7	0	0	0	0
472930	0	0	1.5	210	3.1	15	22	471	0	4.56	0	0	0	0	0.08	120	5	0.3	19.7	0	0	0	0
472931	0	0	0	280	0	11	38	469	0	6.61	2	0	0	0	0.26	130	0	1.2	21.4	0	0	0	1
472932	0	0	0	80	3.4	10	50	813	0	6.21	1	0	0	5	0.22	281	0	0.9	23.2	0	0	0	0
472933	0	0	3	90	5.2	13	37	130	0	6.95	2	0	0	5	0.1	41	0	0.8	16.1	0	0	0	1.7
472934	0	0	9.2	90	2.2	8	54	513	0	5.63	2	0	0	0	0.06	220	0	1.2	19.4	0	0	0	2.3
472935																							
472936																							
472937																							
472938																							
472939																							
472940																							
472941																							
472942																							

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Au ppb	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe %	Hf	Hg	Ir	Mo	Na %	Ni	Rb	Sb	Sc	Se	Sn	Sr	Ta
472943	0	0	23.1	180	8	6	34	590	0	5.35	0	0	0	0	0.1	291	5	46.5	18.2	0	0	0	0
472944	5	0	8.8	200	6.8	8	61	646	1	5.19	1	0	0	4	0.11	300	18	49.2	18.2	0	0	0	1.1
477817	71	0	0	0	0	6	102	1710	2	9.5	2	0	0	0	0.26	1000	0	0.2	25.7	0	0	0	0
477818	0	0	0	0	0	17	47	699	0	4.62	0	0	0	0	0.03	377	0	0.1	12.4	0	0	0	0
477819	0	0	1.4	85	0.5	24	11	58	0	1.67	0	0	0	0	0.04	88	5	0	1.3	0	0	0	0
477820	31	0	0	0	0	25	27	121	0	2.64	0	0	0	4	0.03	98	0	0.4	3.4	0	0	0	0
477821	48	0	0	1400	0	1	21	13	0	2.67	14	0	0	5	3.28	0	0	0.4	5	0	0	0	6.9
477822	39	0	0	0	0	24	37	141	0	7.09	0	0	0	0	0.02	183	0	0	8	0	0	0	0
477823	65	0	0	0	0	24	34	196	0	5.93	0	0	0	0	0.03	129	0	0	3.8	0	0	0	0
477824	6	0	0	110	0	2	64	573	0	9.23	3	0	0	0	2.18	311	0	0	38.6	0	0	0	0
477825	147	0	1.4	0	1	12	83	630	0	7.77	1	0	0	0	0.32	344	0	0.3	17.5	0	0	0	0
477826	104	0	0	0	0	8	71	312	0	8.8	3	0	0	0	1.81	218	0	0.3	40.7	0	0	0	0
477827	0	0	21.3	0	0	15	45	608	0	7.63	0	0	0	0	0.34	170	0	49.9	21.6	0	0	0	0
477828	0	0	0	70	0	8	84	1050	0	7.5	2	0	0	0	0.04	344	0	0.3	33.4	0	0	0	0.9
477829	19	0	6.9	0	0	17	27	111	0	7.44	0	0	0	0	0.03	48	0	5.9	20.3	0	0	0	0
477830	5	0	9.5	140	0	19	18	89	0	5.67	0	0	0	0	0.05	0	0	6.4	18.7	0	0	0	0
477831	0	0	9.9	0	0	20	25	23	0	6.21	0	0	0	11	0.02	0	0	2.3	10	0	0	0.06	0
477832	0	0	12.3	0	0	13	21	96	0	6.07	0	0	0	0	0.03	36	5	3.8	20.8	0	0	0	0
477833	8	0	35.3	0	3.3	10	51	226	0	7.4	0	0	0	0	0.08	199	5	3.5	21.1	0	0	0	0
477834	0	0	0	60	0	5	76	162	0	6.61	2	0	0	0	0.05	72	0	0.9	27.8	0	0	0	0
477835	4	0	64.3	0	0	0	52	226	0	9.77	0	0	0	0	0.07	180	5	6.2	28.1	0	0	0	0
477836	12	0	1.4	0	0	26	37	119	0	4.78	0	0	0	0	0.04	41	0	0.9	16.2	0	0	0	0
477837	0	0	35.7	0	0	10	32	90	0	8.84	0	0	0	0	0.03	70	5	1.4	29	0	0	0	0
477838	66	0	38.4	0	0	7	108	72	0	9.99	3	0	0	3	0.05	67	0	3.2	27.2	0	0	0	0
477839	20	0	2.3	0	0	13	41	373	0	5.87	0	0	0	0	0.04	168	0	1.4	19.7	0	0	0	0
477840	0	0	0	430	0	19	36	12	0	3.97	4	0	0	0	0.06	120	24	0.2	3.6	0	0	0	1.5

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Au ppb	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe %	Hf	Hg	Ir	Mo	Na %	Ni	Rb	Sb	Sc	Se	Sn	Sr	Ta
477841	69	0	1.9	0	0	21	38	133	0	5.17	0	0	0	0	0.03	150	0	0.4	3.2	0	0	0	0
477842	3	0	1	0	0	23	22	15	0	1.78	0	0	0	0	0.02	90	0	0	0.9	0	0	0	0
477843	5	0	0	0	0	24	15	67	0	4.21	0	0	0	0	0.02	65	0	0	2.8	0	0	0	0
477844	0	0	9.1	0	0	10	49	641	0	6.22	2	0	0	0	0.03	261	0	28.8	15.3	0	0	0	0
477845	0	0	1.5	0	2.7	17	34	243	0	5.43	0	0	0	0	0.06	134	5	0	17.1	0	0	0	0
477846	0	0	0.6	0	1.5	17	43	210	0	6.57	1	0	0	0	0.07	78	21	0.2	15.8	0	0	0	0
477847	0	0	3.4	0	2.6	12	49	324	0	4.97	1	0	0	0	0.09	54	0	1.1	18	0	0	0	0
477848	0	0	1.9	0	5.1	16	23	286	0	4.85	0	0	0	0	0.11	82	33	0.2	12.7	0	0	0	0
477849	24	0	47.8	0	6	17	46	398	0	6.4	1	0	0	0	0.14	82	0	3.6	18.4	0	0	0	0
477850	6	0	3.7	100	9.2	8	54	366	1	5.43	2	0	0	0	0.23	51	42	1.1	24.9	0	0	0	0.7
477851																							
477852																							
477853																							
477854	11	0	2.6	50	8.3	15	51	112	0	4.52	0	0	0	0	0.14	86	0	0.6	10.1	0	0	0	0
477855	0	0	0.9	0	0	19	24	199	0	3.93	0	0	0	0	0.02	108	0	0.2	6.9	0	0	0	0
477856	0	0	2	0	1.7	18	26	75	0	3.81	0	0	0	0	0.04	103	5	0.3	4.8	0	0	0	0
477857	5	0	1.9	0	0	20	40	86	0	4.2	0	0	0	0	0.04	95	0	0.4	6	0	0	0	0
477858	12	0	1.3	0	3.7	17	33	214	0	5.8	0	0	0	0	0.08	52	19	0.5	15.7	0	0	0	0
477859	4	0	2.3	0	1.5	19	32	74	0	4.81	0	0	0	0	0.04	63	0	0.3	6.9	0	0	0.06	0
477860	3	0	4.5	0	2.6	17	28	336	0	4.89	0	0	0	0	0.06	152	5	2.7	11	0	0	0	0
477861	0	0	0	0	2	18	42	415	0	4.61	0	0	0	0	0.05	96	0	0.5	15.3	0	0	0	0
477862	0	0	3	0	2.4	18	25	167	0	3.4	0	0	0	0	0.05	51	21	14.2	7.8	0	0	0.07	0
477863	0	0	1.9	90	3.3	9	43	298	0	4.52	2	0	0	2	0.06	52	0	0.4	21.1	0	0	0	0
477864	0	0	1.2	0	0	19	11	42	0	3.41	0	0	0	0	0.03	0	0	0.2	5.2	0	0	0	0
477865	0	0	0	0	0	19	13	72	0	3.35	0	0	0	0	0.03	32	0	0.4	9.8	0	0	0.05	0
477866																							

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Au ppb	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe %	Hf	Hg	Ir	Mo	Na %	Ni	Rb	Sb	Sc	Se	Sn	Sr	Ta
477867	0	0	0	0	2.5	17	26	118	0	3.52	0	0	0	1	0.05	70	0	0.2	11.3	0	0	0	0
477868	0	0	2.3	0	1.6	15	16	151	0	3.86	0	0	0	0	0.05	69	5	0.4	15.9	0	0	0	0
477869	0	0	2.9	150	0	0	66	261	0	3.63	0	0	0	1	0.04	100	0	3.4	24.5	0	0	0	1
477870	23	0	39	200	8.1	0	106	301	0	9.27	2	0	0	0	0.15	154	0	5.8	39.8	0	0	0	0
477871	0	0	24.9	370	5.7	0	25	315	0	7.4	0	0	0	0	0.1	112	50	8.3	42.7	0	0	0	0
477872	330	110	15800	100	0	0	37	174	0	16.2	0	0	0	0	0.08	93	5	167	41.1	17	0	0	0
477872H	1300	110	10600	0	0	0	33	21	0	29.1	0	0	0	0	0.02	51	5	200	11.8	31	0	0	0
477873	13	0	40.9	150	12.3	0	70	304	0	8.11	0	0	0	0	0.2	70	5	22.8	24.3	9	0	0	0.6
477874	0	0	5.6	310	6	0	67	357	0	5.47	3	0	0	7	0.12	49	0	1.9	28.8	0	0	0	1
477875																							
477876																							
477877																							
477878																							
477879																							
477880																							
477881																							
477882																							
477883																							
477884																							
477885	158	30	1830	0	7.9	15	11	81	0	13.8	0	0	0	0	0.08	9	5	28.2	9.9	9	0	0	0
477885 H	67	67	202	0	4.2	0	6	11	0	43	0	0	0	0	0.03	59	5	38.3	3.6	38	0	0	0
477886	478	44	14800	170	0	3	42	476	0	12.2	0	0	0	0	0.08	263	5	68.7	21.6	13	0	0	0
477886 H	59	40	50.4	0	5.1	0	40	9	0	36.3	0	0	0	0	0.03	5	5	20.1	0.5	25	0	0	0
477887	22	25	62.9	0	8.6	12	22	228	0	11.1	0	0	0	0	0.05	60	5	12.8	14	4	0	0	0
477888	0	0	5	110	5.3	11	41	313	0	5.33	3	0	0	0	0.18	0	45	2	23.8	0	0	0	0
477889																							

