The Samphire Project: A distal IOCG and evidence for Mesoarchean crust in the Gawler Craton

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THE SAMPHIRE PROJECT: A DISTAL IOCG AND EVIDENCE FOR MESOARCHEAN CRUST IN THE GAWLER CRATON

THE SAMPHIRE PROJECT: A DISTAL IOCG

ABSTRACT

The Samphire project on the north eastern Eyre Peninsula contains proven uranium resources. These are in paleochannel-like deposits hosted within saprolite that has a granite origin. This granite forms the bedrock of the area and is of a batholith scale termed the Samphire batholith. Alteration takes the form of hematite, quartz and fluorite, forming vein assemblages that display cross cutting relationships. Characterization of this alteration by scanning electron microscope and geochemical analysis suggests this alteration strongly resembles iron oxide-copper-gold alteration that is seen through out the Gawler Craton. U-Pb dating of zircon, thorite and hematite is used to provide reconnaissance geochronology for age of the host granite and also stages of alteration. The summation of results from these techniques, creates a genetic model with the suggestion of the origin of the uranium in the overlying cover from the bedrock granite.

SAMPHIRE, GAWLER CRATON, BEDROCK, MESOARCHEAN, IOCG, U-PB GEOCHRONOLOGY

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INTRODUCTION

The Gawler Craton contains a significant record of Archean to Proterozoic crustal evolution and tectonic processes. Continued study of the region, particularly with respect to geochronology, contributes to an understanding of Precambrian tectonic cycles and how these relate to regional metallogeny. U-Pb dating of zircon or monazite is a well-established method for obtaining ages of crystallization of igneous rocks but does not, necessarily provide accurate ages for associated mineralization. Recent work by Ciobanu et al. (2013) has used the trace amount of uranium in the common Fe-oxide hematite to establish a new geochronometer for dating iron-oxide copper-gold (IOCG) style mineralization. This study showed geologically reasonable ages of ~1590 Ma for the super-giant (>9000 Mt) Olympic Dam deposit, the archetypal IOCG deposit for the Gawler Craton, demonstrating the potential for application to analogous Fe-oxidebearing mineralization elsewhere. Geochemical analysis of hematite and fluorite trace elements showed an enrichment in rare earth elements (REE), Y and High Field Strength Elements (HFSE) that is a recognised trend of IOCG type alteration and deposits within the Gawler Craton (Oreskes & Einaudi 1992; Agangi et al. 2010; Kontonikas-Charos et al. 2014).

Mineral exploration across the Gawler Craton is hindered by the thickness of the overlying cover sequence (Skirrow *et al.* 2002; Drummond *et al.* 2006; Direen & Lyons 2007). The lack of bedrock outcrop hampers geological mapping and has meant that the tectonic evolution of the region is less well understood than in other better exposed parts of the world. The recent expansion of mineral exploration in South Australia and particularly, the diamond drilling of prospects in parts of the Craton in which negligible data was previously available, has however, provided valuable windows to the bedrock

geology. Such is the case of Samphire, a uranium project on the eastern Eyre Peninsula largely concentrated in the cover sequence but likely rooted in the underlying granite bedrock.

This paper provides a description of the granite bedrock at Samphire (Figure 1a, b), and of associated alteration and crosscutting fluorite veins that carry modest amounts of sulphides, Fe-oxides and REE-bearing minerals. The hypothesis offered is that this 'bedrock mineralization' represents a distal IOCG-type mineralization related to the ~ 1590 Ma event. This hypothesis was put forward based on the visual similarity of the host granite to Hiltaba Suite granites elsewhere in the region, observed alteration, mineralogy and the apparent enrichment in U, Th, REE, Y, and various granitophile elements (Sn+W+Mo). The mineralogical-petrographic work is complemented by trace element analysis and reconnaissance geochronology to test this hypothesis, and thus contribute to a genetic model for the Samphire mineralization as well as a better understanding of regional geology.



Figure 1 a) Location map of EL4979 within South Australia and relavant lithologies. Inset map provides extent of crystalline basement of the Gawler Craton. b) Bouguer anomaly removed gravity map of prospect area with drillhole locations. Data compiled in ESRI's ARCgis using data sets from SARIG with drillhole location and gravity map provided by Uranium SA.

GEOLOGICAL BACKGROUND

GEOLOGICAL SETTING

The Gawler Craton, South Australia (Figure 1a), is dominated by two phases of tectonic activity – Late Archean and late Paleoproterozoic-early Mesoproterozoic (Hand *et al.* 2007; Betts *et al.* 1998). The stratigraphy and tectonic evolution of the Gawler Craton are covered in depth by Daly *et al.* (1998) and Hand *et al.* (2007) and are only briefly summarised here. It is widely acknowledged that the Gawler Craton consists of an Archean nucleus with a Paleoproterozoic arcuate belt wrapped around (Daly *et al.* 1998; Betts *et al.* 2002), however Fraser *et al.* (2010) suggest extending the timeline of the Gawler Craton back ~500 million years into the Mesoarchean. Fraser *et al.* (2010) dated the Cooyerdoo granite at ~3150 Ma suggesting that parts of the Gawler Craton contain a Mesoarchean basement (see also McAveney 2012). Gneisses of the Late Archean

Sleaford and Mulgathing Complexes display granulite facies metamorphism in many areas that has been attributed to the ~2500-2400 Sleaford Orogeny (Betts *et al.* 2002; Swain *et al.* 2005). The Proterozoic period is split by Hand *et al.* (2007) by the 1730-1690 Ma Kimban orogeny, before which sedimentation was the primary rock-forming process, and after which the main rock forming process was magmatism. Time before the Kimban Orogen was dominated by rift-basin formations and includes deposition of the ~1780 Ma Hutchison group (Parker & Lemon 1982; Szpunar *et al.* 2011). The formation of the arc-related St Peters Suite between 1620 Ma and 1615 Ma, places the Gawler Craton in close proximity to an active plate margin (Hand *et al.* 2007; Swain *et al.* 2008).

The Gawler Range Volcanics (GRV) cover an area greater than 25 000 km² with a preserved thickness of 1.5 km (Hand *et al.* 2007; Agangi *et al.* 2012) and outcrop as rhyolites, dacites, andesites, rhyodacites and minor basalts. These GRV are divided into a small- to moderate-volume lower, and a highly-voluminous upper sequence interpreted to represent a siliceous felsic large igneous province (SLIP; Allen *et al.* 2008). The GRV-Hiltaba event is a product of a major tectonic-tectonothermal metallogenic event that also led to widespread greenschist to upper amphibolite facies metamorphism in some parts of the craton (Hand *et al.* 2007). The Hiltaba Suite granites locally intrude the GRV, and occur as oxidized, silicic I- and A- type, metaluminous granitoids of plutonic extent (Ferris *et al.* 2002; Hayward & Skirrow 2010). These Hiltaba Suite granitoids are strongly enriched in uranium, fluorine and other HFSE (Hayward & Skirrow 2010). In the eastern Gawler Craton, Hiltaba Suite plutons are more oxidized and evolved with average εNd_{1595} of -5.9 indicating a greater crustal contribution compared to those of the central and western Gawler Craton (Hand

et al. 2007; Hayward & Skirrow 2010). Emplacement of Hiltaba Suite granites occurred over a period of approximately 25 million years and is interpreted to have formed via extensive fractionation and crustal contamination of mantle-derived mafic magmas, mixed with silicic crustal melts (Hayward & Skirrow 2010).

Multiple geodynamic models have been proposed for the Late Paleoproterzoic and Mesoproterozoic evolution of the Gawler Craton in an attempt to account for the vast magmatism of the 1595-1575 Ma Gawler Range Volcanics-Hiltaba event. These include anorogenic or intracontinental rift setting, plume-modified back-arc, foreland basin and lithospheric delamination (Giles 1988; Wade *et al.* 2006; Hand *et al.* 2007). This wide spread event coincides with a shift towards a continental interior regime (Hand *et al.* 2007).

IOCG MINERALIZATION WITHIN THE GALWER CRATON

The IOCG deposit clan form a continuum in which the largest examples occur in Earlyto Mid-proterozoic regions in intraplate environments (Hitzman *et al.* 1992; Williams *et al.* 2005). IOCG mineralization is, however, not restricted to just these regions (e.g. Corriveau 2007; Groves *et al.* 2010) and can be found in Archean, Mesozoic or Cenozoic terranes (Barton 2014). Mineralisation of this style is defined based upon geochemical features, without a specific tectonic setting, geologic environment or source of ore-forming fluids and metals (Williams *et al.* 2005).

The intrusive Hiltaba Suite and GRV package displays a strong spatial and temporal association with IOCG mineralisation within the Gawler Craton (Williams *et al.* 2005). A domain extending over 700 km on the eastern margin of the Gawler Craton show in Figure 1a, is recognised as the Olympic Cu-Au Province which contains the majority of IOCG deposits and prospects discovered within the Gawler Craton to date (Ferris *et al.*

2002; Skirrow *et al.* 2002; Hayward & Skirrow 2010). The deposits of IOCG-style mineralisation within this province include Olympic Dam, Prominent Hill, Carrapateena, Hillside (Pine Point), Punt Hill and Cairn Hill (Belperio *et al.* 2007; Conor *et al.* 2010; Ismail *et al.* 2014). These deposits display a variety of mineralization and alteration styles consistent with formation at different crustal depths, in different local geological settings, and with different proportions of lithological and structural control. Given the thickness of the overlying cover, recent studies (e.g Ismail *et al.* 2014; Kontonikas-Charos *et al.* 2014; Nikolakopoulos *et al.* in press) have investigated the potential of using trace element concentrations of REE and Y in a range of different minerals as a vectoring tool towards prospective mineralisation in an attempt to overcome this.

THE SAMPHIRE PROJECT

The Samphire Project (Figure 1a) is on the north-eastern Eyre Peninsula, approximately 20 km southwest of Whyalla. The project is wholly owned by Uranium SA Limited and contains two proven sediment (paleochannel)-hosted uranium deposits, Blackbush and Plumbush. The deposits contain a total estimated inferred resource of 86.3 million tonnes of mineralisation (Uranium SA 2014). This uranium mineralization is hosted in sediments of Eocene age, referred to as the Kanaka Beds (Hou *et al.* 2012). The Samphire granite was intersected below the uranium mineralization by diamond drillholes aimed at delineating the extent of uranium mineralisation. Granite basement was found below 100-120 m below an extensive saprolite. Petrographic studies and geochemical (REE + U) data collected on behalf of Uranium SA suggest that the granite resembles the Hiltaba-aged Roxby Downs Granite.



Figure 2 Schematic diagram showing drillcore lithologies and alteration with depth (m) and sample locations. Above 105 m is undifferentiated saprolite and cover sequence.

METHODS

Approach and Sampling

3 diamond drillhole cores (Figure 2) were logged below the saprolite-granite boundary with 20 samples selected for further microanalysis. The samples were chosen to target vein relationships, vein mineralisation, brecciation, clay alteration and compositional variations within the granite and are considered to be representative of the alteration within the drill core. Uranium SA has supplied detailed logs for 6 of the diamond drill holes in the project area which have been used to supplement the logging exercise. The chosen samples were prepared as 1 inch epoxy-resin mounted blocks by Adelaide Petrographics and are detailed in Table 1. Microanalytical observations were used to supplement macroscale observations and provide more semi-quantitative data at a greater degree of accuracy. Traditional petrographic techniques can identify minerals at the grain scale but defining compositional zonation and trace element concentrations within mineral grains requires more advanced, higher-resolution techniques such as scanning electron microscopy (SEM) and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). The latter offers sub-ppm sensitivity coupled with micron-scale resolution and permits a quantitative understanding of trace element distribution at the scale of single grains.