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Au ppb	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe %	Hf	Hg	Ir	Mo	Na %	Ni	Rb	Sb	Sc	Se	Sn	Sr	Ta
477890																							
477891																							
477892																							
477893																							
477894																							
477895																							
477896																							
477897																							
482246	0	0	3.1	100	0.0	0	0	0	0	5.92	16	0	0	17	0.03	0	0	1.0	4.7	0	0.00	0.00	5.5
482247	0	0	2.5	200	0.0	13	85	560	0	4.80	1	0	0	0	0.02	890	0	0.8	13.6	0	0.00	0.00	0.0
482248	0	0	4.1	0	0.0	0	29	433	0	3.50	0	0	0	10	0.03	186	0	11.2	13.2	0	0.00	0.00	0.0
482249	0	0	2.0	0	0.0	11	30	378	0	2.50	0	0	0	0	0.03	256	0	0.7	9.2	0	0.00	0.00	0.0
482250	0	0	1.5	0	0.0	8	36	450	0	3.07	1	0	0	0	0.02	222	0	0.5	11.3	0	0.00	0.00	0.0
482251	0	0	6.8	121	0.0	4	63	798	0	3.18	2	0	0	0	0.03	492	0	2.1	17.0	0	0.00	0.00	0.0
482252	0	0	1.0	0	0.0	9	20	176	0	3.23	0	0	0	0	0.02	75	0	1.0	10.3	0	0.00	0.00	0.0
482253	8	0	2.0	0	0.0	8	42	427	0	3.73	1	1	0	0	0.03	225	0	0.8	15.9	4	0.00	0.00	0.0
482254	0	0	8.1	0	0.0	4	41	654	0	2.87	0	0	0	0	0.02	196	0	2.1	12.9	0	0.00	0.00	0.0
482255	5	0	2.4	0	0.0	3	68	642	0	4.38	1	0	0	0	0.02	644	0	0.8	12.4	0	0.00	0.00	0.0
482256	8	0	4.4	171	0.0	5	60	896	0	6.71	2	0	0	0	0.02	877	0	6.8	20.6	0	0.00	0.00	0.0
482257																							
482258	0	6	2.2	0	0.0	2	22	887	1	2.30	2	0	0	0	0.04	182	0	0.8	14.8	0	0.00	0.00	0.0
482259	0	0	0.8	0	0.0	9	22	329	0	2.70	0	0	0	0	0.04	100	0	0.0	7.6	0	0.00	0.00	0.0
482260	4	0	0.8	0	0.0	4	41	134	0	5.87	2	0	0	0	0.05	119	0	0.2	23.3	0	0.00	0.00	0.0
482261	0	0	1.4	0	0.0	4	44	329	1	4.93	2	0	0	0	0.05	101	0	0.6	19.4	0	0.00	0.00	0.7
482262	4	0	1.1	1900	0.0	10	37	207	0	4.82	3	0	0	0	1.65	110	51	0.0	22.7	0	0.00	0.17	6.9
482263	8	0	3.6	0	0.0	8	51	244	0	6.94	2	0	0	0	0.04	130	0	0.6	23.0	3	0.00	0.00	1.1

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Au ppb	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe %	Hf	Hg	Ir	Mo	Na %	Ni	Rb	Sb	Sc	Se	Sn	Sr	Ta
482264	0	0	0.0	185	0.0	7	99	243	0	5.19	2	0	0	4	0.12	194	20	0.5	19.7	0	0.00	0.00	0.8
482265	0	0	1.9	0	0.0	4	54	320	0	7.52	2	0	0	0	0.03	149	0	0.5	25.9	0	0.00	0.00	0.6
482266	16	0	4.4	0	0.0	2	60	163	0	12.7	3	12	0	3	0.03	206	0	0.6	13.9	0	0.00	0.00	1.3
482267	5	0	3.0	0	0.0	7	36	176	0	5.53	2	0	0	0	0.04	105	19	0.3	21.3	0	0.00	0.00	2.2
482268	3	0	5.2	415	0.0	7	30	20	0	6.45	4	0	0	0	0.89	0	32	0.5	16.5	0	0.00	0.00	3.2
482269	7	0	1.8	0	0.0	6	59	418	0	7.19	3	0	0	0	0.06	150	0	0.3	26.0	0	0.00	0.00	1.3
482270	5	0	5.5	305	0.0	10	3	9	0	5.59	5	0	0	0	0.12	0	43	2.5	1.8	0	0.00	0.00	3.0
482271	0	0	6.7	520	0.7	0	8	0	0	3.42	10	0	0	6	0.13	0	78	0.5	4.1	0	0.00	0.05	6.6
482272	3	0	4.4	0	0.0	12	20	23	0	5.65	2	0	0	19	0.04	0	17	2.0	10.9	0	0.00	0.00	0.0
482273	0	0	6.9	0	0.0	4	29	65	0	4.76	5	0	0	10	0.06	0	17	0.9	28.5	0	0.00	0.00	0.0
482274	3	0	9.8	295	0.0	9	30	49	0	6.31	3	0	0	0	1.01	0	0	0.5	26.6	0	0.00	0.00	0.0
482275	0	0	5.1	100	0.0	4	2	0	0	2.87	12	0	0	6	0.08	0	0	0.6	1.9	0	0.00	0.00	7.7
482276	0	0	54.5	95	0.0	8	6	6	0	4.50	4	0	0	0	0.04	0	0	12.4	1.9	0	0.00	0.00	1.2
482277	0	0	30.9	0	0.0	4	5	0	0	3.27	7	0	0	7	0.05	0	0	7.4	1.9	0	0.00	0.00	4.1
482278	0	0	6.8	1350	0.0	5	17	55	0	4.72	7	0	0	4	1.26	0	57	0.4	9.4	0	0.00	0.00	6.1
482279	2	0	12.8	680	0.0	3	2	9	2	3.52	7	0	0	6	0.18	0	78	0.5	4.0	0	0.00	0.00	4.1
482280	0	0	10.8	0	0.0	0	2	0	0	3.22	16	0	0	7	0.04	0	20	0.8	1.2	0	0.00	0.00	10.1
482281	0	0	5.4	400	0.0	0	0	0	1	4.02	11	0	5	18	0.13	0	105	0.8	1.4	4	0.00	0.00	7.6
482282	5	0	22.3	0	0.0	4	28	26	0	6.88	5	0	0	0	0.04	0	22	0.0	21.6	0	0.00	0.00	1.7
482283	0	0	2.8	350	0.0	6	24	28	0	7.35	0	0	0	0	0.03	0	0	0.3	7.2	0	0.00	0.00	0.0
482284	0	0	1.6	215	0.0	6	31	263	0	5.28	5	0	0	57	0.19	76	24	0.0	13.8	0	0.00	0.05	3.9
482285	0	0	0.0	0	0.9	8	44	1110	0	4.48	0	0	0	0	0.06	399	0	0.0	14.6	0	0.00	0.09	0.0
482286	0	0	0.0	0	0.0	1	215	26	0	26.3	0	0	0	0	0.01	759	0	0.0	38.6	0	0.00	0.00	0.0
482287	5	0	0.0	0	0.0	0	110	512	0	12.8	0	0	0	0	0.03	703	23	0.0	17.6	0	0.00	0.00	0.0
482288	0	0	1.0	55	0.5	0	13	16	0	1.14	0	0	0	0	0.07	0	0	0.1	0.3	0	0.00	0.00	0.0
482289	6	13	1.3	115	0.0	11	40	25	2	9.14	0	0	0	30	0.06	111	0	13.2	4.3	0	0.00	0.00	0.0

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Au ppb	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe %	Hf	Hg	Ir	Mo	Na %	Ni	Rb	Sb	Sc	Se	Sn	Sr	Ta
482801																							
482802	0	0	8.4	140	0.0	0	2	20	0	11.2	10	0	0	30	0.04	0	44	1.6	5.8	0	0.00	0.00	3.3
482803	0	0	2.1	0	0.0	8	18	404	0	3.93	1	0	0	2	0.02	178	0	0.4	16.5	0	0.00	0.00	0.0
482804	0	0	1.7	0	0.0	18	3	22	0	2.61	0	0	0	0	0.02	0	0	0.0	1.1	0	0.00	0.00	0.0
482805	2	0	7.5	120	0.0	1	20	396	0	2.16	0	0	0	0	0.04	294	0	1.3	6.7	0	0.00	0.00	0.0
482806	3	0	3.4	0	0.0	1	51	949	0	6.02	0	0	0	0	0.03	633	0	1.0	15.3	0	0.00	0.00	0.0
482807																							
482808	33	0	8.1	110	0.0	0	25	182	0	1.53	1	0	0	34	0.03	110	24	13.1	8.2	0	0.00	0.00	0.6
482809	3	0	3.2	0	0.0	12	17	515	0	4.24	0	0	0	3	0.03	150	0	0.2	16.9	0	0.00	0.00	0.0
482810	0	0	3.2	0	0.0	2	25	521	0	2.62	2	0	0	1	0.03	221	0	1.1	9.4	0	0.00	0.00	0.6
482811	7	0	1.7	0	0.0	3	58	1060	0	6.25	2	4	0	0	0.03	685	0	0.0	20.6	0	0.00	0.00	0.0
482812																							
482813	8	0	2.4	0	0.0	3	49	1040	0	6.23	2	1	0	0	0.03	560	0	0.7	21.8	0	0.00	0.00	0.0
482814	0	0	1.6	0	0.0	6	55	943	0	4.66	0	0	0	0	0.02	690	0	0.0	14.5	0	0.00	0.00	0.0
482815																							
482816																							
482817	0	0	1.3	99	0.0	10	25	403	0	3.79	0	0	0	0	0.02	275	0	0.1	8.6	0	0.00	0.00	0.0
482818																							
482819																							
482820	0	0	1.9	190	0.0	5	38	674	0	4.43	1	0	0	0	0.02	251	0	0.2	20.9	0	0.00	0.00	0.0
482821																							
482822	0	0	3.0	0	0.0	4	48	808	0	4.91	0	0	0	0	0.02	499	0	0.2	15.8	0	0.00	0.00	0.0
482823	0	0	1.3	0	0.0	14	27	155	0	10.5	0	0	0	0	0.02	427	0	0.1	10.8	0	0.00	0.00	0.0
482824	0	0	1.6	0	0.0	16	31	88	0	8.45	0	0	0	0	0.01	501	0	0.0	6.8	0	0.00	0.00	0.0
482825	15	0	2.3	0	0.0	11	25	365	0	2.72	0	0	0	0	0.02	240	0	0.2	10.3	0	0.00	0.00	0.0
482826																							

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Au ppb	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe %	Hf	Hg	Ir	Mo	Na %	Ni	Rb	Sb	Sc	Se	Sn	Sr	Ta
482827																							
482828																							
482829																							
482830	6	0	3.0	0	0.0	2	38	450	0	3.38	0	0	0	0	0.02	300	0	0.6	13.2	0	0.00	0.00	0.0
482831	0	0	4.5	90	0.0	7	30	528	0	3.49	0	2	0	0	0.02	177	0	0.3	14.1	0	0.00	0.00	0.0
482832	0	0	1.6	0	0.9	3	32	278	0	2.76	0	0	0	0	0.05	221	0	0.5	5.5	4	0.00	0.00	0.0
482833																							
482834																							
482835	3	0	1.0	0	0.0	7	15	267	0	1.85	0	2	0	0	0.03	69	0	1.7	10.8	0	0.00	0.00	0.0
482836	6	0	0.0	0	0.0	5	61	684	0	6.98	2	0	0	0	0.04	324	0	0.4	24.0	0	0.00	0.00	0.0
482837	0	0	1.1	0	0.7	4	36	463	0	4.67	1	0	0	0	0.04	183	0	0.8	16.7	0	0.00	0.00	0.0
482838	0	0	0.9	72	0.0	8	41	378	0	4.79	1	2	0	0	0.03	199	0	0.6	15.1	0	0.00	0.00	0.0
482839	6	0	1.1	0	0.0	6	51	601	0	6.08	2	0	0	0	0.05	270	0	0.3	19.3	0	0.00	0.00	0.0
482840	2	0	0.8	95	0.0	7	24	568	0	2.84	0	0	0	0	0.02	205	0	0.0	13.9	0	0.00	0.00	0.0
482841																							
482842																							
482843																							
482844																							
482845																							
482846																							
482847	0	0	7.1	500	0.0	0	39	685	0	2.31	2	0	0	0	0.05	279	15	4.9	8.3	0	0.00	0.00	0.8
482848	0	0	3.8	180	0.0	0	35	862	0	1.19	2	0	0	0	0.04	156	0	3.2	7.3	0	0.00	0.00	0.0
482849	6	0	7.9	85	2.3	0	46	1400	0	5.20	1	3	0	0	0.06	527	0	4.3	21.6	0	0.00	0.00	0.0
482850																							
482851																							
482852																							

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Au ppb	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe %	Hf	Hg	Ir	Mo	Na %	Ni	Rb	Sb	Sc	Se	Sn	Sr	Ta
482853																							
482854	12	0	4.8	0	0.0	0	59	772	0	4.44	1	0	0	7	0.03	238	0	10.3	9.7	0	0.00	0.00	0.0
482855																							
482856																							
482857																							
482858																							
482859	2	0	1.7	0	0.9	9	16	65	0	3.26	1	0	0	0	0.04	65	0	0.1	10.3	0	0.00	0.00	0.0
482860	0	0	1.1	350	0.0	7	41	380	0	4.78	2	0	0	0	0.09	187	16	0.6	15.7	0	0.00	0.00	1.8
482861	3	0	1.5	0	0.6	10	26	377	0	3.29	0	0	0	0	0.07	172	0	0.2	11.4	0	0.00	0.00	0.0
482862																							
482863	4	0	4.2	62	0.0	11	16	65	1	3.27	0	0	0	30	0.03	65	0	1.6	4.3	0	0.00	0.00	0.9
482864																							
482865	7	0	1.1	0	0.0	7	21	42	0	4.48	1	0	0	0	0.05	0	0	0.3	11.8	0	0.00	0.00	0.7
482866																							
482867	8	0	3.1	0	1.0	9	42	604	0	4.99	0	0	0	0	0.04	253	0	0.8	13.6	0	0.00	0.00	0.0
482868																							
482869	0	0	2.4	375	0.0	5	19	16	0	5.45	5	2	0	0	0.97	0	21	0.7	8.4	0	0.00	0.00	3.6
482870																							
482871	0	0	1.8	0	0.0	8	33	444	0	3.59	1	1	0	0	0.03	171	0	1.4	10.2	0	0.00	0.00	0.6
482872	8	0	1.0	165	0.0	8	10	111	0	4.06	2	0	0	0	0.06	0	0	1.1	10.4	0	0.00	0.00	3.5
482873																							
482874	4	0	4.9	0	0.0	10	10	43	0	3.55	4	0	0	9	0.05	0	20	0.4	3.1	0	0.00	0.00	2.5
482875	0	0	8.2	0	0.0	4	2	0	0	3.57	7	0	0	0	1.06	0	0	0.4	2.6	0	0.00	0.00	4.2
482876																							
482877																							
482878																							

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Au ppb	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe %	Hf	Hg	Ir	Mo	Na %	Ni	Rb	Sb	Sc	Se	Sn	Sr	Ta
482879																							
482880	0	0	1.7	0	0.0	8	46	445	0	5.75	1	0	0	0	0.03	158	0	0.3	12.8	0	0.00	0.00	0.6
482881	3	0	2.4	70	0.0	15	12	163	0	2.58	0	0	0	0	0.03	75	0	0.0	3.9	0	0.00	0.00	0.6
482882	2	0	3.5	0	0.0	9	25	282	0	3.71	1	0	0	0	0.03	106	19	0.3	12.2	0	0.00	0.00	0.7
482883	0	0	4.1	0	0.0	6	19	97	0	5.53	5	0	0	2	0.67	0	32	0.8	22.2	0	0.00	0.00	3.1
482884	8	0	2.9	2360	0.0	4	5	0	0	3.43	10	0	5	3	2.42	0	86	0.7	2.3	0	0.00	0.00	5.7
482885																							
482886																							
482887																							
482888	6	0	5.4	0	0.0	4	4	10	0	3.29	17	0	0	12	0.13	0	55	0.7	2.1	0	0.00	0.00	11.2
482889																							
482890	0	0	3.6	1200	0.0	2	4	0	2	5.13	10	0	0	7	1.11	0	147	0.0	4.6	0	0.00	0.00	6.5
482891																							
482892	0	0	4.2	0	0.0	6	22	136	0	4.54	2	0	0	4	0.10	50	0	1.7	16.2	0	0.00	0.00	0.0
482893																							
482894																							
482895																							
482896																							
482897																							
482898																							
482899																							
482901	0	0	3.1	0	0.0	5	32	142	0	6.23	2	0	0	0	1.26	75	0	0.0	26.5	0	0.00	0.00	0.0
482902																							
500651	0	0	6	0	0	11	110	7100	3	10.7	7	0	0	0	0.53	500	0	0	37.2	0	0	0	0
500652	0	0	3	0	0	4	130	11000	0	12.6	4	0	0	0	0.38	870	0	0	29.1	0	0	0	3
500653	5660	0	3	0	0	6	130	11000	0	12.9	6	0	0	0	0.39	760	0	0	31.6	0	0	0	3

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Au ppb	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe %	Hf	Hg	Ir	Mo	Na %	Ni	Rb	Sb	Sc	Se	Sn	Sr	Ta
500654	0	0	3	0	0	5	130	10000	0	11.7	5	0	0	0	0.28	850	0	0	23.5	0	0	0	2
500655	0	0	5	0	0	4	140	12000	0	13.6	8	0	0	0	0.25	1000	0	0	25.4	0	0	0	3
500656	0	0	0	0	0	9	100	5200	0	11	6	0	0	0	0.41	610	0	0	37.8	0	0	0	0
500657	3750	0	2	0	0	12	74	3600	0	8.39	2	0	0	0	0.53	430	0	0	44.4	0	0	0	0
500658	0	0	3	380	0	0	94	7300	0	12.1	5	0	0	0	0.59	430	0	0	37.8	0	0	0	0
500659	0	0	2	0	0	9	87	4300	0	10.8	5	0	0	0	0.73	430	0	0	36.2	0	0	0	0
500660	11	0	5	0	0	8	96	5300	0	11.7	5	0	0	0	0.77	490	0	0	39.4	0	0	0	0
500661	0	0	19	0	0	9	87	4500	0	12.2	3	0	0	0	0.75	330	0	0.4	37	0	0	0	0
506251	0	0	2.5	270	0	7	80	3130	0	9.63	2	0	0	0	0.58	727	0	0	40	0	0	0	0
506252	0	0	0	0	0	6	68	2500	0	8.52	3	0	0	0	0.78	664	25	0	36.7	0	0	0.06	1.9
506253	0	0	2.8	0	0	5	69	2540	2	8.68	3	0	0	0	0.81	699	0	0	35	0	0	0	0
506254	66	0	0	0	0	6	66	3980	3	9.21	5	0	0	0	1	554	38	0	40.6	0	0	0	0
506255	7	0	0	10	0	5	58	3190	3	8.31	5	0	0	0	1.03	512	31.5	0	36.4	0	0	0	3.3
506256	4	0	1.9	220	5.6	6	77	2210	0	8.65	2	0	0	0	0.46	873	0	0	32.9	0	0	0	1.5
506257	0	0	1.9	320	0	4	87	2630	0	9.66	2	0	0	0	0.45	814	0	0	30.6	0	0	0	0
506258	0	0	4	380	5.2	5	57	1660	2	8.51	3	0	0	0	0.94	458	31.5	0	36.1	0	0	0	1.9
506259	0	0	4.6	150	6.6	5	62	2820	0	8.91	3	0	0	0	1.06	360	29.5	0	38.4	0	0	0	0
506260	0	0	2.4	390	6.6	5	58	1590	0	8.39	2	0	0	0	1.02	290	43	0	36.2	0	0	0	2.3
506261	0	0	2	0	6.8	7	55	1590	2	8.4	3	0	0	0	1	447	0	0	35.9	0	0	0	0

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Mass gramme
470031	4	0	2	90	21.1	41	16	4.3	1	0	1.7	0.25	24.26
470032	3.1	1.5	0	70	23.9	47	20	4.1	1.1	0	1.7	0.26	24.18
470033	0.3	0	1	67	6.8	15	7	2.7	1	0	1.5	0.23	29.81
472921	0	0	77	114	3.4	12	8	2.7	1	0	2.1	0.3	30.48
472922	0	0	21	140	3.6	11	9	3.1	1.1	0.7	2.5	0.38	19.39
472923	0	0	51	181	2.9	8	6	2.5	1	0.6	2.4	0.36	22.89
472924	0	0	36	169	4.9	15	0	2.5	0.8	0	2	0.3	18.83
472925	0	0	37	111	2.8	9	0	2.5	1	0	2	0.3	17.04
472926	0	0	0	120	5.7	15	0	3.1	1.1	0	2.1	0.31	27.67
472927	1.8	0	43	121	7.7	18	0	3.1	1.1	0	1.6	0.28	19.02
472928	0.6	0	41	166	7.8	19	10	3	1	0	1.5	0.24	21.96
472929	1	0	34	82	5.9	15	6	2.3	0.8	0	1.5	0.24	20.32
472930	0.8	0	0	59	8.6	15	0	1.7	0.5	0	1.1	0.16	31.45
472931	1.9	0.7	21	0	22	39	19	3.6	1.1	0	1.5	0.23	23.78
472932	1.2	0	36	56	17.8	31	12	2.6	0.9	0	1.3	0.2	22.97
472933	2.1	0	55	108	23.9	45	22	4.2	1.3	0.5	1.8	0.24	18.43
472934	1.7	0	79	58	12.8	25	11	2.8	0.9	0	1.3	0.2	27.29
472935													
472936													
472937													
472938													
472939													
472940													
472941													
472942													