Analytical

An FEI Quanta 450 scanning electron microscope (SEM) with energy dispersive X-ray spectrometry and back-scatter electron (BSE) imaging capabilities (Adelaide Microscopy) was used. BSE imaging (accelerating voltage, 20 kV, spot size of 4 and beam current of 10 nA) allowed for characterisation of each polished block sample in terms of significant textures and mineralogical relationships.

LA-ICP-MS was used to quantitatively analyse trace elements as spot analysis, element maps from suitable samples and for *in situ* U-Pb dating. The minerals targeting for trace element analysis were hematite and fluorite. This was performed on a Resonetics M-50-LR 193-nm Excimer laser microprobe coupled to an Agilent 7700cx Quadrupole ICP-MS (Adelaide Microscopy). Full details of analytical methods including spot sizes and beam transmission for all LA-ICP-MS methods are given in Appendix A.

OBSERVATIONS AND RESULTS

Petrography

The petrographic-mineralogical study was conducted on granites, their altered equivalent and on cross-cutting veins. The objective was to provide insights into the variation within the host lithologies, as well as the (hydrothermal) mineralogy and textures in the veins. Lithology, alteration stages and mineralogy are summarised in Table 1. Key textures and mineral relationships are illustrated in Figures 3-8.

SAMPHIRE GRANITE

The Samphire granite is a large homogeneous, undeformed, medium-grained granite that contains quartz and K-feldspar as main minerals with lesser amounts of plagioclase feldspar. Mafic minerals are broadly absent as phenocrysts but biotite forms up to 10% of the groundmass. Very small amounts of hornblende were also noted. The granite ranges from pink to purple to grey in colour which relates directly to the proportions of K-feldspar, quartz and fluorite, respectively. Small vesicles, ~2 mm in size, are noted in some intervals of the granite. The groundmass is made up of equigranular, 5-8 mmsized K-feldspar-quartz-plagioclase with minor biotite and may contain phenocrysts of K-feldspar.

Textures are complex with porphyritic or pegmatite-like packages interspersed in short cm-scale intervals of drillcore within the more common medium-grained texture (Figure 3a, c). Within these porphyritic or pegmatitic varieties, K-feldspar forms 30-50 mmsized phenocrysts and the groundmass is composed of finer quartz-K-feldsparplagioclase. There is sufficient compositional variation within the drillcore for small intervals to be recognised as quartz syenite, alkali feldspar granite or monzogranite.



Figure 3 Photos of drill core samples showing textural and compositional variations within Samphire granite. a) 37 cm section from MRM751 with porphyritic texture. b) Fluorite 'flooding' texture towards right hand side with distinct purple colour compared to the left hand section. c) Quartz rich vein containing wall rock clasts with chlorite alteration. Gap between sections is a cavity that is 5 cm in size. Below cavity is a 8-10 cm section of porphyritic texture. d) A hydrothermal 'boiling' texture with very dominant hematite alteration and prominent vugs intersected for 20 cm. e) 4 cm thick fluorite vein with earth hematite overprint. f) hematite vein-let swam imparting breccia-like texture. Scale for e, d and f is in cm.

A series of 'flooded' textures are observed where the K-feldspar content is reduced and quartz or fluorite become almost as abundant as K-feldspar or, more rarely, even greater (Figure 3b). In 'fluorite flooded' intervals, the fluorite content approaches 30% and imparts a distinct purple colouration to the granite. The fluorite is of the non-fluorescent variety.

K-feldspar content ranges from 60-80%. In the groundmass, plagioclase grains are 4-8 mm in length and content is up to 15% of the groundmass and is difficult to distinguish from K-feldspar due to hematite staining. Quartz grains are consistently medium 3-8 mm in size and form 25-50% of the ground mass.

Biotite forms aggregates of grains amounting up to 15% however, is primarily found to make up <10% of the main mineral assemblage.

Hydrothermal alteration is present through much of the Samphire granite and is manifested as clay alteration of primary minerals and crosscutting hydrothermal veins. At the granite-saprolite contact, chlorite and kaolinite replace both plagioclase and potassium feldspar, leaving grains of slightly altered quartz resulting in a rock with low competency (somewhere between a granite and saprolite). Quartz shows little signs of alteration but has a gritty/granular appearance in the clay-rich sections. Plagioclase displays an irregular clouding of grains with sericite and hematite. K-feldspar shows degrees of sericite alteration, overprinting by hematite overprinting and small exsolved lamella of plagioclase giving a perthitic texture. Biotite tends to be greener in altered parts of the drillcore and often with a lustrous sheen that can be attributed to alteration to fine-grained mixtures of chlorite and sericite.

Veins, veinlets and vein swarms are present within the Samphire granite. These contain quartz, fluorite and hematite as dominant minerals and this assemblage defines veinstage alteration. The veins are infrequent and tend to occur in the deepest 20-30 m of the drill core (i.e., ~20 m below the saprolite). The thickest veins are quartz-fluorite veins, up to 4 cm thick and display selvages of fluorite including coarse (~1 cm), euhedral fluorite grains that grow into to the quartz-fluorite vein centres. These quartz-fluorite veins are generally sub-vertical and do not display significant deformation. Macroscopic pyrite grains, approximately 3 mm in size, are accessory to quartz-fluorite veins. Veins of specular hematite run near-vertical and are <2 cm thick but can be relatively long (~30 cm), with respect to other veins observed. They also show short branches extending into the surrounding granite. Vein swarms of earthy hematite are sub-

horizontal and consist of swarms of 5-15 veinlets ~1 mm in thickness giving a brecciated appearance to the granite. Vertical veins of earthy hematite are 1 cm thick and display crosscutting relationships with the thick quartz-fluorite veins, indicating they are later. Thin 2 mm-sized quartz veins are sub-horizontal and crosscut by specular hematite veins and quartz-fluorite veins and earthy hematite veins. A 5-10 cm thick vein is noted in one drill core (MRM845) that contains wall rock clasts displaying chlorite-kaolinite alteration. This vein displays 'dog tooth' quartz grains that project downwards into a 5-8 cm cavity (Figure 3c). Thicker (cm-scale) veins are observed to contain fragments of wall rock and can be described as small-scale hydrothermal breccias. No carbonate veins were noted in hand specimen, however when viewed under the SEM, very thin calcite veins with chlorite-kaolinite selvedges were observed.

Mineralogy

ROCK FORMING MINERALS

As briefly described above, the feldspars display alteration to assemblages of sericitechlorite-kaolinite. This alteration imparts a dusty appearance to the K-feldspar. Some grains display inclusions among this dusty texture that are the result of hematite overprinting and possibly fine-grained REE-minerals (synchysite, monazite and thorite). SEM observation also revealed varying degrees of albitisation of K-feldspar. Small decussate grains of biotite showing distinct parallel cleavage orientations display various stages of alteration and contain inclusions of rutile within cleavage domains but generally retain their lath-like appearance. Advanced stages of alteration of biotite include replacement by chlorite and sericite along cleavage planes and some fraying of grain boundaries.

| ID | Hole | Depth (m) | Lithology | Mineralog | sy | | |
|--------|------|-----------|----------------|--------------|---------------------|-------------------|------------------------------------|
| | | | | Early Hem | Hydrothermal Hem | Sulphides | Accessory |
| 751001 | 751 | 135.8 | Hem. Vein | | Х | gl | Syn, Bst |
| 751002 | 751 | 137.9 | Granite | Х | Х | | Zrc, Thr, Rt, Ilm, Mt |
| 751003 | 751 | 139.2 | Granite | | xХ | PY | Thr, Sny, Ap, Zrc |
| 751004 | 751 | 139.5 | Granite | | Х | PY, cp | Zrc, Rt, Ilm |
| 751005 | 751 | 140.1 | Granite | | Х | PY | |
| 751007 | 751 | 143.5 | Granite | | Х | | Zrc, Ap, Thr, Rt, Ilm |
| 751008 | 751 | 145.5 | Granite | Х | xХ | ср | Mt, Rt, Ilm, Syn, Cof |
| 762001 | 762 | 133.7 | Granite | | Х | PY | Ap, Rt, Ilm, Zrc, Thr |
| 762003 | 762 | 141.1 | Granite | | Х | | |
| 762004 | 762 | 146.6 | Granite | | Х | PY, Moly, CP | Ap, Rt, Zrc, Mnz, Cof |
| 762005 | 762 | 148 | Granite | | Х | SP | Ap, Zrc, Thr, Syn, Mnz |
| 762006 | 762 | 149.6 | Quartz vein | | х | PY, py, CP, GL | Thr, Rt, Syn, Bst, Zrc |
| 762007 | 762 | 149.6 | Granite | | | | Thr, Rt, Syn, Bst, Zrc, Cof |
| 845001 | 845 | 124.5 | Saprolite | | | | Zrc, Thr, Syn, Ba, Rst |
| 845002 | 845 | 144.8 | Granite | | Х | | Rt, Syn, |
| 845003 | 845 | 145.5 | Granite | | х | | Thr, Zrc, Ap, Syn, Rt, Cof |
| 845004 | 845 | 146.2 | Granite | | S, x | ср | Thr |
| 845005 | 845 | 148.5 | Granite | | | PY, GL | Thr, Zrc, Syn, Bst, Rt, Ap, Cof |
| 845006 | 845 | 148.9 | Granite | Х | Х | PY, Moly | Mnz, Rt, Cof |
| 845007 | 845 | 155.8 | Granite | Х | | | Thr, Syn, Bst, Zrc, Ap, Cof |

Table 1 Index of sample suite

Abbreviations: Hem – hematite, py – pyrite, cp – chalcopyrite, gl – galena, moly – molybdenite, sp – sphalerite, syn – synchysite, bst – bastnäsite, zrc – zircon, thr – thorite, cof, - coffinite, mnz – monazite, ap - apatite, rt – rutile, ilm – ilmenite, mt – magnetite, qtz – quartz, bt – biotite, chl – chlorite, cal – calcite, K-feld – K-feldspar, alb – albite. Note: x, X, py and PY are used to convey the difference in grain sizes in each sample. Capital letters denote coarser grains and lower case denotes finer grains.

FE-(TI)-OXIDES (HEMATITE, MAGNETITE AND ILMENITE)

The oxide minerals are found in the majority of samples and the most common is hematite. There are four distinct textural varieties of hematite occurring within both the granite groundmass and hydrothermal vein alteration. The first of these is porous, anhedral blebs of hematite (Figure 4g-j) that occur clustered together with the space between grains filled with chlorite-kaolinite (?) alteration of albite or K-feldspar. These porous grains can contain microscopic inclusions, predominantly of quartz but also Kfeldspar or a mineral, heavily enriched in Nb and Y (pyrochlore) (Figure 4h). Although blebby and anhedral, this hematite is generally not fractured and appears compositionally homogeneous.

Acicular hematite within veins (Figure 4a-c), shows two size groups: a coarse 100-300 μ m-sized population and a distinctly finer population <60 μ m in size. These acicular grains form radial rosette-shaped aggregates. The coarser population can be seen bridging across veins and vugs in the samples and contain minor fractures and pores but otherwise appear homogeneous. This coarse type does not appear to replace or be associated with magnetite.