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Mass gramme
472943	0	0	2	110	2.4	4	0	1.5	0.5	0	1	0.15	25.89
472944	0	0	78	0	3	8	0	1.9	0.6	0	1	0.16	26.03
477817	0.5	0	11	107	2.6	9	10	2	0.7	0	1.6	0.24	22.91
477818	0.3	0	15	0	1.5	5	0	1.1	0.4	0	1	0.15	28.85
477819	0	0	0	0	0	0	0	0.1	0	0	0	0	29.38
477820	0	0.6	88	0	0.5	0	0	0.3	0.2	0	0.3	0	22.2
477821	25.7	5	128	0	209	305	88	14.5	2.3	0	7.6	1.19	20.93
477822	0	0	11	0	1.3	4	0	1.2	0.5	0	2	0.3	20.02
477823	0	0	24	0	1.1	0	0	0.5	0.2	0	0.5	0.07	18.46
477824	0.9	0	8	0	7.8	21	14	3.6	1.3	0	2.3	0.35	21.92
477825	0	0	27	82	3.8	11	7	2	0.7	0	1.4	0.21	30.51
477826	0	0	25	107	8.8	24	16	4.8	1.6	0	3.5	0.51	17.88
477827	0	0	62	97	6.5	16	0	2.3	0.9	0	1.5	0.23	16.18
477828	0	0	94	59	10.4	24	11	3.3	1.2	0	2.3	0.34	23.03
477829	0	0	27	61	5.3	12	12	2.5	1.3	0	1.3	0.2	20.89
477830	0	0	27	0	3.8	11	0	2	1	0	0.9	0.14	20.09
477831	0.8	0	78	0	11.3	22	11	2.5	1.2	0	0.8	0.11	20.1
477832	0	0	0	99	7.7	15	10	2.7	1.1	0.6	1.5	0.23	28.43
477833	0	0	0	178	6.9	17	8	3.3	1.3	0	1.6	0.24	36.15
477834	1.2	0	139	111	6.3	15	9	3.6	1.1	0.8	2.5	0.39	19.55
477835	1	0	0	128	8.9	17	8	3.1	1.1	0	1.7	0.26	34.41
477836	0.7	0	29	0	4.5	12	0	1.6	0.7	0	1.2	0.2	17.65
477837	1.1	0	0	153	13.2	25	15	4.3	1.6	0.7	2.7	0.41	32
477838	1.6	1.6	142	65	16.3	35	19	5.1	1.5	0.7	2.8	0.42	33.27
477839	0	0	69	69	3.4	9	12	1.9	0.7	0.5	1	0.16	19.43
477840	8.3	1.6	56	0	60.7	94	32	4.8	0.7	1	2.4	0.35	17.87

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Mass gramme
477841	0	0	59	0	1.4	0	0	0.5	0	0	0.4	0.06	18.38
477842	0	0	46	0	0.5	0	0	0.2	0	0	0	0	19.32
477843	0	0	27	0	1.8	0	0	0.8	0.4	0	0.7	0.1	20.37
477844	2.6	0	81	51	26	43	14	3.6	1.1	0	1.7	0.26	19.42
477845	0	0	0	71	3.5	9	0	1.4	0.7	0	1.1	0.16	29.21
477846	0.9	0	74	62	6.1	16	7	1.7	0.6	0	0.9	0.15	18.53
477847	0.9	0	135	56	6.1	15	8	2	0.8	0	1.2	0.18	24.89
477848	0.6	0	0	94	5.3	12	0	1.6	0.6	0	0.9	0.14	30.47
477849	0.7	0	47	87	7.4	18	8	2.3	0.7	0	1.3	0.17	16.7
477850	2	0	37	0	11.9	26	13	3	1.1	0	1.6	0.25	27.71
477851													
477852													
477853													
477854	0.7	0	89	91	4.1	7	0	1	0.3	0	0.7	0.11	16.71
477855	0.5	0	19	0	1.9	5	0	0.7	0.2	0	0.5	0.08	33.18
477856	0.4	0	0	0	1.7	4	0	0.6	0	0	0.4	0.07	27.84
477857	0.6	0	39	75	2.1	6	0	0.7	0.3	0	0.4	0.06	17.4
477858	0.5	0	32	0	4.8	11	8	1.7	0.6	0	1.3	0.2	20.45
477859	0.6	0	64	91	8.1	15	0	1.3	0.5	0	0.5	0.07	18.12
477860	0.5	0	0	60	4	7	0	1.2	0.4	0	0.7	0.11	28.71
477861	0.5	0	71	0	4	8	7	1.3	0.5	0	0.8	0.12	18.09
477862	0	0	76	65	2.8	7	0	1	0.3	0	0.3	0.06	18.36
477863	1.6	0	65	51	11.2	21	13	2.6	0.9	0	1.4	0.22	32.38
477864	0.7	0.8	35	0	5	10	0	1	0.4	0	0.5	0.08	21.42
477865	0.5	0	32	0	4.7	10	6	1.1	0.4	0	0.7	0.1	17.57
477866													

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Mass gramme
477867	0	0	50	0	1	0	0	0.7	0.3	0	0.6	0.1	31.94
477868	0	0	0	0	1.1	0	0	0.9	0.3	0	0.7	0.12	30.27
477869	2.4	1.1	335	0	15.7	32	16	3.4	1.1	0.6	1.1	0.16	19.32
477870	1.3	1.1	124	342	15.4	30	15	3.3	1.1	0	1.9	0.26	29.66
477871	2.6	1.2	0	270	14.9	28	13	3.2	0.9	0	3	0.45	32.67
477872	0	0	0	1940	12.5	31	6	1.7	0	0	0.7	0.11	29.36
477872H	0	0	0	22400	2.9	5	0	0	0	0	0	0	50.09
477873	3.1	0	0	180	16.6	36	15	4.1	1.6	0	2.2	0.33	27.94
477874	2.4	0	135	114	15.5	32	18	3.9	1.1	0	2.1	0.31	24.02
477875													
477876													
477877													
477878													
477879													
477880													
477881													
477882													
477883													
477884													
477885	0	0	0	8080	1.6	3	0	0.6	0.3	0	0.5	0.08	30.28
477885 H	0	0	0	1730	0	0	0	0	0	0	0	0	50.92
477886	0	0	0	6450	8.2	20	7	2	1.1	0	1	0.15	31.99
477886 H	0	0	0	71100	1.4	0	0	0.1	0	0	0	0	43.55
477887	0.6	0	0	10600	5.5	14	0	1.4	0.9	0	0.9	0.14	28.41
477888	2.1	1.3	88	89	30.3	55	27	4.3	1.2	0	1.6	0.24	16.9
477889													

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Mass gramme
477890													
477891													
477892													
477893													
477894													
477895													
477896													
477897													
482246	25.5	7.1	0	0	184	267	78	11.7	1.4	2.2	8.0	1.21	23.10
482247	0.0	0.0	0	0	2.0	7	0	1.3	0.5	0.5	0.8	0.16	23.96
482248	0.0	0.0	0	0	2.5	9	11	1.5	0.5	0.6	1.0	0.14	26.13
482249	0.3	0.0	0	0	1.4	5	0	0.7	0.3	0.0	0.5	0.09	28.92
482250	0.0	0.0	0	0	1.9	4	0	1.1	0.4	0.0	0.7	0.11	28.90
482251	0.7	0.0	1	90	5.1	14	13	2.0	0.6	0.7	1.1	0.14	31.03
482252	0.0	0.0	0	52	2.8	5	0	1.1	0.6	0.9	0.7	0.14	24.55
482253	0.0	0.0	0	0	3.1	10	0	1.4	0.5	0.0	1.3	0.22	30.18
482254	0.0	0.0	0	0	2.7	6	0	1.2	0.5	1.1	0.8	0.10	22.59
482255	0.6	0.0	0	96	1.9	7	0	0.8	0.0	0.0	0.6	0.15	27.57
482256	0.0	0.6	0	0	3.2	8	5	1.7	0.7	1.1	1.2	0.21	25.08
482257													
482258	0.3	0.0	0	0	2.9	6	0	1.3	0.5	0.0	1.2	0.16	30.72
482259	0.0	0.0	0	0	2.2	6	0	0.7	0.3	0.6	0.5	0.08	25.40
482260	0.3	0.9	0	96	13.8	23	11	2.4	0.8	0.5	1.7	0.28	33.45
482261	2.0	0.0	0	0	25.0	35	15	2.9	0.9	0.0	1.6	0.25	27.94
482262	9.9	3.4	0	0	137	176	62	8.0	2.1	0.0	1.4	0.25	32.67
482263	1.4	0.0	0	110	19.9	28	15	2.4	0.8	0.9	1.6	0.23	30.06

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Mass gramme
482264	1.5	0.0	0	0	29.1	39	19	2.7	0.7	0.0	1.5	0.25	33.15
482265	0.9	0.0	0	115	17.4	25	16	2.3	0.7	0.6	2.0	0.32	30.15
482266	3.4	0.0	0	0	33.7	48	20	3.7	1.0	0.7	2.2	0.31	28.80
482267	3.8	0.0	0	0	47.2	65	20	3.1	1.0	0.0	1.6	0.22	29.75
482268	2.8	2.0	0	0	36.4	59	27	5.2	1.4	1.0	2.5	0.38	27.04
482269	1.4	0.0	0	113	16.1	32	17	3.1	0.9	0.6	2.9	0.45	28.05
482270	5.0	1.3	0	0	36.1	62	32	4.3	0.8	1.0	3.6	0.59	22.13
482271	11.2	4.7	0	158	81.2	134	73	8.9	1.5	1.3	4.9	0.75	23.32
482272	0.7	0.8	0	135	8.5	16	12	2.4	0.8	0.5	1.7	0.27	26.77
482273	1.3	1.0	0	0	13.5	26	23	4.3	1.3	1.1	3.5	0.53	27.72
482274	0.9	0.0	0	0	9.4	19	14	3.6	1.1	0.0	3.5	0.55	29.49
482275	13.9	4.4	0	122	91.0	154	62	9.1	0.9	1.5	6.0	0.81	25.32
482276	4.4	2.0	0	85	34.4	56	30	3.7	0.7	0.6	2.5	0.34	26.79
482277	7.6	3.6	0	78	54.7	91	44	5.2	1.0	0.7	3.0	0.50	25.45
482278	10.5	2.6	0	106	67.6	103	47	6.0	1.2	1.2	4.4	0.63	28.19
482279	7.4	3.0	0	132	63.8	108	59	7.2	1.6	1.0	3.8	0.57	22.76
482280	18.1	6.8	0	154	121.0	196	98	12.0	0.8	2.0	7.7	1.08	22.37
482281	12.6	2.5	0	95	97.0	159	81	9.6	0.9	1.5	5.7	0.84	22.96
482282	1.8	1.5	4	0	20.2	40	36	5.2	1.5	0.9	3.4	0.51	26.55
482283	0.3	0.0	0	0	2.8	7	0	1.0	0.3	0.0	1.0	0.16	25.59
482284	5.3	2.0	0	98	43.8	72	35	5.3	1.4	0.7	2.2	0.35	28.83
482285	0.4	0.0	0	0	4.7	11	0	1.3	0.4	0.0	0.8	0.14	25.77
482286	0.0	0.0	0	330	2.5	8	0	2.5	1.0	0.0	2.8	0.39	34.11
482287	0.0	0.0	0	125	2.0	6	0	1.3	0.5	0.6	2.0	0.33	28.76
482288	0.4	1.2	0	0	0.6	0	0	0.0	0.0	0.0	0.0	0.00	27.70
482289	0.3	18.6	4	1800	4.6	8	5	0.6	0.0	0.0	0.8	0.09	27.23

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Mass gramme
482801													
482802	25.2	4.3	0	281	159	267	64	10.5	1.4	1.6	9.8	1.49	31.39
482803	0.4	0.0	0	0	2.6	9	0	1.6	0.6	0.0	1.1	0.21	31.84
482804	0.0	0.0	0	0	0.9	0	0	0.3	0.0	0.0	0.4	0.07	26.92
482805	0.2	0.0	0	0	1.1	3	0	0.6	0.2	0.0	0.5	0.09	26.38
482806	0.0	0.0	0	94	2.6	8	5	1.6	0.6	0.0	1.0	0.19	28.25
482807													
482808	0.6	0.6	0	112	4.5	13	0	1.2	0.4	0.0	0.6	0.10	24.57
482809	0.0	0.0	0	109	1.8	5	0	1.1	0.6	0.0	1.6	0.26	25.74
482810	2.4	0.5	0	0	21.0	39	10	2.4	0.9	0.0	1.4	0.25	29.18
482811	0.3	0.0	0	0	4.0	11	0	1.8	0.7	0.0	1.1	0.15	24.27
482812													
482813	0.0	0.0	0	0	4.3	11	5	2.2	0.9	0.5	2.2	0.35	29.36
482814	0.0	0.0	0	0	2.1	6	0	1.3	0.5	0.0	0.9	0.16	27.93
482815													
482816													
482817	0.0	0.0	0	0	1.0	4	0	0.8	0.3	0.0	0.6	0.09	27.13
482818													
482819													
482820	0.6	0.0	0	0	5.8	16	7	2.0	0.8	0.5	1.5	0.27	29.39
482821													
482822	0.0	0.0	0	0	2.0	7	0	1.3	0.6	0.0	0.9	0.14	31.65
482823	0.0	0.0	0	0	0.7	5	0	0.8	0.5	0.0	1.4	0.22	28.44
482824	0.0	0.0	0	61	0.0	0	0	0.5	0.3	0.0	0.9	0.14	29.05
482825	0.3	0.0	0	0	0.9	0	0	0.6	0.0	0.0	0.6	0.08	28.82
482826													

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Mass gramme
482827													
482828													
482829													
482830	0.0	0.0	0	0	2.4	8	0	1.4	0.6	0.0	1.0	0.14	26.12
482831	0.0	0.0	0	0	2.3	6	0	1.3	0.4	0.0	0.9	0.13	24.18
482832	0.0	0.0	0	200	1.0	4	0	0.5	0.0	0.0	0.4	0.06	26.14
482833													
482834													
482835	0.4	0.0	0	0	2.3	10	0	0.9	0.3	0.0	0.5	0.10	23.84
482836	0.0	0.0	0	84	4.7	17	6	2.0	0.8	0.5	1.4	0.23	28.84
482837	0.0	0.0	0	0	3.7	13	0	1.5	0.5	0.0	1.0	0.15	29.80
482838	0.3	0.0	0	0	2.9	8	0	1.3	0.5	0.0	0.8	0.14	27.50
482839	0.0	0.0	0	0	4.5	17	0	1.9	0.7	0.0	1.2	0.19	27.29
482840	0.3	0.0	0	0	2.8	9	0	1.1	0.4	0.0	0.7	0.12	26.21
482841													
482842													
482843													
482844													
482845													
482846													
482847	0.2	0.0	0	0	5.4	21	7	1.7	0.6	0.0	0.7	0.13	28.70
482848	0.0	0.0	0	85	1.6	8	0	1.1	0.4	0.0	0.6	0.10	30.49
482849	0.0	0.0	0	110	1.8	8	0	1.3	0.4	0.0	1.1	0.17	25.52
482850													
482851													
482852													

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Mass gramme
482853													
482854	0.0	0.0	0	0	1.8	0	0	1.1	0.4	0.0	0.7	0.11	27.91
482855													
482856													
482857													
482858													
482859	0.0	0.0	0	0	4.1	11	0	1.5	0.5	0.0	0.9	0.16	25.90
482860	4.8	1.1	0	0	47.8	65	33	3.5	1.1	0.0	1.0	0.17	28.87
482861	0.3	0.0	2	0	4.5	9	0	1.1	0.4	0.0	0.8	0.12	28.70
482862													
482863	2.5	0.6	0	0	23.6	31	16	1.4	0.5	0.0	0.5	0.08	27.59
482864													
482865	0.5	0.8	0	0	6.4	12	6	1.7	0.6	0.0	1.1	0.16	27.30
482866													
482867	0.0	0.0	0	0	2.9	7	6	1.2	0.4	0.0	0.8	0.12	30.44
482868													
482869	5.6	2.1	0	89	61.7	82	52	6.2	1.8	0.8	2.5	0.38	28.31
482870													
482871	0.0	0.0	0	0	4.5	8	6	1.4	0.4	0.0	0.8	0.13	26.34
482872	4.9	0.9	0	0	60.0	83	43	4.4	1.5	0.0	1.3	0.22	28.22
482873													
482874	5.8	2.4	0	55	50.1	63	22	3.5	0.6	0.6	1.8	0.27	28.30
482875	8.0	3.1	0	82	69.2	93	47	6.4	1.2	0.8	3.3	0.50	27.54
482876													
482877													
482878													

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Mass gramme
482879													
482880	0.3	0.6	0	75	5.3	9	6	1.2	0.4	0.6	1.0	0.16	28.96
482881	0.0	0.5	0	0	2.0	4	0	0.5	0.2	0.6	0.4	0.05	27.12
482882	1.6	0.9	2	0	14.0	24	8	1.8	0.7	0.7	0.9	0.17	26.66
482883	6.0	1.8	3	80	34.9	61	22	4.8	0.8	1.1	3.0	0.45	26.21
482884	20.7	5.3	3	85	87.8	137	54	7.8	1.3	1.5	3.8	0.59	19.41
482885													
482886													
482887													
482888	32.4	9.3	0	131	148	223	77	11.3	0.7	2.3	7.7	1.15	23.84
482889													
482890	22.7	5.6	0	165	119	189	67	11.1	2.4	1.9	5.0	0.77	21.18
482891													
482892	1.6	0.8	0	0	16.0	27	13	2.3	0.8	0.8	1.3	0.22	26.45
482893													
482894													
482895													
482896													
482897													
482898													
482899													
482901	0.7	0.0	0	80	5.1	13	10	2.7	0.9	0.8	1.9	0.30	28.32
482902													
500651	4.1	0	0	0	12.7	33	18	3.2	0.9	0	2.2	0.36	16.28
500652	6	0	0	0	15.5	35	22.5	2.8	0.7	0	2	0.32	25.61
500653	6.5	0	5	0	19	45	23	3.3	0.9	0	2.7	0.43	18.77

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Th	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Mass gramme
500654	7.2	0	0	0	16.9	40	0	2.6	0.5	0	2.8	0.38	31.36
500655	9.4	0	8	0	24.4	53	0	3.5	0.7	0	2.3	0.36	28.02
500656	5	0	0	0	17.7	42	0	3.5	1.1	0	2.6	0.4	21.01
500657	0	0	16	0	7.9	17	0	2.8	1.2	0	1.8	0.32	22.59
500658	5.1	0	6	0	22.3	49	32.5	4.3	1	0	2.3	0.35	17.86
500659	2.7	0	0	0	16.3	35	17.5	3.7	1.1	0	3.2	0.45	22.51
500660	3.3	0	0	0	17.5	40	23.5	4	1.1	0	2.9	0.44	17.07
500661	3.5	0	0	0	15.4	37	22	3.7	1.1	0	2.6	0.38	20.17
506251	2.6	0	0	110	9.4	21.6	22	3.6	0.8	0	1.84	0.256	6.612
506252	3.3	1	0	95	11	22.4	20	3.5	0.9	0	1.68	0.272	7.49
506253	2.7	1.4	0	92	11.9	20	15	3.6	0.8	0	2.16	0.312	7.284
506254	6.6	2.4	0	85	19.3	36	25	4.4	1	0	2.56	0.392	6.183
506255	7.6	0	0	84	19.5	32.8	25	4.3	1	0	2.16	0.344	6.482
506256	1	0	0	80	6.8	14.4	14	3	0.8	0.8	1.76	0.248	6.139
506257	1.1	0	0	110	7.4	14.4	11	3	0.7	0	1.52	0.248	6.886
506258	4.3	0	0	96	28.3	48	28	5.1	1.3	0	2.16	0.312	6.609
506259	3.6	0	0	99	21.2	34.4	22	4.6	1	0	2.08	0.312	6.898
506260	3.3	0	0	85	21.2	36	19	4.4	1.2	0	2.16	0.304	7.184
506261	3.9	2.1	0	103	23.7	36.8	25	4.6	1	0	1.84	0.36	6.796