Fine grains of magnetite were discerned in reflected light (Figure 4j) occurring in porous, blebby hematite grains with the appearance of hematite rims on magnetite cores. The hematite rim is not a universal feature of magnetite grains with several grains displaying no hematite directly in contact however, most of the grains found did exhibit such a rim. Fine, anhedral minor ilmenite (Figure 4l) are observed forming symplectites with rutile.



Figure 4 BSE images (a-i) showing hematite textures. Reflected light images (j-l) allow distinction hematite from magnetite. a) Fine-grained aggregates of acicular hematite in quartz groundmass displaying no preferred orientation with quartz grains and clay infilling fracture space. b) Coarse, acicular hematite in a vein with fine hematite in between. c) Small quartz-bearing vein with coarse acicular hematite displaying fractures. Finer-grained hematite is also growing within the vein and in veinlets in K-feldspar. d) Fine-grained aggregates of hematite with a fibrous texture in Kfeldspar showing a similar fibrous texture surrounded by homogenous quartz. e) Skeletal hematite with quartz in a clay-rich sample displaying voids. f) Hematite as rims on K-feldspar-albite intergrowths. g) Isolated hematite grain with a very slightly vuggy texture in a quartz vein crosscutting K-feldspar with fluorite on rim. h) Porous, blebby, clustered hematite with zircons and thorite in fluorite and albite. Calcite fills the space between these grains and as veins in the lower fluorite. j) Porous, blebby hematite showing magnetite cores with fine-grained, interstitial hematite. Metamict zircon is present at the bottom of the image. k) Coarse acicular, homogeneous hematite. l) Rutile-ilmenite symplectite. A fourth sub-type of hematite displays a skeletal-like texture with a distinct hematite rim surrounding void-space and containing small dendritic hematite attached to the rim. This texture was only seen in one same sample (Figure 4e).

SULPHIDES

Sulphides (pyrite, molybdenite, galena, chalcopyrite and sphalerite in order of abundance) occur as disseminated, commonly isolated, grains either alone or in multicomponent assemblages. Pyrite occurs as coarse, subhedral to anhedral grains up to 500 µm in size (Figure 5d, e). These grains form small clusters which are either homogenous or contain vugs and fractures. In some cases, pyrite is clearly altered or replaced, causing destruction of the euhedral morphology to give rounded grain margins (Figure 5d). One unusual texture in pyrite comprises rims on coarse grains of thorite (Figure 5c). Fine grains of euhedral pyrite are found within cavities in K-feldspar and albite. These grain aggregates (Figure 5e) are ~10 µm in size.

Coarse grains of disseminated molybdenite up to 2 mm across were observed in several samples. Molybdenite contains few to no inclusions and maintains a visible cleavage as evident by the ribbon-like appearance (Figure 6b).

Galena grains are scattered through the sample suite the most significant textures occurred as coarse, euhedral to anhedral grains. Euhedral galena up to 100 μ m, and a finer-grained variety were noted. Anhedral galena is strongly associated with chalcopyrite (Figure 6c) where the galena forms rims on chalcopyrite with small pyrite inclusions.

Chalcopyrite is a relatively uncommon sulphide and is found only in samples that contain pyrite or pyrite-galena assemblages. Chalcopyrite is highly anhedral and commonly infills finely brecciated pyrite (Figure 6d). Small grains of sphalerite were noted filling voids however these are uncommon. Only one sample (762005) contained significant amounts of sphalerite (Figure 6a). Such sphalerite displays a variety of grain sizes from ~10 μ m up to 200 μ m, typically disseminated within a calcite groundmass. Sphalerite is anhedral and occupies voids within the calcite.

ACCESSORY MINERALS

Accessory zircons are variable in size with the coarsest being $\sim 300 \ \mu m$ while the smallest are 20 μm . All display strongly metamict textures with internal zonation and fracturing. Some zoned zircons contain a core that is fractured overgrown by a fracture-free rim (Figure 4i). SEM-EDS study revealed no systematic trend of light cores with darker rims compared to darker cores with lighter rims on the back-scatter electron images.

Thorite is abundant and can be quite coarse (grains up to 250 µm: Figure 5c, d). Thorite grains show some zonation and appear strongly altered under reflected light. Coffinite was detected in 7 samples (Table 1) and displays two dissimilar textures. The majority of coffinite was found as thin veins that appear to infill fractures within host phases (Figure 8b, e) with a possible replacement component (Figure 8c, d). Coffinite also occurs as rims on the margins of pyrite (Figure 8a). Synchysite is also a common accessory mineral throughout much of the sample suite; EDS analysis confirmed this as synchysite-(Ce). Synchysite grains are anhedral and can form large (~200-300 µm-sized) aggregates (Figure 7c, d). The mineral also appears to form within veins (Figure 8c) and the sample suite is also a common form large (~200-300 µm-sized) aggregates (Figure 7c, d).



Figure 5 a) Euhedral pyrite within a vug on fluorite-quartz vein margin. Heavily metamict and fracture zircon is present; co--existing K-feldspar has a dusty appearance. Small aggregates of fine, REE-Th-(U)-enriched minerals can be seen growing in the vug. b) Quartz-fluorite vein with coarse and fine pyrite growing close to phase boundaries. K-feldspar has dusty appearance and fluorite veins. c) Pyrite forming rims on thorite grains in a quartz-fluorite vein containing fine-grained hematite. d) Coarse, fractured pyrite containing inclusions of fluorite. e) Fine-grained pyrite clusters in a void within K-feldspar-albite. K-feldspar has dusty appearance at the bottom of the image but the grains within the void are lath- shaped and not dusty. f) Coarse-grained pyrites in a quartz vein. Top pyrite grain is anhedral and has is surrounded by void space into which fine, acicular REE-Th-U-minerals are growing. K-feldspar displays a dusty appearance.



Figure 6 a) Anhedral sphalerite within vuggy calcite with an inclusion of euhedral fluorite, hosted in a quartz-K-feldspar groundmass. This sample displays a high proportion of calcite compared with many other samples, and also features abundant synchysite. b) Coarse-grained molybdenite with rims of pyrite-chalcopyrite symplectites (shown in detail in [d]). c) Galena rims forming on elongate chalcopyrite with cores of pyrite. Voids are found close to the pyrite cores and one pyrite is within a void. This assemblage contains significant void space hosting fibrous REE-minerals. The assemblage is hosted in a fluorite-bearing vein. d) Anhedral pyrites with chalcopyrite infill forming a symplectite close to molybdenite. Halite grains can be seen above feldspar (K-feldspar?) that displays a 'wormy' texture. e) Coarse euhdral pyrite with fine anhedral pyrite present between grains with some clay alteration. Coffinite veins form rims and inside voids in the coarse pyrite. Coffinite also surrounds fine-grained pyrite. Quartz fills void space in this assemblage. f) Finegrained pyrite with uranium-bearing inclusions (coffinite?) in a clay-bearing vein that contains thin laths of biotite with rutile inclusions. A small monazite displaying some internal zonation represents an uncommon accessory component within the sample.

7c, d). Bastnäsite forms aggregates of thin acicular-like grains within synchysite (Figure

7a, b).

Apatite displays two distinct textures. In the first, apatite is heavily altered resulting in extensive fracturing (Figure 7 (g), whereas the other shows apatite displaying internal compositional zoning (Figure 7h). The compositional zoning could not be resolved by EDS analysis but this commonly reflects variation in REE content. The fractured apatite is typically coarse-grained and contains inclusions of thorite; the zoned grains are less altered. Monazite (Figure 6f and Figure 7f) is an uncommon accessory mineral within the system and only a few small ($<50 \mu m$) grains were observed.



Figure 7 a) Coarse, anhedral synchysite displaying thin lamella of bastnäsite. An inclusion within this grain contains a silica-bearing Fe-oxide signature - probably an intergrowth of quartz and hematite/magnetite. The grain is located on the contact of porous quartz with acicular, vein hematite and dusty K-feldspar. b) Fragmented synchysite grains containing lamella/aggregates of bastnäsite within rich zone of clay alteration. Bastnäsite displays a thin acicular crystal habit and does occur outside of synchysite grains. c) Synchysite vein in quartz. d) Calcite veins in fluorite containing synchysite. e) Coarse and porous synchysite with fine-grained thorite-monazite in a calcite-fluorite groundmass. From previous images there is a possibility of some bastnäsite within the synchysite although the acicular habit is not prominent. g) Heavily altered apatite with synchysite inclusions and minor monazite. Area is heavily altered with void space, REE fibres, metamict zircon and clay alteration. h) Thorite-apatite assemblage with clear zonation within the apatite. Thorite also displays some zonation the reason for this zonation in apatite and thorite was not discernible via EDS analysis. Porous ilmenite can be seen in the top of the frame sharing a transitional boundary with fine grained hematite. i) Heavily altered apatite with thorite. A K-feldspar grain displays small voids imparting a porous texture. Several rutile grains in a clay groundmass. j) Heavily altered ilmenite containing both rutile and fine-grained hematite. Quartz has fractured this mineral but morphology is maintained. k) Coarse zircon in dusty albite, displaying strongly metamict texture including internal zonation and fracturing. I) Fractured zircon with some zonation with a rim of fine-grained hematite located in a fracture within porous albite.



Figure 8 a) Back scatter electron images showing aspects of REE- and U- mineralogy. (a) Coarse pyrite (Pyr) with significant fracturing and pore space filled with coffinite (Cof). Coffinite veins also fill fractures in quartz (Qtz). b) Fine coffinite and coexisting rutile (Rtl) at grain boundary between quartz and K-feldspar. Coffinite is also present within cleavage planes in biotite. c) Strongly-altered rutile displaying coffinite replacement/infill in a very porous albite (Alb) groundmass. Pyrite displays some alteration but is not strongly affected by coffinite forms a thick rim about this mineral and breaches into the grain along fracture/cleavage. e) Coffinite veins in an albite groundmass. Synchysite (Syn) also occurs within this vein but does not contain coffinite. f) EDS spectrum for coffinite in (d).

Mineral Relationships

Mineral relationships can be summarised as follows. Common sulphides (pyrite, molybdenite, galena and chalcopyrite), are closely associated with quartz-fluorite veins and vugs. The less common sphalerite is only associated with calcite. Acicular hematite is wholly related to veining whereas blebby hematite shows an association with magnetite (which it replaces), ilmenite, zircon and thorite within the K-feldsparplagioclase (albite) groundmass. Skeletal hematite is associated with clay-quartz alteration. Apatite and monazite display a weak spatial association but apatite and thorite are always closely related. Bastnäsite is very strongly associated with synchysite which in turn shows an association with fluorite and calcite.

The very fine-grained, earthy hematite between blades of the acicular hematite appears to be very late stage in the mineral sequence and can be seen cross cutting quartzfluorite bearing veins.