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Ag	Cd	Cu	Mn	Mo	Ni	Pb	Zn	Al %	Be	Bi	Ca %	K %	Mg %	P %	Sr	Ti %	V	Y	S %
470031	0.0	0.0	30	898	0	31	0	68	5.55	0	0	7.93	0.97	3.07	0.053	146	0.71	199	21	0.113
470032	0.0	0.0	33	906	0	20	0	43	4.93	0	0	8.01	1.47	3.17	0.049	84	0.64	176	17	0.071
470033	0.0	0.0	97	1270	0	55	0	45	5.11	0	0	8.72	1.12	4.03	0.031	134	0.66	219	18	0.655
472921	0.0	0.8	134	1135	2	184	0	76	5.30	2	4	5.22	0.21	2.43	0.036	39	0.73	299	18	0.268
472922	0.0	0.8	144	1119	2	162	0	67	5.07	2	4	4.22	0.36	2.27	0.036	29	0.79	313	16	0.160
472923	0.0	0.9	132	1162	2	186	0	91	4.75	2	2	5.69	0.27	2.43	0.031	27	0.70	293	17	0.181
472924	0.0	0.8	81	1097	2	112	0	137	3.79	2	5	9.63	0.28	4.87	0.025	100	0.49	222	16	0.263
472925	0.0	0.7	93	1175	2	145	6	45	4.01	2	4	10.10	0.16	4.49	0.029	91	0.54	224	16	0.300
472926	0.4	0.4	134	1468	3	179	0	85	4.64	2	0	7.66	0.23	4.17	0.041	106	0.84	268	19	0.480
472927	0.0	0.9	60	1265	4	204	3	69	4.13	2	3	8.36	0.03	3.86	0.034	69	0.58	231	17	0.265
472928	0.0	1.0	62	1150	6	189	4	92	4.09	2	3	8.04	0.04	4.56	0.030	98	0.58	232	15	0.180
472929	0.0	0.9	33	1149	2	126	10	36	2.49	1	7	13.23	0.05	5.92	0.020	205	0.35	165	13	0.112
472930	0.0	0.0	38	843	2	122	6	48	1.93	1	0	14.19	0.22	7.15	0.017	315	0.31	141	11	0.041
472931	0.0	1.0	34	953	1	139	5	45	3.76	2	6	10.95	0.28	5.81	0.059	247	0.67	161	14	0.049
472932	0.0	1.0	52	1376	0	222	5	36	3.31	2	6	9.64	0.08	6.34	0.028	271	0.45	156	12	0.055
472933	0.0	0.7	17	1018	2	43	7	33	3.14	2	6	12.07	0.18	5.73	0.066	310	0.65	130	13	0.133
472934	0.0	0.3	30	795	0	209	6	41	3.24	2	3	8.57	0.10	4.00	0.051	239	0.57	143	12	0.671
472935																				
472936																				
472937																				
472938																				
472939																				
472940																				
472941																				
472942																				

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Ag	Cd	Cu	Mn	Mo	Ni	Pb	Zn	Al %	Be	Bi	Ca %	K %	Mg %	P %	Sr	Ti %	V	Y	S %
472943	0.0	0.5	85	871	2	292	0	66	2.49	2	0	5.94	0.13	4.70	0.014	228	0.46	145	8	0.366
472944	0.0	0.6	65	750	0	262	5	33	2.36	2	5	7.77	0.40	5.72	0.015	374	0.38	138	8	0.602
477817	0.0	1.2	97	1281	1	990	0	72	3.16	2	12	5.95	0.12	11.23	0.037	36	0.52	201	11	0.003
477818	0.0	0.8	13	793	0	355	9	26	1.62	0	9	15.53	0.03	8.13	0.015	59	0.26	103	6	0.009
477819	0.0	0.0	9	385	2	87	12	7	0.17	0	0	23.69	0.00	7.81	0.008	146	0.03	16	0	0.024
477820	0.0	0.9	4	531	0	105	17	0	0.34	0	9	23.67	0.01	7.09	0.010	174	0.05	22	2	0.024
477821	0.7	0.6	6	497	7	22	4	24	4.19	3	0	1.16	2.89	0.56	0.019	76	0.22	12	30	0.520
477822	0.0	1.0	0	1617	0	182	21	12	0.25	0	10	20.96	0.00	7.45	0.009	57	0.04	26	19	0.021
477823	0.3	0.9	6	1071	0	129	14	7	0.37	0	9	20.01	0.02	8.73	0.008	73	0.06	22	4	0.017
477824	0.0	0.8	140	1261	0	318	0	72	5.70	3	3	2.13	0.23	4.27	0.057	227	0.97	318	16	0.004
477825	0.0	0.8	70	1723	0	334	9	47	2.30	2	7	11.62	0.04	6.05	0.022	74	0.39	132	15	0.013
477826	0.0	0.7	210	1299	3	224	4	39	4.50	3	5	8.70	0.14	4.63	0.039	155	0.98	261	23	0.007
477827	0.0	0.7	3	1267	0	153	9	39	2.85	2	5	12.83	0.03	4.66	0.027	275	0.44	154	12	0.010
477828	0.0	1.0	97	1380	2	314	0	72	4.69	3	6	8.36	0.07	1.70	0.045	91	0.80	312	18	0.003
477829	0.0	0.4	32	1663	0	45	10	18	2.28	1	7	17.53	0.02	4.66	0.027	330	0.36	160	15	0.075
477830	0.0	0.6	29	1368	0	24	11	6	2.57	1	4	18.15	0.09	4.49	0.019	265	0.33	124	10	0.013
477831	0.0	0.5	5	2508	10	11	16	0	0.96	1	8	19.69	0.04	6.05	0.026	379	0.24	58	11	0.023
477832	0.3	0.0	41	1387	3	35	5	59	59	2	0	12.90	0.08	4.04	0.046	249	0.61	169	15	0.040
477833	0.6	0.6	130	1265	0	186	0	142	3.26	3	0	10.20	0.02	3.90	0.065	92	1.01	222	19	2.323
477834	0.0	1.0	238	1375	0	69	0	71	4.41	2	3	5.41	0.44	2.19	0.042	19	0.63	240	20	0.093
477835	0.4	1.2	133	1154	14	178	0	110	4.31	2	0	0.33	0.19	0.40	0.047	2	0.88	341	16	2.278
477836	0.0	0.8	40	1066	0	36	13	5	1.89	1	6	23.25	0.01	2.88	0.028	159	0.28	109	11	1.681
477837	0.6	0.0	155	1537	3	62	0	116	4.12	4	0	9.97	0.02	2.92	0.107	67	1.34	286	30	2.344
477838	0.4	0.9	128	1126	4	61	10	68	3.68	4	4	7.57	0.30	1.72	0.088	38	1.32	297	27	4.831
477839	0.0	0.6	43	1129	0	153	8	31	2.33	1	6	12.94	0.03	5.65	0.028	83	0.40	145	12	0.168
477840	0.0	1.0	0	807	0	115	12	6	1.62	1	9	15.58	0.81	7.80	0.008	139	0.05	11	21	0.015

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Ag	Cd	Cu	Mn	Mo	Ni	Pb	Zn	Al %	Be	Bi	Ca %	K %	Mg %	P %	Sr	Ti %	V	Y	S %
477841	0.0	0.5	3	1399	0	131	14	11	0.33	0	8	18.07	0.02	7.89	0.007	90	0.05	23	5	0.011
477842	0.0	0.8	0	302	0	86	13	0	0.18	0	11	20.26	0.02	10.40	0.006	149	0.00	4	2	0.015
477843	0.0	0.8	0	1009	0	70	13	6	0.17	1	10	21.30	0.00	8.91	0.008	103	0.03	16	11	0.017
477844	0.0	0.7	48	922	2	246	0	38	2.62	1	4	9.89	0.06	5.51	0.033	149	0.40	127	14	0.153
477845	0.3	0.0	44	1374	1	134	10	58	2.19	0	0	17.06	0.18	3.59	0.044	76	0.32	176	10	0.028
477846	0.0	0.8	20	1088	0	71	7	27	2.09	0	7	15.20	0.29	5.09	0.027	90	0.27	132	9	0.035
477847	0.0	1.0	27	920	0	55	7	26	2.54	1	4	11.70	0.36	4.59	0.023	202	0.35	136	10	0.174
477848	0.4	0.0	17	998	2	77	8	50	1.73	0	0	15.51	0.52	6.40	0.025	186	0.32	132	10	0.071
477849	0.0	0.9	16	860	0	76	10	30	2.55	1	5	14.16	0.80	5.57	0.033	167	0.36	136	11	1.267
477850	0.0	0.7	24	792	0	47	0	45	4.33	2	3	8.01	1.14	2.98	0.036	102	0.57	183	15	0.185
477851																				
477852																				
477853																				
477854	0.0	0.7	8	696	0	85	7	24	1.06	0	6	14.19	0.26	6.90	0.011	222	0.13	104	6	0.115
477855	0.0	0.7	8	783	0	98	12	19	0.85	0	9	18.39	0.03	8.48	0.015	188	0.11	95	6	0.034
477856	0.0	0.0	9	879	0	102	8	44	0.60	0	0	18.29	0.07	8.60	0.008	314	0.08	136	5	0.042
477857	0.0	0.8	5	700	0	91	14	26	0.72	0	10	18.44	0.24	8.86	0.010	324	0.10	81	4	0.138
477858	0.0	0.8	10	890	0	45	12	25	1.93	1	8	15.65	0.40	7.08	0.019	135	0.24	134	11	0.126
477859	0.0	0.8	3	754	0	61	12	36	0.84	0	10	17.59	0.24	8.25	0.012	241	0.10	79	5	0.099
477860	0.3	0.3	18	1070	0	123	8	49	1.29	0	0	17.16	0.03	7.41	0.017	155	0.21	135	10	0.076
477861	0.0	0.7	18	1169	0	93	8	19	1.57	0	6	15.48	0.03	6.81	0.017	88	0.18	153	8	0.049
477862	0.0	0.6	5	541	0	53	10	16	0.99	0	8	16.49	0.15	7.93	0.037	521	0.13	58	4	0.077
477863	0.0	0.6	18	829	0	44	5	39	3.44	2	0	8.90	0.06	3.56	0.033	32	0.46	231	14	0.040
477864	0.0	0.8	0	643	0	25	11	7	0.84	0	9	17.61	0.08	8.38	0.023	257	0.16	38	5	0.028
477865	0.0	0.8	2	586	0	33	9	9	0.90	0	10	17.38	0.06	9.04	0.021	650	0.16	67	7	0.031
477866																				

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Ag	Cd	Cu	Mn	Mo	Ni	Pb	Zn	Al %	Be	Bi	Ca %	K %	Mg %	P %	Sr	Ti %	V	Y	S %
477867	0.0	0.9	26	640	0	72	14	21	1.13	0	9	16.62	0.02	8.45	0.011	284	0.15	119	7	0.030
477868	0.0	0.0	40	837	0	77	8	38	1.41	0	0	14.97	0.02	7.35	0.011	280	0.24	132	9	0.042
477869	0.0	0.4	32	634	3	96	0	51	3.31	2	0	0.21	0.05	0.24	0.036	129	0.46	190	10	0.024
477870	0.0	2.5	93	1217	6	130	155	362	4.62	3	4	0.17	0.40	0.46	0.037	6	0.71	357	12	1.459
477871	0.6	1.9	54	1332	9	78	116	253	4.83	3	0	0.28	1.00	0.70	0.035	13	0.84	283	29	1.212
477872	50.7	12.3	237	848	30	76	31798	1937	2.43	1	0	0.18	0.68	0.40	0.029	5	0.41	192	10	8.554
477872H	101.8	118.5	1044	418	3	55	38434	22422	0.21	0	0	0.07	0.04	0.05	0.003	0	0.01	37	0	22.786
477873	0.6	1.2	96	906	19	74	73	165	3.53	2	0	0.24	0.66	0.43	0.056	5	0.89	332	10	2.288
477874	0.0	0.9	35	798	2	47	6	85	5.28	3	0	0.19	0.98	0.42	0.053	7	0.79	360	14	0.146
477875																				
477876																				
477877																				
477878																				
477879																				
477880																				
477881																				
477882																				
477883																				
477884																				
477885	22.3	36.7	575	1178	1	28	6980	5372	0.57	0	47	13.10	0.14	6.01	0.012	290	0.08	38	3	6.426
477885 H	64.3	9.1	1765	107	0	57	19957	1511	0.02	0	152	0.05	0.00	0.07	0.000	0	0.00	8	0	21.598
477886	43.5	44.6	1085	1065	2	147	8937	6490	3.19	2	145	3.40	0.41	1.99	0.042	69	0.74	219	7	3.151
477886 H	29.6	476.3	5910	245	0	25	4111	70949	0.07	0	80	0.43	0.01	0.00	0.000	0	0.00	0	0	24.448
477887	19.5	88.1	450	1489	2	56	3196	9282	2.05	0	53	11.80	0.24	5.15	0.022	286	0.33	100	7	4.586
477888	0.0	0.6	21	816	0	34	6	52	3.63	2	4	10.51	1.10	3.68	0.040	92	0.46	160	13	0.106
477889																				

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Ag	Cd	Cu	Mn	Mo	Ni	Pb	Zn	Al %	Be	Bi	Ca %	K %	Mg %	P %	Sr	Ti %	V	Y	S %
477890																				
477891																				
477892																				
477893																				
477894																				
477895																				
477896																				
477897																				
482246	0.0	0.0	13	64	11	7	33	52	4.74	11	0	0.05	0.16	0.00	0.028	43	0.17	0	66	0.021
482247	0.4	0.0	62	1208	1	994	0	50	2.08	1	2	13.39	0.08	8.17	0.030	178	0.35	133	11	0.100
482248	0.3	0.0	88	475	7	223	5	41	2.63	0	0	0.40	0.11	1.60	0.019	29	0.50	185	15	0.038
482249	0.0	0.0	104	557	0	301	0	25	1.51	0	3	12.48	0.03	7.91	0.009	121	0.24	95	6	0.054
482250	0.4	0.0	113	782	0	299	0	30	1.97	0	0	10.48	0.02	7.14	0.015	196	0.36	120	8	0.122
482251	1.8	0.9	10320	664	2	504	9	77	3.37	0	0	4.23	0.05	2.52	0.027	78	0.71	201	11	0.489
482252	0.0	0.0	275	1478	0	81	0	14	1.69	0	0	10.71	0.02	5.99	0.013	257	0.27	118	8	0.026
482253	0.7	0.0	55	1096	0	244	5	40	2.50	0	0	9.53	0.03	5.60	0.029	272	0.47	173	10	0.134
482254	0.0	0.0	73	595	1	207	4	30	2.22	0	0	4.49	0.11	3.76	0.004	158	0.37	123	8	0.113
482255	0.4	0.0	214	761	1	720	0	95	2.13	0	0	3.47	0.03	6.47	0.018	48	0.33	86	5	0.393
482256	0.6	0.0	103	1162	0	949	6	48	3.06	0	3	5.14	0.02	7.59	0.021	204	0.59	213	12	2.276
482257																				
482258	0.4	0.0	72	546	0	224	5	61	3.11	0	0	1.98	0.06	1.11	0.023	18	0.59	168	14	0.702
482259	0.6	0.0	2714	1316	0	100	0	15	1.30	0	3	11.48	0.05	6.06	0.010	144	0.25	85	6	0.017
482260	0.8	0.0	73	1420	0	133	10	80	4.27	1	0	5.41	0.24	2.78	0.075	71	0.90	275	21	0.346
482261	0.7	0.0	119	1313	2	127	10	76	4.29	0	0	5.92	0.18	2.97	0.079	94	0.73	219	20	0.408
482262	0.0	0.0	90	1361	0	121	11	58	4.53	1	0	11.01	1.17	5.52	0.356	1307	0.58	224	23	0.164
482263	0.4	0.0	87	1825	0	144	6	97	3.29	0	0	8.79	0.19	3.95	0.073	123	0.54	237	20	1.412

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Ag	Cd	Cu	Mn	Mo	Ni	Pb	Zn	Al %	Be	Bi	Ca %	K %	Mg %	P %	Sr	Ti %	V	Y	S %
482264	0.6	0.0	161	1370	3	208	6	49	3.92	0	0	9.83	0.55	4.10	0.082	189	0.78	245	17	0.581
482265	0.8	0.0	100	1593	0	121	19	109	3.90	0	0	5.28	0.48	3.41	0.043	82	0.79	255	18	1.787
482266	1.3	0.0	30	1198	4	261	15	77	4.01	0	0	3.17	0.11	1.30	0.120	51	0.67	163	22	10.571
482267	0.0	0.0	147	1677	0	104	11	68	3.88	0	2	8.93	0.15	3.81	0.136	108	0.71	214	19	0.667
482268	0.4	0.3	65	1853	0	20	14	97	4.07	2	0	7.98	1.49	2.80	0.195	259	1.01	164	30	0.977
482269	0.5	0.0	114	1623	0	172	12	102	3.93	0	0	7.90	0.12	3.77	0.078	125	0.79	314	21	0.571
482270	1.0	0.0	12	1985	0	8	11	43	3.07	2	0	11.49	1.56	3.78	0.013	170	0.10	7	41	3.030
482271	1.3	0.7	21	750	7	15	18	138	4.93	2	0	0.43	2.90	0.11	0.071	81	0.41	28	40	1.645
482272	0.5	0.0	94	2528	18	27	5	110	1.83	1	0	12.75	0.18	5.42	0.042	138	0.51	127	26	0.235
482273	0.4	0.0	273	1512	11	39	13	78	4.49	3	0	4.44	0.44	2.03	0.113	97	1.32	361	32	0.420
482274	0.8	0.0	244	1818	0	34	10	84	3.95	1	0	10.16	0.57	2.20	0.093	310	1.07	314	31	0.337
482275	1.3	0.5	19	857	6	8	19	146	4.27	3	0	1.74	0.16	0.62	0.024	53	0.21	15	64	1.861
482276	0.9	0.0	3	1259	1	26	10	92	2.06	2	0	9.03	0.15	4.34	0.022	277	0.09	9	25	3.545
482277	0.7	0.0	5	817	7	16	17	88	4.08	2	0	5.39	0.27	2.40	0.034	307	0.17	8	31	2.381
482278	0.7	0.0	33	1433	5	21	12	96	4.44	2	0	6.70	1.86	2.38	0.080	216	0.51	110	37	0.142
482279	1.0	0.8	71	1293	6	5	15	112	4.75	2	0	2.49	3.84	0.54	0.049	194	0.35	14	35	3.577
482280	1.5	0.6	14	265	8	5	17	164	5.51	2	0	0.38	0.85	0.18	0.038	216	0.18	0	84	3.863
482281	1.1	0.6	25	645	14	6	24	93	5.26	2	0	1.83	3.78	0.78	0.021	182	0.15	0	64	4.431
482282	0.8	0.0	129	1394	2	15	17	58	3.66	2	0	4.02	0.71	1.31	0.159	77	1.12	195	31	3.347
482283	0.7	0.4	29	1683	2	38	0	32	0.42	0	3	7.94	0.03	0.68	0.024	135	0.09	183	11	0.037
482284	0.7	0.0	39	1479	52	100	15	88	4.78	2	0	6.68	1.06	3.56	0.157	425	0.92	158	28	0.631
482285	0.5	0.0	50	1056	0	458	0	34	2.01	0	5	8.93	0.08	9.85	0.024	809	0.32	138	9	0.030
482286	2.3	0.4	1	7201	3	763	9	287	0.08	0	9	2.10	0.00	2.09	0.011	9	0.00	231	55	0.037
482287	1.5	0.0	73	3663	3	711	8	105	2.35	0	3	1.20	0.01	6.46	0.014	14	0.37	172	25	0.047
482288	0.3	0.0	212	55	1	58	0	3	0.15	0	0	0.06	0.06	0.05	0.001	5	0.00	0	0	0.552
482289	11.5	11.7	140	1267	27	133	6005	1787	0.61	0	13	11.95	0.47	6.30	0.041	84	0.09	133	13	6.819