LA-ICP-MS trace element data

IRON-OXIDES

Trace element data for hematite are given in Table 2. Chondrite-normalised REEfractionation trends are shown in Figure 9a-b. Key geochemical trends are shown as Figure 10. Two types of hematite are present: these can be distinguished both texturally (Figure 10e-f), and in terms of mineral chemistry.

| Table 2 I A | -ICP-MS d | ata far ha | motite and | other Fe | -(Ti)-ovides |
|-------------|--------------|------------|------------|----------|---------------|
| I ADIC 2 LA | -101 -1við u | ala 101 m | manie anu | other re | -(II)-UAIUCS |

| | | | | | | 10(| 11) 01 | iuco | | | | | | |
|---|---|---|--|--|--|---|---|--|---|--|---|---|---|--|
| Hematite (hydrotherma | Mg | AI | Si | Р | Ca | Sc | Ti | v | Cr | Mn | Со | Ni | Cu | Zn |
| 751003-1 | 69 | 660 | 976 | <14 | <116 | 2.5 | 5615 | 97 | <0.76 | 10 | < 0.063 | 0.41 | <0.80 | 1.2 |
| 751003-2 | 198 | 1970 | 22337 | 19 | <107 | 21 | 2565 | 234 | <1.25 | 17 | <0.105 | <0.00 | 0.95 | 4.6 |
| 751003-3 | 126 | 3667 | 10886 | ~1/ | ~111 | 5.0 | 6321 | 820 | <0.46 | 16 | 0.105 | <0.00 | 1 1 | 3.0 |
| 751003-3 | 056 | 6007 | 27041 | 21 | ~126 | 5.0 | 6027 | 274 | ~1 72 | 10 | 0.10 | 0.04 | 20 77 | 1.0 |
| 751005-4 | 950 | 224 | 207 | 17 10 | <100 | 0.9 | 4750 | 2/4 | <1.25 | 13 | 0.21 | 0.95 | <0.77 | 1.9 |
| /51003-5 | 32 | 234 | 397 | <17.10 | <102 | 2.4 | 4758 | 81 | <1.2/ | 14 | 0.13 | < 0.54 | < 0.56 | 0.6 |
| 751003-6 | 140 | 1286 | 1/22 | <16.20 | 136 | 3.1 | 6140 | 155 | 1.5 | 14 | < 0.116 | 0.7 | 1.09 | 2.7 |
| 751003-7 | 103 | 1643 | 1616 | <15.85 | <129 | 8.4 | 1040 | 483 | 0.67 | 18 | 0.40 | 0.34 | 1.00 | 2.6 |
| 751003-8 | 304 | 2661 | 3974 | <13.02 | <103 | 15.7 | 4874 | 1559 | <0.65 | 26 | 0.25 | <0.28 | <0.52 | 3.9 |
| 751003-9 | 101 | 803 | 8131 | 16 | <94.74 | 2.6 | 6483 | 570 | <0.90 | 23 | 0.15 | 0.6 | <0.85 | 4.2 |
| 751003-10 | 302 | 2489 | 3221 | <14.61 | <97.15 | 12.9 | 4512 | 1097 | 0.51 | 24 | 0.25 | 1.18 | 0.92 | 4.1 |
| 751003-11 | 555 | 3788 | 6994 | <12 87 | 121 | 56 | 5154 | 405 | 1 19 | 47 | 0 44 | 07 | 1 1 9 | 31 |
| 751003-12 | 363 | 2112 | 4005 | ~1/ | 28/ 77 | 12.0 | 69/5 | 980 | <0.74 | /1 | 0.17 | 0.63 | 0.58 | 21 |
| 751003 12 | 1102 | 7700 | 12015 | ~17 /6 | ~20 1/ | Q 5 | 1977 | 211 | ~1 1/ | 75 | 0.47 | 1 2 | 27 | 15 |
| 751003-13 | 1192 | 4724 | 11104 | 11.40 | 201 | 10.0 | 17027 | 440 | ~1.14 | 22 | 0.35 | 1.2 | 1.20 | 1.5 |
| 751003-14 | 300 | 4/31 | 11184 | <14.80 | 201 | 10.0 | 1/62 | 419 | 3.1 | 32 | 0.36 | 0.82 | 1.38 | 5.7 |
| 751003-15 | 510 | 4026 | 6015 | <15.32 | <92.77 | 13.9 | 4002 | 1268 | < 0.94 | 59 | 0.69 | 0.81 | <0.85 | 14 |
| 751003-16 | 1118 | 9551 | 13541 | <14 | 135 | 23.5 | 4312 | 1088 | <0.76 | 53 | 0.95 | 0.79 | 1.79 | 14 |
| 751003-17 | 1599 | 10195 | 16771 | <18.11 | 173 | 8.6 | 10044 | 126 | 2.96 | 160 | 1.04 | 0.41 | 2.24 | 19 |
| 751003-18 | 1278 | 7621 | 13470 | <15.53 | 152 | 5.8 | 5857 | 147 | 3.03 | 64 | 1.03 | 1.14 | 2.3 | 19 |
| 751003-19 | 508 | 4135 | 8866 | <14 | <90.81 | 10.4 | 1542 | 434 | 1.32 | 30 | 0.177 | 0.34 | 0.4 | 5.1 |
| Mean (n=19) | 517 | 4062 | 9688 | 19 | 153 | 8.5 | 4726 | 557 | 1.8 | 39 | 0.48 | 0.73 | 1.4 | 8.1 |
| S D | 476 | 3006 | 9031 | 24 | 29 | 5.6 | 2250 | 446 | 11 | 35 | 0 34 | 0.29 | 0.70 | 81 |
| Maximum | 1500 | 10105 | 270/1 | 21 | 201 | 24 | 10044 | 1550 | 2 1 | 160 | 1.0 | 12 | 27 | 31 |
| Minimerum | 2355 | 10133 | 207 | 10 | 101 | 24 | 1040 | 1333 | 0 51 | 100 | 0.12 | 0.24 | 0.40 | 0.64 |
| 751000 1 | 32 | 170 | 397 | 10 | 121 | 2.1 | 11040 | 01 | 0.51 | 10 | 0.15 | 0.54 | 0.40 | 0.04 |
| 751008-1 | 10 | 1/3 | 223 | 18 | 154 | 0.25 | 1197 | 60 | 1.0 | 8 | 0.36 | 0.44 | 0.91 | 0.97 |
| 751008-2 | 1./ | 599 | 11670 | 18 | 118 | 1.2 | 891 | 42 | 1.1 | 11 | 0.19 | 0.71 | 0.77 | 1.08 |
| 751008-3 | 543 | 6237 | 8040 | 19 | 120 | 3.4 | 4425 | 253 | 1.1 | 17 | 3.95 | 0.97 | 2.6 | 6.19 |
| 751008-4 | 6.2 | 100 | 200 | 27 | 251 | 1.1 | 9922 | 74 | 1.3 | 10 | 0.53 | 0.67 | 1.7 | 1.77 |
| 751008-5 | 11 | 490 | 251 | 23 | 204 | 0.59 | 906 | 93 | 1.1 | 14 | 1.9 | 0.62 | 1.1 | 1.49 |
| 751008-6 | 52 | 715 | 1221 | 22 | 174 | 1.7 | 1111 | 93 | 1.0 | 22 | 3.1 | 0.39 | 1.3 | 1.77 |
| 751008-7 | 07 | 212 | 146 | 17 | 93 | 1 2 | 571 | 258 | 1 4 | 3 1 | 0.09 | 0.11 | 0.9 | 1 23 |
| 751008 9 | 0.7 | 100 | 202 | 10 | 1/0 | 0 07 | 564 | 200 | 1 2 | 25 | 0.00 | 0.11 | 0.5 | 0.07 |
| 751008-8 | 0.7 | 190 | 100 | 19 | 149 | 17 | C04 | 203 | 1.5 | 3.5 | 0.09 | 0.45 | 1.01 | 1 52 |
| 751008-9 | 0.5 | 206 | 133 | 19 | 163 | 1.7 | 623 | 399 | 1.3 | 4.5 | 0.09 | 0.00 | 1.0 | 1.52 |
| 751008-10 | 10.8 | 392 | 354 | 19 | 151 | 1.1 | 622 | 93 | 1.2 | 22 | 2.74 | 0.2 | 0.7 | 1.12 |
| Mean (n=10) | 64 | 932 | 2244 | 20 | 158 | 1.3 | 2083 | 165 | 1.2 | 11 | 1.3 | 0.46 | 1.2 | 1.8 |
| S.D. | 169 | 1875 | 4114 | 3.0 | 45 | 0.85 | 2988 | 122 | 0.15 | 7.1 | 1.5 | 0.30 | 0.59 | 1.6 |
| Maximum | 543 | 6237 | 11670 | 27 | 251 | 3.4 | 9922 | 399 | 1.4 | 22 | 4.0 | 1.0 | 2.6 | 6.2 |
| Minimum | 0.49 | 100 | 133 | 17 | 93 | 0.25 | 564 | 42 | 1.0 | 3.1 | 0.09 | 0.00 | 0.61 | 1.0 |
| Hematite (early) | | | | | | | | | - | - | | | | - |
| 751008-1 | 47 | 741 | 733 | 16 | 127 | 19 | 9436 | 681 | 11 1 | 136 | 13 | 6 19 | 0.85 | 54 |
| 751008 2 | 21/ | 2020 | 1025 | 16 | 0/ | 50 | 5291 | 457 | 2 0 | 205 | 22 | 12 17 | 0.05 | 172 |
| 751008-2 | Z14 | 1000 | 20121 | 10 | 00 | Э.Э Э.Г | 1616 | | 3.0 | 147 | 22 | 6 22 | 0.52 | 71 |
| 751008-3 | 29 | 1990 | 20124 | 10 | 99 | 3.5 | 1010 | 000 | 20 | 147 | 21 | 0.23 | 0.97 | 1.1 |
| 751008-4 | 282 | 3034 | 1745 | 15 | 95 | 7.5 | 2087 | /8/ | 6.8 | 258 | 14 | 6.48 | 0.84 | 12.6 |
| 751008-5 | 3 | 1575 | 497 | 19 | 117 | 4.5 | 2489 | 691 | 25 | 77 | 12 | 8.2 | 0.88 | 4.3 |
| | | F004 | 0067 | 10 | 127 | 6.2 | 2842 | 684 | 40 | 181 | 20 | 70 | 0 07 | 16 E |
| 751008-6 | 504 | 5894 | 0007 | 19 | | | | | | | | 7.8 | 0.87 | 10.5 |
| 751008-6 751008-7 | 504 541 | 5894 5396 | 8717 | 18 | 190 | 2.8 | 982 | 570 | 48 | 169 | 13 | 7.8 5.33 | 0.87 0.71 | 13.8 |
| 751008-6 751008-7 751008-8 | 504 541 95 | 5894 5396 2098 | 8007 8717 7031 | 18 15 15 | 190 114 | 2.8 3.3 | 982 1859 | 570 630 | 48 36 | 169 166 | 13 13 | 7.8 5.33 7.27 | 0.87 0.71 0.84 | 13.8 4.6 |
| 751008-6 751008-7 751008-8 Mean (n=8) | 504 541 95 218 | 5396 2098 3070 | 8717 7031 7367 | 18 15 15 16 | 190 114 120 | 2.8 3.3 | 982 1859 3337 | 570 630 649 | 48 36 25 | 169 166 178 | 13 13 16 | 7.8 5.33 7.27 7.6 | 0.87 0.71 0.84 0.81 | 13.8 4.6 10 |
| 751008-6 751008-7 751008-8 Mean (n=8) | 504 541 95 218 209 | 5396 2098 3070 1856 | 8717 7031 7367 9002 | 18 15 15 16 1 4 | 190 114 120 31 | 2.8 3.3 6.6 5.4 | 982 1859 3337 2793 | 570 630 649 99 | 48 36 25 16 | 169 166 178 69 | 13 13 16 4 2 | 7.8 5.33 7.27 7.6 7.4 | 0.87 0.71 0.84 0.81 0.14 | 10.5 13.8 4.6 10 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum | 504 541 95 218 209 541 | 5396 2098 3070 1856 5894 | 8007 8717 7031 7367 9002 28124 | 18 15 15 16 1.4 | 190 114 120 31 190 | 2.8 3.3 6.6 5.4 | 982 1859 3337 2793 9436 | 570 630 649 99 787 | 48 36 25 16 48 | 169 166 178 69 295 | 13 13 16 4.2 22 | 7.8 5.33 7.27 7.6 2.4 13 | 0.87 0.71 0.84 0.81 0.14 | 10.5 13.8 4.6 10 5.5 17 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum | 504 541 95 218 209 541 | 5894 5396 2098 3070 1856 5894 | 8007 8717 7031 7367 9002 28124 | 18 15 15 16 1.4 19 | 190 114 120 31 190 | 2.8 3.3 6.6 5.4 19 | 982 1859 3337 2793 9436 | 570 630 649 99 787 | 48 36 25 16 48 | 169 166 178 69 295 | 13 13 16 4.2 22 | 7.8 5.33 7.27 7.6 2.4 13 | 0.87 0.71 0.84 0.81 0.14 0.97 | 10.5 13.8 4.6 10 5.5 17 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum Minimum | 504 541 95 218 209 541 2.66 | 5394 5396 2098 3070 1856 5894 741 | 8007 8717 7031 7367 9002 28124 497 | 18 15 15 16 1.4 19 15 | 190 114 120 31 190 94 | 2.8 3.3 6.6 5.4 19 2.8 | 982 1859 3337 2793 9436 982 | 570 630 649 99 787 457 | 48 36 25 16 48 2.95 | 169 166 178 69 295 77.25 | 13 13 16 4.2 22 11.74 | 7.8 5.33 7.27 7.6 2.4 13 5.33 | 0.87 0.71 0.84 0.81 0.14 0.97 0.52 | 10.5 13.8 4.6 10 5.5 17 4.27 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum Minimum 84500-1 | 504 541 95 218 209 541 2.66 92 | 5394 5396 2098 3070 1856 5894 741 1565 | 8007 8717 7031 7367 9002 28124 497 486 | 18 15 15 16 1.4 19 15 <15.37 | 190 114 120 31 190 94 <130 | 2.8 3.3 6.6 5.4 19 2.8 4.3 | 982 1859 3337 2793 9436 982 1310 | 570 630 649 99 787 457 722 | 48 36 25 16 48 2.95 57 | 169 166 178 69 295 77.25 | 13 13 16 4.2 22 11.74 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 | 0.87 0.71 0.84 0.81 0.14 0.97 0.52 <0.85 | 10.5 13.8 4.6 10 5.5 17 4.27 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum Minimum 84500-1 84500-2 | 504 541 95 218 209 541 2.66 92 114 | 5394 5396 2098 3070 1856 5894 741 1565 1372 | 8007 8717 7031 7367 9002 28124 497 486 551 | 18 15 15 16 1.4 19 15 <15.37 <10.96 | 190 114 120 31 190 94 <130 <73 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 | 982 1859 3337 2793 9436 982 1310 1083 | 570 630 649 99 787 457 722 680 | 48 36 25 16 48 2.95 57 63 | 169 166 178 69 295 77.25 57 59 | 13 13 16 4.2 22 11.74 5.1 5.9 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 | 0.87 0.71 0.84 0.81 0.14 0.97 0.52 <0.85 0.77 | 10.3 13.8 4.6 10 5.5 17 4.27 19 16 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum Minimum 84500-1 84500-2 84500-2 84500-3 | 504 541 95 218 209 541 2.66 92 114 347 | 5394 5396 2098 3070 1856 5894 741 1565 1372 1482 | 8717 7031 7367 9002 28124 497 486 551 1401 | 18 15 15 16 1.4 19 15 <15.37 <10.96 <14.53 | 190 114 120 31 190 94 <130 <73 2398 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 | 982 1859 3337 2793 9436 982 1310 1083 1379 | 570 630 649 99 787 457 722 680 661 | 48 36 25 16 48 2.95 57 63 63 | 169 166 178 69 295 77.25 57 59 64 | 13 13 16 4.2 22 11.74 5.1 5.9 5.9 5.9 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 | 0.87 0.71 0.84 0.81 0.14 0.97 0.52 <0.85 0.77 5.8 | 10.3 13.8 4.6 10 5.5 17 4.27 19 16 17 |
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| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum 84500-1 84500-1 84500-2 84500-3 84500-4 84500-4 | 504 541 95 218 209 541 2.66 92 114 347 541 8695 | 5394 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 | 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 | 18 15 15 16 1.4 19 15 <15.37 <10.96 <14.53 <10.59 <15.73 | 190 114 120 31 190 94 <130 <73 2398 224 44570 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 | 982 1859 3337 2793 9436 982 1310 1083 1379 1023 987 | 570 630 649 99 787 457 722 680 661 713 756 | 48 36 25 16 48 2.95 57 63 63 63 66 98 | 169 166 178 69 295 77.25 57 59 64 71 148 | 13 13 16 4.2 22 11.74 5.1 5.9 5.9 5.9 5.8 8.0 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 | 0.87 0.71 0.84 0.81 0.14 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 | 10.3 13.8 4.6 10 5.5 17 4.27 19 16 17 16 23 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum 84500-1 84500-1 84500-2 84500-3 84500-3 84500-5 84500-6 | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 | 5394 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 | 8007 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 | 18 15 15 16 1.4 19 15 <15.37 <10.96 <14.53 <10.59 <15.73 <15.73 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 | 2.8 3.3 6.6 5.4 19 2.8 4 .3 5.5 10 5.7 11 13 | 982 1859 3337 2793 9436 982 1310 1083 1379 1023 987 15896 | 570 630 649 99 787 457 722 680 661 713 756 782 | 48 36 25 16 48 2.95 57 63 63 63 66 98 74 | 169 166 178 69 295 77.25 57 59 64 71 148 128 | 13 13 16 4.2 22 11.74 5.1 5.9 5.9 5.9 5.8 8.0 9.0 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 | 0.87 0.71 0.84 0.81 0.14 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 | 10.3 13.8 4.6 10 5.5 17 4.27 19 16 17 16 23 28 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum 84500-1 84500-2 84500-2 84500-2 84500-4 84500-5 84500-6 84500-7 | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 3154 | 5394 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 | 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 | 18 15 15 16 1.4 19 15 <15.37 <10.96 <14.53 <10.59 <15.73 <15.73 70.99 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 | 982 1859 3337 2793 9436 982 1310 1083 1379 1023 987 15896 2251 | 570 630 649 99 787 457 722 680 661 713 756 782 797 | 48 36 25 16 48 2.95 57 63 63 63 66 98 74 76 | 169 166 178 69 295 77.25 57 59 64 71 148 128 117 | 13 13 16 4.2 22 11.74 5.1 5.9 5.9 5.9 5.9 5.8 8.0 9.0 13 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 5.5 | 0.87 0.71 0.84 0.81 0.14 0.97 0.52 0.77 5.8 1.4 4.0 5.4 20 | 10.3 13.8 4.6 10 5.5 17 4.27 19 16 17 16 23 28 47 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum Minimum 84500-1 84500-2 84500-3 84500-3 84500-3 84500-5 84500-6 84500-7 84500-8 | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 3154 122 | 5394 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 | 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 | 18 15 15 16 1.4 19 15 <15.37 <10.96 <14.53 <10.59 <15.73 <15.73 70.99 <14.06 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 <82 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 | 982 1859 3337 2793 9436 982 1310 1083 1379 1023 987 15896 2251 1614 | 570 630 649 99 787 457 722 680 661 713 756 782 797 746 | 48 36 25 16 48 2.95 57 63 63 66 98 74 76 64 | 169 166 178 69 295 77.25 57 59 64 71 148 128 117 68 | 13 13 16 4.2 22 11.74 5.1 5.9 5.9 5.9 5.9 5.8 8.0 9.0 13 6.0 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 5.5 7.9 | 0.87 0.71 0.84 0.81 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 20 <0.78 | 10.3 13.8 4.6 10 5.5 17 4.27 19 16 17 16 23 28 47 17 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum Minimum 84500-1 84500-1 84500-2 84500-3 84500-5 84500-5 84500-6 84500-7 84500-8 | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 3154 122 262 | 5394 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 | 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 | 18 15 15 16 1.4 19 15 <15.37 <10.96 <14.53 <10.59 <14.53 <15.73 70.99 <14.06 <13.20 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 <82 169 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 | 982 1859 3337 2793 9436 982 1310 1083 1379 1023 987 15896 2251 1614 892 | 570 630 649 99 787 457 722 680 661 713 756 782 797 746 744 | 48 36 25 16 48 2.95 57 63 63 66 98 74 76 64 66 | 169 166 178 69 295 77.25 57 59 64 71 148 128 117 68 56 | 13 13 16 4.2 22 11.74 5.9 5.9 5.9 5.8 8.0 9.0 13 6.0 6.2 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 5.5 7.9 8.5 | 0.87 0.71 0.84 0.81 0.14 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 20 <0.78 1.7 | 10.3 13.8 4.6 10 5.5 17 4.27 19 16 17 16 23 28 47 17 16 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum 84500-1 84500-2 84500-2 84500-2 84500-3 84500-4 84500-6 84500-6 84500-7 84500-8 84500-9 84500-10 | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 3154 122 262 | 5394 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 2204 | 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 477 | 18 15 15 16 1.4 19 15 <15.37 <10.96 <14.53 <10.59 <15.73 <15.73 70.99 <14.06 <13.20 <15.21 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 <82 169 225 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 5.9 | 982 1859 3337 2793 9436 982 1310 1083 1379 1023 987 15896 2251 1614 892 1174 | 570 630 649 99 787 457 722 680 661 713 756 782 797 746 744 725 | 48 36 25 16 48 2.95 57 63 63 66 98 74 76 64 66 50 | 169 166 178 69 295 77.25 57 59 64 71 148 128 117 68 56 | 13 13 16 4.2 22 11.74 5.9 5.9 5.9 5.9 5.8 8.0 9.0 13 6.0 6.2 6.0 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 5.5 7.9 8.5 7.9 8.5 8.0 | 0.87 0.71 0.84 0.81 0.14 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 20 <0.78 1.7 2.6 | 10.3 13.8 4.6 10 5.5 17 4.27 19 16 17 16 23 28 47 17 16 20 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum Minimum 84500-1 84500-2 84500-2 84500-2 84500-3 84500-4 84500-5 84500-7 84500-7 84500-7 84500-9 84500-10 | 504 541 95 218 209 541 2.66 92 114 347 541 8695 3154 122 262 58 | 3894 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 2304 | 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 477 259 | 18 15 15 16 1.4 19 15 <15.37 <10.96 <14.53 <15.73 70.99 <14.06 <13.20 <15.37 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 <82 169 225 469 267 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 5.9 6.2 | 982 1859 3337 2793 9436 982 1310 1083 1379 1023 987 15896 2251 1614 892 1174 | 570 630 649 99 787 457 722 680 661 713 756 782 797 746 744 725 | 48 36 25 16 48 2.95 57 63 63 63 63 63 63 74 76 64 64 66 50 041 | 169 166 178 69 295 77.25 57 59 64 71 148 128 117 68 56 55 57 | 13 13 16 4.2 22 11.74 5.9 5.9 5.9 5.9 5.9 5.9 5.8 8.0 9.0 13 6.0 6.2 6.0 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 5.5 7.9 8.5 8.5 8.0 7.7 | 0.87 0.71 0.84 0.84 0.97 0.97 0.97 0.97 0.97 0.97 0.97 0.77 5.8 1.4 4.0 5.4 20 <0.78 1.7 2.6 | 10.38 13.8 4.6 10 5.5 17 4.27 19 16 17 16 23 28 47 17 16 20 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum Minimum 84500-1 84500-2 84500-2 84500-3 84500-4 84500-5 84500-5 84500-6 84500-7 84500-9 84500-9 84500-10 84500-11 | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 3154 122 262 58 88 | 3894 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 2304 2437 | 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 477 358 | 18 15 15 16 1.4 19 15 <15.37 <10.96 <14.53 <10.59 <14.05 <15.73 70.99 <14.06 <13.20 <15.37 <13.90 <14.06 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 <82 169 225 <67 252 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 5.9 6.2 | 982 1859 3337 2793 9436 982 1310 1083 1379 1023 987 15896 2251 1614 892 1174 1728 | 570 630 649 99 787 457 722 680 661 713 756 782 797 746 744 725 764 | 48 36 25 16 48 2.95 57 63 63 66 98 74 76 64 66 50 41 | 169 166 178 69 295 77.25 57 59 64 71 148 128 117 68 56 55 55 57 20 | 13 13 16 4.2 22 11.74 5.1 5.9 5.9 5.9 5.8 8.0 9.0 13 6.0 6.2 6.0 6.2 6.0 6.2 | 7.83 7.27 7.6 2.4 13 7.5 6.3 7.7 9.2 9.4 8.7 7.9 8.5 8.0 7.7 9.5 8.5 8.0 7.7 | 0.87 0.71 0.84 0.84 0.97 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 20 <0.78 1.7 2.6 <0.62 | 13.8 13.8 4.6 10 5.5 17 4.27 19 16 17 16 23 28 47 17 16 20 30 30 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum 84500-1 84500-2 84500-2 84500-2 84500-3 84500-4 84500-6 84500-6 84500-6 84500-7 84500-8 84500-9 84500-10 84500-11 84500-12 | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 3154 122 262 58 88 239 | 5394 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 2304 2437 1408 | 8007 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 477 358 739 | 18 15 15 16 1.4 19 15 <15.37 <10.96 <14.53 <10.59 <15.73 70.99 <14.06 <13.20 <13.20 <13.390 <13.13 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 <82 169 225 <67 <93 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 5.9 6.2 4.5 | 982 1859 3337 2793 9436 982 1310 1083 1379 1023 987 15896 2251 1614 892 1174 1728 1120 | 570 630 649 99 787 457 722 680 661 713 756 782 797 746 744 725 764 693 | 48 36 25 16 48 2.95 57 63 63 66 98 74 76 64 66 50 41 47 | 169 166 178 69 295 77.25 57 59 64 71 148 128 117 68 56 55 57 60 | 13 13 16 4.2 22 11.74 5.1 5.9 5.9 5.9 5.9 5.8 8.0 9.0 13 6.0 6.2 6.0 6.9 5.2 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 5.5 7.9 8.5 8.0 7.7 6.6 | 0.87 0.71 0.84 0.84 0.97 0.52 0.77 5.8 1.4 4.0 5.4 20 <0.78 1.7 2.6 <0.62 0.97 | 10.38 13.8 4.6 10 5.5 17 4.27 19 16 17 16 23 28 47 17 16 20 30 17 |
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| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum 84500-1 84500-2 84500-3 84500-3 84500-5 84500-5 84500-6 84500-7 84500-6 84500-7 84500-10 84500-10 84500-10 84500-11 84500-12 84500-13 84500-14 84500-14 84500-15 84500-17 84500-18 Mean (n=18) S.D. | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 3154 122 262 58 88 239 292 9385 2255 10015 197 291 2251 3495 | 3594 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 2304 2437 1408 1742 15068 5493 26485 2039 1340 5222 6619 | 8007 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 477 358 739 2321 16677 5683 45721 1368 846 6142 11073 | 18 15 15 16 1.4 19 15 <10.96 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 <82 169 225 <67 <93 <97 22919 >50000 3933 799 150 7112 14085 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 5.9 6.2 4.5 6.0 5.9 6.2 4.5 10 21 80 5.8 4.9 16 21 80 5.8 4.9 16 17 19 19 19 19 19 19 2.8 | 982 1859 3337 2793 9436 982 1310 1023 987 15896 2251 1614 892 1174 1728 1120 1922 5467 2087 17232 937 17232 937 3277 4952 | 570 630 649 99 787 457 722 680 661 713 756 782 797 746 744 725 764 693 681 758 736 851 758 736 851 758 736 851 758 736 851 758 736 851 758 736 851 758 736 851 758 736 851 758 758 758 758 758 758 758 758 758 758 | 48 36 25 16 48 2.95 57 63 66 98 74 76 66 98 74 76 64 66 50 41 47 48 191 139 191 139 191 50 80 46 | 169 166 178 69 295 77.25 57 64 71 148 128 117 68 55 57 60 56 208 1721 224 59 57 181 388 | 13 13 16 4.2 22 11.74 5.9 5.9 5.8 8.0 9.0 13 6.0 6.2 6.0 6.9 5.2 5.4 13 6.5 13.9 6.5 13.9 6.5 13.9 6.5 13.9 6.5 13.9 6.5 13.9 6.2 5.4 13 6.5 13.9 5.9 5.9 5.4 13 6.5 13.9 5.9 5.9 5.2 5.4 13 6.5 13.9 5.2 5.4 5.2 5.2 5.4 5.2 5.2 5.2 5.4 5.2 5.2 5.2 5.2 5.2 5.2 5.2 5.2 5.2 5.2 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.5 6.3 7.7 9.2 9.4 8.7 5.5 7.9 8.5 8.0 7.7 6.6 7.1 11 7.1 10.3 8.5 8.0 1.5 8.0 1.5 | 0.87 0.71 0.84 0.84 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 20 <0.78 1.7 2.6 <0.62 0.97 3.5 10.0 3.2 6.9 4.7 <0.69 5.0 4.9 - | 10.38 13.8 4.6 10 5.5 17 4.27 19 16 17 16 23 28 47 17 16 20 30 17 25 59 32 57 24 10 26 14 |
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| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum 84500-1 84500-2 84500-2 84500-2 84500-3 84500-3 84500-4 84500-3 84500-6 84500-7 84500-6 84500-7 84500-10 84500-11 84500-11 84500-11 84500-12 84500-13 84500-15 84500-16 84500-15 84500-16 84500-17 84500-18 Mean (n=18) S.D. Maximum Minimum | 504 541 95 218 209 541 2.62 92 114 347 541 8695 4360 3154 122 262 58 88 239 292 9385 2255 10015 197 291 2251 3495 10015 58 | 3894 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 2304 2437 1408 5493 26485 2039 1340 5222 6619 26485 1340 | 8007 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 477 358 739 2321 16677 5683 45721 1368 846 6142 11073 45721 358 | 18 15 15 16 14 19 15 <10.59 <15.73 <10.59 <15.73 <15.73 <15.73 <15.73 <15.73 <13.90 <13.13 <14.89 <18.57 <21.83 32.3 <13.52 52 27 71 32 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 <82 169 225 <67 <93 <97 22919 >50000 3933 799 150 7112 140850 150 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 5.7 6.2 4.5 10 21 80 2.8 4.9 16 17 18 10 19 19 19 19 19 19 19 19 | 982 1859 3337 2793 9436 982 13103 1023 987 15896 2251 1614 892 1174 1728 1120 1922 5467 2087 17232 937 879 3277 4952 17232 879 | 570 630 649 99 787 457 722 680 661 713 756 782 797 746 744 725 764 693 681 758 756 693 681 758 756 692 736 47 851 661 | 48 36 25 16 48 2.95 57 63 63 66 98 74 76 64 66 50 41 47 48 191 139 191 51 50 80 46 191 41 | 169 166 178 69 295 77.25 57 64 71 148 128 117 68 56 55 57 60 56 208 1721 224 59 57 181 388 1721 55 | 13 13 13 14 22 11.74 5.9 5.9 5.8 8.0 9.0 13 6.0 6.2 6.0 6.2 6.0 5.2 5.4 13 6.3 5.9 7.4 2.8 14 5.1 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 5.5 8.0 7.7 6.6 7.1 11 7.1 10.3 8.5 8.0 7.7 6.5 8.0 7.7 11 5.5 8.0 7.2 7.5 8.5 8.0 7.2 7.5 8.5 8.5 8.0 7.2 7.5 8.5 8.0 7.2 7.5 8.5 8.5 8.0 7.5 8.5 8.5 8.5 8.5 8.5 8.5 8.5 8.5 8.5 8 | 0.87 0.71 0.84 0.84 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 4.0 5.4 4.0 <0.78 1.7 2.6 <0.67 3.5 10.0 3.2 6.97 3.5 10.0 3.2 6.97 5.0 4.7 <0.69 5.0 4.7 <0.69 5.0 4.7 <0.69 5.0 4.7 | 13.8 13.8 4.6 10 5.5 17 4.27 19 16 17 16 23 28 47 17 16 20 30 17 25 59 32 57 24 10 26 14 59 10 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum 84500-1 84500-2 84500-3 84500-3 84500-4 84500-5 84500-5 84500-6 84500-7 84500-18 84500-10 84500-10 84500-11 84500-12 84500-13 84500-14 84500-15 84500-16 84500-17 84500-18 Mean (n=18) S.D. Maximum Minimum Magnetite | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 3154 122 262 58 88 239 292 9385 2255 10015 197 291 2251 3495 10015 58 | 3894 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 2304 2437 1408 5493 26485 2039 1340 5222 6619 26485 1340 | 8007 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 477 358 739 2321 16677 5683 45721 1368 846 6142 1073 45721 358 | 