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Ag	Cd	Cu	Mn	Mo	Ni	Pb	Zn	Al %	Be	Bi	Ca %	K %	Mg %	P %	Sr	Ti %	V	Y	S %
482801																				
482802	0.0	1.5	26	151	34	26	52	310	3.71	5	2	0.05	0.05	0.00	0.021	13	0.17	7	78	0.016
482803	0.0	0.0	71	800	0	242	4	35	2.74	1	0	8.69	0.03	5.51	0.091	125	0.51	186	13	0.078
482804	0.0	0.0	3	691	0	38	7	7	0.13	0	0	17.09	0.00	10.32	0.003	413	0.00	22	7	0.013
482805	0.0	0.0	28	370	0	352	0	43	1.33	2	0	1.88	0.09	0.76	0.027	23	0.23	81	5	0.004
482806	0.5	0.3	85	1063	0	719	0	90	3.59	0	0	1.08	0.04	3.21	0.022	28	0.55	187	12	0.195
482807																				
482808	1.5	0.4	1831	191	32	133	7	111	2.46	1	0	0.65	0.64	0.36	0.045	25	0.46	178	6	0.250
482809	0.0	0.0	23	1364	0	167	5	111	1.64	0	0	13.40	0.03	6.58	0.041	71	0.28	141	19	0.306
482810	0.0	0.0	97	618	3	233	5	64	2.37	1	0	3.07	0.09	1.30	0.028	40	0.36	132	18	0.270
482811	0.0	0.0	88	1408	0	760	4	72	3.25	0	0	4.10	0.02	3.81	0.031	55	0.59	224	12	1.070
482812																				
482813	0.3	0.0	61	949	1	582	0	58	3.79	0	0	3.84	0.01	5.84	0.025	255	0.65	147	23	2.370
482814	0.0	0.0	21	1142	0	710	0	67	2.78	0	0	6.82	0.01	8.31	0.013	163	0.43	162	10	0.207
482815																				
482816																				
482817	0.0	0.0	54	747	0	293	5	29	1.62	0	0	10.45	0.04	8.23	0.019	212	0.25	97	6	0.025
482818																				
482819																				
482820	0.0	0.0	92	1070	0	276	3	41	3.41	0	0	6.15	0.13	5.47	0.057	503	0.56	240	20	0.082
482821																				
482822	0.0	0.0	50	985	0	543	0	60	2.87	0	0	5.15	0.01	7.53	0.024	160	0.45	211	11	0.178
482823	0.0	0.0	17	3127	0	465	0	53	0.38	1	0	13.17	0.00	8.59	0.010	112	0.05	182	33	0.018
482824	0.0	0.0	7	2342	0	598	0	51	0.15	1	0	14.68	0.00	9.11	0.006	99	0.02	123	22	0.013
482825	2.1	0.0	9500	1068	0	260	0	20	1.04	0	0	11.20	0.00	9.07	0.000	178	0.16	211	7	0.292
482826																				

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Ag	Cd	Cu	Mn	Mo	Ni	Pb	Zn	Al %	Be	Bi	Ca %	K %	Mg %	P %	Sr	Ti %	V	Y	S %
482827																				
482828																				
482829																				
482830	0.4	0.4	227	1034	0	336	0	45	2.63	0	0	2.48	0.01	2.91	0.012	36	0.46	160	10	0.162
482831	0.0	0.0	141	851	0	226	5	30	2.19	0	0	7.42	0.01	5.11	0.023	170	0.42	159	10	0.049
482832	0.3	0.0	21	708	2	248	27	207	0.85	0	0	3.41	0.04	5.32	0.007	99	0.15	65	4	0.038
482833																				
482834																				
482835	0.0	0.0	326	729	0	78	7	45	1.59	0	0	7.43	0.02	3.93	0.011	75	0.27	92	7	0.018
482836	0.8	0.0	85	1274	0	395	11	71	3.64	0	0	5.82	0.03	5.51	0.042	214	0.75	256	17	0.019
482837	0.5	0.0	1099	808	0	211	6	52	2.73	0	0	5.05	0.03	4.02	0.019	159	0.48	168	12	0.040
482838	0.0	0.0	1100	1048	0	228	4	43	2.20	0	0	10.25	0.02	6.34	0.019	191	0.42	189	10	0.037
482839	0.3	0.0	58	1137	0	286	8	59	3.17	0	0	6.62	0.04	5.46	0.033	240	0.67	217	15	0.014
482840	0.4	0.0	200	752	0	249	0	23	1.84	0	0	7.84	0.02	4.06	0.026	44	0.32	91	8	0.007
482841																				
482842																				
482843																				
482844																				
482845																				
482846																				
482847	0.5	0.0	95	212	2	298	11	62	3.27	1	0	0.20	0.11	0.14	0.062	32	0.88	244	8	0.759
482848	0.0	0.0	451	156	0	186	8	75	3.22	0	0	0.13	0.12	0.10	0.038	16	0.68	191	6	0.590
482849	0.5	0.0	304	874	3	541	7	105	3.33	0	0	0.11	0.06	0.20	0.033	12	0.62	272	11	0.251
482850																				
482851																				
482852																				

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Ag	Cd	Cu	Mn	Mo	Ni	Pb	Zn	Al %	Be	Bi	Ca %	K %	Mg %	P %	Sr	Ti %	V	Y	S %
482853																				
482854	0.4	0.0	96	735	8	272	8	50	3.08	0	0	0.36	0.06	2.10	0.018	53	0.52	178	7	0.425
482855																				
482856																				
482857																				
482858																				
482859	0.0	0.0	94	970	0	70	5	24	1.88	0	0	10.51	0.11	6.02	0.037	170	0.46	134	12	0.057
482860	0.4	0.0	52	1208	0	179	12	33	3.19	0	0	9.30	0.25	4.95	0.152	204	0.54	168	14	0.448
482861	0.4	0.0	101	1876	0	163	0	22	1.92	0	0	10.42	0.20	5.88	0.025	178	0.34	123	10	0.143
482862																				
482863	0.0	0.0	18	818	24	62	0	28	1.30	0	0	13.59	0.03	7.19	0.078	261	0.22	75	6	0.284
482864																				
482865	0.0	0.0	90	1244	0	41	0	43	2.25	0	0	9.65	0.15	4.40	0.046	98	0.59	174	13	0.191
482866																				
482867	0.4	0.0	68	1021	0	256	0	46	2.46	0	0	9.82	0.06	6.20	0.029	261	0.42	135	10	0.195
482868																				
482869	0.6	0.0	25	1377	2	11	11	89	4.55	1	0	5.59	0.99	2.53	0.261	144	0.82	93	29	0.367
482870																				
482871	0.3	0.0	73	925	0	176	0	49	2.90	0	0	10.43	0.03	5.30	0.029	160	0.57	153	9	0.257
482872	0.5	0.0	35	1202	3	48	10	41	3.41	0	0	9.33	0.47	5.22	0.224	279	0.55	104	18	0.135
482873																				
482874	0.4	0.0	11	1161	2	49	4	48	2.44	1	0	13.40	0.45	6.03	0.016	148	0.12	34	22	0.165
482875	1.2	0.4	6	1268	7	15	12	88	6.63	2	0	5.95	1.40	2.35	0.034	62	0.23	0	49	0.754
482876																				
482877																				
482878																				

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Ag	Cd	Cu	Mn	Mo	Ni	Pb	Zn	Al %	Be	Bi	Ca %	K %	Mg %	P %	Sr	Ti %	V	Y	S %
482879																				
482880	0.3	0.0	59	1363	2	186	3	62	2.22	0	0	8.76	0.13	4.22	0.027	127	0.39	143	11	0.024
482881	0.0	0.0	16	744	0	76	0	13	0.63	0	4	16.87	0.03	8.49	0.009	145	0.11	36	4	0.009
482882	0.3	0.0	80	1037	0	129	4	36	2.38	0	0	11.23	0.22	5.38	0.062	157	0.48	135	10	0.061
482883	0.7	0.0	192	1407	0	34	11	81	4.49	3	0	6.29	0.85	2.80	0.048	178	0.82	222	30	0.503
482884	1.5	0.0	39	909	4	5	10	88	3.25	2	0	3.54	2.32	1.22	0.038	219	0.26	7	23	0.162
482885																				
482886																				
482887																				
482888	1.3	0.0	27	1344	10	10	33	154	3.11	2	0	4.99	1.12	1.89	0.011	72	0.11	16	42	1.889
482889																				
482890	1.5	0.0	19	1340	6	6	26	157	3.23	3	0	1.61	3.48	0.69	0.063	140	0.43	0	29	0.196
482891																				
482892	0.0	0.0	86	1304	4	57	7	58	3.52	0	0	8.39	0.51	3.69	0.088	241	0.63	180	15	0.288
482893																				
482894																				
482895																				
482896																				
482897																				
482898																				
482899																				
482901	0.6	0.0	216	1300	0	83	12	78	4.13	1	0	6.59	0.74	3.57	0.080	264	1.01	323	18	0.048
482902																				
500651	0.0	1.2	222	572	0	517	5	38												0.008
500652	0.0	0.6	402	752	0	830	4	47												0.032
500653	0.0	0.6	59	757	0	743	3	50												0.019

Table 1. *Sample descriptions and analytical results. All concentrations in ppm, except where otherwise stated.*

Sample no.	Ag	Cd	Cu	Mn	Mo	Ni	Pb	Zn	Al %	Be	Bi	Ca %	K %	Mg %	P %	Sr	Ti %	V	Y	S %
500654	0.0	0.0	38	774	0	880	2	51												0.023
500655	0.0	0.0	33	777	0	889	4	48												0.029
500656	0.0	0.0	40	665	0	582	6	37												0.007
500657	32.0	0.7	76	504	0	358	11	39												0.013
500658	0.0	0.7	78	695	0	498	7	56												0.068
500659	0.0	0.7	220	675	0	483	7	53												0.004
500660	0.0	0.9	116	687	0	490	7	55												0.031
500661	0.0	1.2	79	530	0	395	4	42												0.022
506251	0.0	0.0	104	1356	0	626	4	80	4	0	10	6.26	0.21	10.59	0.039	83	0.86	291	20	0.012
506252	0.5	0.0	105	1299	0	556	6	80	4	0	10	5.80	0.39	9.57	0.041	114	0.89	283	20	0.014
506253	0.0	0.0	100	1261	0	559	6	75	4	0	9	5.45	0.39	9.12	0.041	113	0.84	257	19	0.014
506254	0.5	0.0	105	1364	0	470	5	86	4	0	9	5.88	0.60	8.32	0.047	124	1.10	339	22	0.020
506255	0.0	0.0	93	1263	0	444	7	80	4	0	8	5.35	0.67	7.70	0.046	124	0.99	296	22	0.018
506256	0.0	0.0	90	1429	0	686	5	82	4	0	11	6.70	0.15	9.64	0.037	77	0.83	260	19	0.011
506257	0.0	0.0	98	1433	0	755	0	97	5	0	11	5.44	0.13	11.62	0.040	88	0.88	264	19	0.012
506258	0.0	0.0	114	1473	0	353	8	86	5	0	9	6.39	0.59	7.11	0.088	241	1.12	313	26	0.037
506259	0.0	0.0	109	1312	0	361	5	80	5	0	9	6.13	0.52	7.21	0.063	189	1.00	288	23	0.022
506260	0.0	0.0	117	1398	0	372	3	83	5	0	10	6.18	0.54	7.46	0.066	215	1.07	307	24	0.021
506261	0.0	0.0	118	1410	0	354	7	81	5	0	9	6.18	0.57	7.20	0.071	235	1.04	301	24	0.029