18 15 15 16 1.4 19 15 <10.96 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 <82 169 225 <67 <93 <97 22919 >50000 3933 799 150 7112 14085 44570 150 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 5.9 6.2 4.5 10 21 80 52 5.8 4.9 16 21 80 5.5 19 19 2.8 4.3 5.7 11 19 2.8 4.3 5.7 11 13 4.2 5.7 11 13 4.2 5.7 11 13 4.2 5.7 11 13 4.2 5.7 11 13 4.2 5.5 5.7 11 13 4.2 5.5 5.7 11 13 4.2 5.5 5.7 11 13 4.2 5.5 5.7 11 13 4.2 5.5 5.7 11 13 4.2 5.5 5.7 11 13 4.2 5.5 5.7 11 13 4.2 5.5 5.5 10 5.7 11 13 4.2 5.5 4.5 10 5.5 7 11 13 4.2 5.5 10 5.7 11 13 4.2 5.5 10 5.5 7 11 13 80 5.5 5.8 4.9 16 4.9 16 4.9 16 4.9 16 4.9 16 4.9 4.9 4.9 4.9 4.9 4.9 4.9 4.9 4.9 4.3 4.9 4.9 4.3 4.9 4.3 4.9 4.3 4.9 4.3 4.9 4.3 4.9 4.3 4.9 4.3 4.9 4.3 4.9 4.3 4.9 4.3 4.9 4.3 4.9 4.3 4.9 4.3 4.9 4.3 4.9 4.3 4.9 4.3 4.34.3 4.3 4.34.3 4.34.34.34.34.34.34.34.3 | 982 1859 3337 2793 9436 982 1310 1023 987 15896 2251 1614 892 1174 1728 1120 1922 5467 2087 17237 937 879 3277 4952 17232 879 | 570 630 649 99 787 457 722 680 661 713 756 782 797 746 744 725 764 693 681 758 736 851 758 736 851 758 736 851 661 | 48 36 25 16 48 2.95 57 63 66 98 74 66 98 74 66 64 66 50 41 47 48 191 139 191 51 50 80 46 191 41 | 169 166 178 69 295 77.25 57 59 64 71 148 128 117 68 56 55 57 60 56 208 1721 224 59 57 181 388 1721 59 57 181 388 1721 59 | 13 13 13 14 5.2 5.4 13 6.0 6.2 6.0 6.2 6.0 6.2 5.4 13 6.5 13.9 6.3 5.9 7.4 2.8 14 5.1 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 5.5 7.9 8.5 8.0 7.7 6.6 7.1 11 7.1 10.3 8.5 8.0 7.7 6.5 8.0 7.7 8.5 8.0 7.5 8.5 8.0 11 7.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.0 1.5 8.5 8.5 8.0 1.5 8.5 8.5 8.5 8.0 8.5 8.5 8.0 8.5 8.5 8.5 8.5 8.5 8.5 8.5 8.5 | 0.87 0.71 0.84 0.84 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 20 <0.78 1.7 2.6 <0.62 0.97 3.5 10.0 3.2 6.9 4.7 <0.69 5.0 4.9 20 0.77 | 10.3.8 13.8 4.6 10 5.5 17 19 16 23 28 47 16 20 30 17 16 20 30 177 25 59 32 57 24 10 26 14 59 10 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum 84500-1 84500-2 84500-3 84500-3 84500-4 84500-5 84500-6 84500-6 84500-7 84500-6 84500-7 84500-10 84500-10 84500-10 84500-11 84500-12 84500-13 84500-14 84500-15 84500-15 84500-17 84500-18 Mean (n=18) S.D. Maximum Minimum Magnetite 751008Mt-1 | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 3154 122 262 58 88 239 292 58 88 239 29385 2255 10015 197 291 3495 10015 58 2251 3495 10015 58 | 5396 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 2304 2437 1408 1742 2304 2437 1408 1742 2508 5493 26485 2039 1340 5222 6619 26485 1340 | 8007 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 477 358 739 2321 16677 5683 45721 1368 846 6142 11073 45721 358 | 18 15 15 16 1.4 19 15 <15.37 <10.96 <14.53 <14.53 <15.73 70.99 <14.06 <13.20 <15.37 <13.90 <13.13 <14.89 <14.21 <13.52 52 27 71 32 13.04 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 <82 169 225 <67 <93 <97 22919 225 <67 <93 3933 799 150 3933 799 150 1112 14085 44570 150 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 5.9 6.2 4.5 10 21 80 52 5.8 4.9 6.2 4.5 10 21 80 4.3 4.3 4.3 4.3 4.3 4.5 4.5 4.4 10 5.7 4.1 13 4.2 4.3 4.3 5.5 10 5.7 11 13 4.2 4.3 5.5 10 5.7 10 5.7 10 5.7 11 13 4.2 6.2 4.3 10 5.7 11 13 4.2 6.2 4.3 10 5.5 10 5.7 11 13 4.2 6.5 10 5.7 11 13 4.2 6.5 10 5.7 11 13 4.2 6.5 10 5.5 10 5.7 11 13 4.2 6.5 10 5.5 10 5.7 10 5.7 10 5.5 10 5.7 10 5.7 10 5.5 10 5.7 10 5.7 10 5.5 10 5.7 10 5.7 10 10 5.7 5.7 10 5.9 5.7 10 5.9 5.8 5.8 5.8 5.8 5.8 5.8 5.8 5.8 5.8 5.8 | 982 1859 3337 2793 9436 982 1310 1083 1379 1023 987 15896 2251 1614 892 1174 892 1174 892 1174 892 11728 1120 1922 5467 2087 17232 937 879 3277 4952 17232 879 | 570 630 649 99 787 457 722 680 661 713 758 782 797 746 742 797 746 744 693 681 758 851 756 851 756 851 756 47 851 661 | 48 36 25 16 48 2.95 57 63 63 66 98 74 76 64 66 50 41 47 48 191 139 191 51 51 50 80 46 191 41 29 | 169 166 178 69 295 77.25 57 59 64 71 148 128 117 68 55 57 60 56 208 1721 224 59 57 181 388 1721 55 57 60 56 208 1721 224 59 57 181 388 1721 59 57 59 50 50 50 50 50 50 50 50 50 50 50 50 50 | 13 13 13 14 5.1 5.9 5.9 5.8 8.0 9.0 13 6.0 6.2 6.0 6.9 5.2 5.4 13 6.5 13.9 6.3 5.9 7.4 2.8 14 5.1 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 5.5 7.9 8.5 8.0 7.7 6.6 7.1 11 7.1 10.3 8.5 6.5 8.0 1.5 11 5.5 8.0 1.5 1.1 5.5 8.0 7.7 6.4 | 0.87 0.71 0.84 0.84 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 20 <0.78 1.7 2.6 <0.62 0.97 3.5 10.0 3.2 6.9 4.7 <0.69 4.7 <0.69 4.7 20 0.77 | 10.38 13.8 4.6 10 5.5 17 4.27 19 16 17 16 23 28 47 16 20 30 17 25 59 32 57 24 10 26 14 59 10 8.7 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum 84500-1 84500-2 84500-2 84500-3 84500-4 84500-3 84500-6 84500-6 84500-6 84500-7 84500-6 84500-7 84500-10 84500-10 84500-11 84500-11 84500-12 84500-13 84500-15 84500-15 84500-15 84500-15 84500-16 84500-17 84500-18 Mean (n=18) S.D. Maximum Minimum Magnetite 751008Mt-1 751008Mt-1 | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 3154 122 262 58 88 239 292 9385 2255 10015 197 291 2251 10015 58 2255 10015 58 | 5396 5396 5396 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 2304 2420 2304 2437 1408 5493 26485 2039 1340 5222 6619 26485 1340 22000 2180 | 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 477 358 45721 1368 846 6142 11073 45721 358 704 563 | 18 15 15 16 14 19 15 <10.59 <14.53 <10.59 <14.53 <10.59 <15.73 <10.59 <14.06 <13.20 <13.13 <14.89 <18.57 <21.83 <14.21 <13.52 52 27 71 32 13.04 12.77 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 <82 169 225 <67 <93 393 799 150 7112 14085 44570 150 77 103 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 5.9 6.2 4.5 10 21 80 4.5 10 21 80 4.3 4.5 4.5 4.5 10 5.2 4.5 10 5.2 4.5 10 5.2 4.5 10 5.2 10 5.7 10 5.7 11 13 80 4.5 10 5.2 10 5.7 10 5.7 10 5.7 10 5.7 10 5.7 10 5.7 10 5.7 10 5.7 11 10 5.7 5.8 10 5.7 5.8 10 5.7 5.8 10 5.8 5.8 5.8 5.8 5.8 5.8 5.8 5.8 5.8 5.8 | 982 1859 3337 2793 9436 982 1310 1023 987 15296 2251 1614 892 1174 1728 1120 1922 5467 2087 17232 937 879 3277 879 3277 879 3277 879 3277 879 3277 | 570 630 649 99 787 457 722 680 661 713 756 782 797 746 744 744 725 764 693 681 756 692 736 851 756 692 736 47 851 661 702 688 | 48 36 25 16 48 2.95 57 63 63 66 98 74 76 64 66 64 66 50 41 47 48 191 139 191 51 50 80 80 46 191 41 29 26 | 169 166 178 69 295 77.25 57 59 64 71 148 128 117 68 56 55 57 60 56 208 11721 224 59 57 181 388 1721 55 | 13 13 16 4.2 22 11.74 5.9 5.9 5.9 5.9 5.9 5.9 5.9 5.8 8.0 9.0 13 6.0 6.2 6.0 6.2 6.0 6.2 6.0 6.2 5.4 13 6.5 13.9 6.3 5.9 7.4 2.8 14 5.1 13 6.3 5.9 7.4 2.8 14 5.9 7.4 14 5.9 7.4 14 5.9 7.4 7.4 7.4 7.4 7.5 7.5 7.5 7.5 7.5 7.5 7.5 7.5 7.5 7.5 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.5 6.3 7.7 9.2 9.4 8.7 5.5 8.0 7.7 9.2 9.4 8.7 5.5 8.0 7.7 6.6 7.1 11 10.3 8.5 6.5 8.0 1.5 11 5.5 8.0 1.5 6.5 8.0 1.5 1.5 1.5 1.5 1.5 8.0 1.5 1.5 8.5 8.0 1.5 1.5 8.5 8.5 8.5 8.5 8.5 8.5 8.5 8.5 8.5 8 | 0.87 0.71 0.84 0.84 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 20 <0.78 1.7 2.6 <0.62 0.97 3.5 10.0 3.2 6.9 4.7 <0.69 5.0 9 4.7 <0.69 5.0 9 0.77 | 10.38 13.8 4.6 10 5.5 17 4.27 19 16 23 28 47 17 16 20 30 17 25 59 32 57 24 10 26 14 59 10 8.7 6.3 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum Minimum 84500-1 84500-2 84500-3 84500-4 84500-5 84500-6 84500-7 84500-8 84500-9 84500-10 84500-10 84500-11 84500-12 84500-13 84500-13 84500-13 84500-14 84500-15 84500-17 84500-18 Mean (n=18) S.D. Maximum Minimum Magnetite 751008Mt-1 751008Mt-1 751008Mt-1 751008Mt-1 751008Mt-1 | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 3154 122 262 58 88 239 292 9385 2255 10015 197 291 2251 3495 10015 58 | 3894 5396 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 2304 2437 1408 5493 26485 2039 1340 5222 6619 26485 3000 2180 | 8007 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 477 358 739 2321 16677 5683 45721 1368 846 6142 11073 45721 358 704 563 | 18 15 15 16 1.4 19 15 <10.96 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 44570 2544 44570 254 44570 225 <67 <93 <97 22919 >50000 3933 799 150 7112 14085 44570 771 103 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 5.9 6.2 4.5 10 21 80 4.5 10 21 80 4.9 16 21 80 4.3 4.3 5.5 80 4.3 5.5 80 4.3 5.5 80 4.5 80 4.5 80 4.5 80 4.5 80 4.5 80 4.5 80 4.5 80 4.5 80 4.5 80 4.5 80 80 80 80 80 80 80 80 80 80 80 80 80 | 982 1859 3337 2793 9436 982 1310 1023 987 15896 2251 1614 892 1174 1728 1120 1922 5467 2087 17232 937 879 3277 4952 17232 937 879 3277 4952 17232 879 | 570 630 649 99 787 457 722 680 661 713 756 782 797 746 744 725 764 693 681 758 736 851 756 692 736 47 851 661 702 688 | 48 36 25 16 48 2.95 57 63 66 98 74 76 64 66 50 41 47 48 191 139 191 51 50 80 46 191 41 29 26 | 169 166 178 69 295 77.25 57 59 64 71 148 128 117 68 56 55 57 60 56 208 1721 224 59 57 181 388 1721 55 100 181 | 13 13 13 14 5.9 5.8 8.0 9.0 13 6.0 6.2 6.0 6.2 6.0 6.2 5.4 13 6.5 13.9 6.3 5.9 7.4 2.8 14 5.1 18.89 16.98 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 5.5 7.9 8.5 8.0 7.7 6.6 7.1 11 7.1 10.3 8.5 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.5 8.0 7.7 6.5 8.0 7.7 9.2 9.4 8.5 8.0 7.7 6.5 8.0 7.7 9.2 9.4 8.5 8.0 7.7 9.2 9.4 8.5 8.0 7.7 9.2 9.4 8.5 8.0 7.7 9.5 8.5 8.0 7.7 9.5 8.5 8.0 7.7 9.2 9.4 8.5 8.0 7.7 9.5 8.5 8.0 7.7 9.5 8.5 8.0 7.7 9.5 8.5 8.0 7.7 9.5 8.5 8.0 7.7 9.5 8.5 8.0 7.7 9.5 8.5 8.0 7.7 9.5 8.5 8.0 7.7 9.5 8.5 8.0 7.7 9.5 8.5 8.0 7.7 9.5 8.5 8.0 7.7 8.5 8.5 8.0 7.7 8.5 8.5 8.0 7.7 8.5 8.5 8.0 7.7 8.5 8.5 8.0 7.7 8.5 8.5 8.0 7.7 8.5 8.5 8.0 8.5 8.5 8.0 8.0 8.5 8.0 8.0 8.5 8.0 8.0 8.5 8.0 8.0 8.5 8.0 8.0 8.5 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 | 0.87 0.71 0.84 0.84 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 20 <0.78 1.7 2.6 <0.62 0.97 3.5 10.0 3.2 6.9 4.7 <0.69 5.0 4.7 <0.69 5.0 4.7 0.77 0.49 0.69 | 13.8 13.8 4.6 10 5.5 17 4.27 19 16 23 28 47 17 16 20 30 177 25 59 32 57 24 10 26 14 59 10 8.7 6.3 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum 84500-1 84500-2 84500-3 84500-3 84500-5 84500-6 84500-5 84500-6 84500-7 84500-10 84500-10 84500-10 84500-10 84500-11 84500-12 84500-13 84500-14 84500-13 84500-14 84500-15 84500-14 84500-15 84500-14 84500-17 84500-18 Mean (n=18) S.D. Maximum Minimum Magnetite 751008Mt-1 751008Mt-2 Ilmenite | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 3154 122 262 58 88 239 292 9385 2255 10015 197 291 2251 3495 10015 58 2255 10015 58 2255 10015 291 2251 3495 2251 3495 2255 2251 3495 2251 2251 2251 2251 2251 2251 2251 22 | 3394 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 2304 2437 1408 2420 2304 2437 1408 1742 15068 5493 26485 2039 1340 5222 6619 26485 1370 2000 2180 | 8007 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 477 358 739 2321 16677 5683 45721 1368 846 6142 11073 45721 358 704 563 | 16 15 15 16 1.4 19 15 <15.37 <10.96 <14.53 <10.59 <15.73 <15.73 <15.73 <15.73 <15.73 <15.73 <13.90 <13.10 <13.20 <13.13 <14.89 <14.857 <21.83 32.3 <14.21 <13.52 27 71 32 13.04 12.27 147 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 <82 169 225 <67 <93 <97 22919 >50000 3933 799 150 7112 14085 44570 150 77 103 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 5.9 6.2 4.5 6.0 5.9 6.2 4.5 10 21 80 52 5.8 4.9 16 21 80 55 5.8 4.3 17 19 2.8 19 2.8 19 2.8 4.3 5.7 11 1 1 1 1 1 1 1 1 1 | 982 1859 3337 2793 9436 982 1310 1023 987 15896 2251 1614 892 1174 1728 1120 1922 5467 2087 17232 937 879 3277 4952 17232 879 1901 1781 | 570 630 649 99 787 457 722 680 661 713 756 782 797 746 742 797 746 744 725 764 693 681 758 736 851 758 736 851 756 47 851 661 702 688 308 | 48 36 25 16 48 2.95 57 63 63 66 98 74 76 64 66 50 41 47 48 191 139 191 51 50 80 46 191 139 191 51 29 26 7 1 | 169 166 178 69 295 77.25 57 64 71 148 128 117 68 55 57 60 56 208 1721 224 59 57 181 388 1721 55 57 181 388 1721 55 57 100 181 | 13 13 13 14 5.9 5.8 8.0 9.0 13 6.0 6.2 6.0 6.2 6.0 6.2 5.4 13 6.5 13.9 6.3 5.9 7.4 2.8 14 5.1 18.89 16.98 2.9 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 5.5 7.9 8.5 8.0 7.7 6.6 7.1 11 7.1 10.3 8.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 1.5 11 5.5 6.3 7.7 9.4 8.7 5.5 6.3 7.7 9.4 8.7 5.5 6.3 7.7 9.4 8.7 5.5 6.3 7.7 9.4 8.7 5.5 6.3 7.7 9.4 8.7 5.5 6.3 7.7 9.4 8.7 5.5 6.3 7.7 9.4 8.7 5.5 6.3 7.7 9.4 8.7 5.5 6.3 7.7 9.4 8.7 5.5 6.3 7.7 9.4 8.7 5.5 6.3 7.7 9.4 8.7 5.5 6.3 7.7 9.4 8.7 5.5 7.9 8.5 8.0 7.7 6.1 11 7.1 11 7.1 11 7.1 11 7.1 11 7.1 11 7.1 7. | 0.87 0.71 0.84 0.84 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 20 <0.78 1.7 2.6 <0.62 0.97 3.5 10.0 3.2 6.9 4.7 <0.69 5.0 4.9 20 0.77 0.49 0.69 | 10.38 13.8 4.6 10 5.5 17 19 16 17 16 23 28 47 16 20 30 17 16 2030 17 25 59 32 57 24 10 26 14 59 10 8.7 6.3 58 |
| 751008-6 751008-7 751008-8 Mean (n=8) S.D. Maximum 84500-1 84500-2 84500-2 84500-3 84500-4 84500-5 84500-6 84500-7 84500-6 84500-7 84500-6 84500-7 84500-10 84500-10 84500-10 84500-11 84500-12 84500-13 84500-15 84500-15 84500-15 84500-15 84500-15 84500-15 84500-15 84500-15 84500-15 84500-17 84500-18 Mean (n=18) S.D. Maximum Minimum Magnetite 751008Mt-1 751008Mt-2 Ilmenite 751003 Ilm/mix-1 | 504 541 95 218 209 541 2.66 92 114 347 541 8695 4360 3154 122 262 58 88 239 292 9385 2255 10015 197 29385 2255 10015 197 2251 3495 10015 58 2255 10015 58 2251 2251 3495 2251 2251 2251 2251 2251 2251 2251 22 | 5394 5396 5396 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 2304 2437 1408 1742 15068 2420 2304 2437 1408 1742 15068 2437 1408 1742 15068 2437 1408 1742 15068 2437 1408 1742 15068 2437 1408 1742 1506 2094 2437 1408 1742 1506 2437 1408 2437 1408 1742 1506 2437 1408 2447 1408 1752 2475 2094 2477 2477 2477 2477 2477 2477 2477 24 | 8717 7031 7037 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 477 358 739 2321 16677 5683 45721 1368 846 6142 11073 45721 358 704 563 | 18 15 15 16 1.4 19 15 <10.96 <14.53 <15.73 70.99 <14.06 <13.20 <13.13 <14.89 <13.13 <14.21 <13.52 52 27 71 32 13.04 12.27 147 20 21 27 21 27 21 27 21 27 21 27 21 27 21 27 21 27 27 27 27 27 27 27 27 27 27 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 301 <82 169 225 <67 <93 3933 799 150 7112 14085 44570 150 77 103 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 5.9 4.5 10 5.7 11 13 42 6.5 6.0 5.9 4.5 10 5.7 11 80 52 5.8 4.9 10 80 4.3 10 80 4.5 4 10 5.2 10 5.7 11 13 42 6.6 4 4.5 10 5.7 11 13 42 6.5 4 10 5.7 10 5.7 11 13 42 6.5 10 5.7 10 5.7 11 13 42 6.5 10 5.7 5.8 10 80 5.7 5.8 10 10 5.7 5.7 10 5.7 5.8 10 5.7 5.8 10 5.7 5.7 10 5.7 5.7 10 5.7 5.8 5.8 5.8 5.8 5.8 5.8 5.7 5.7 5.7 5.7 5.7 5.7 5.7 5.7 5.7 5.7 | 982 1859 3337 2793 9436 982 1310 1083 1379 1023 987 15896 2251 1614 892 1174 1728 1120 1922 5467 2087 17232 937 879 3277 4952 17232 879 3277 4952 17232 879 3277 | 570 630 649 99 787 457 722 680 661 713 756 693 681 756 693 681 756 693 681 756 693 681 756 692 736 851 756 692 736 851 756 693 681 756 693 851 756 693 851 756 756 851 756 851 756 851 756 851 756 851 756 851 756 851 756 851 756 851 756 756 756 756 756 756 756 756 756 756 | 48 36 25 16 48 2.95 57 63 63 66 98 74 76 64 66 64 66 50 41 47 48 191 139 191 51 50 80 46 191 41 29 26 7.1 | 169 166 178 69 295 77.25 57 59 64 71 148 128 117 68 56 55 57 60 56 208 1721 224 59 57 181 388 1721 55 57 60 56 208 1721 224 59 57 181 388 1721 59 57 57 60 50 208 1721 224 57 57 59 57 57 59 60 56 208 172 57 59 57 59 57 59 64 71 148 55 55 57 59 57 59 64 71 148 55 55 57 59 57 59 64 71 148 128 117 68 55 55 57 59 64 71 148 128 117 68 55 55 57 60 56 208 1721 57 59 57 59 57 59 57 59 57 59 57 59 59 57 59 57 59 57 59 57 59 57 59 57 59 57 59 57 59 57 59 57 59 57 57 59 57 59 57 59 57 59 57 59 57 59 57 57 57 59 57 57 57 59 57 57 57 57 57 57 57 57 57 57 57 57 57 | 13 13 16 4.2 22 11.74 5.1 5.9 5.8 8.0 9.0 13 6.0 6.2 6.0 6.2 6.0 6.2 6.0 6.2 6.0 6.2 5.4 13 6.5 13.9 6.3 5.9 5.2 5.4 13 6.5 13.9 6.3 5.9 7.4 2.8 14 5.1 13 6.3 5.9 13.9 6.3 5.9 5.9 5.2 5.4 13 6.5 13.9 6.3 5.9 5.9 5.2 5.4 13 6.5 13.9 5.9 5.2 5.4 13 6.5 13.9 5.9 5.2 5.4 13 6.5 13 6.5 13 5.9 5.2 5.2 5.2 5.2 5.2 5.2 5.2 5.2 5.2 5.2 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 5.5 7.9 8.5 8.0 7.7 6.6 7.1 11 7.1 10.3 8.5 8.0 7.7 6.5 8.0 7.7 6.6 7.1 11 5.5 8.0 7.7 6.6 8.5 8.0 1.5 11 5.5 8.0 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 | 0.87 0.71 0.84 0.84 0.97 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 20 <0.85 0.77 5.8 1.4 4.0 5.4 20 <0.97 3.5 10.0 3.2 6.9 4.7 <0.62 0.97 3.5 10.0 3.2 6.9 4.7 2.6 <0.62 0.97 3.5 10.0 3.2 6.9 4.7 2.0 5.0 4.9 20 0.77 5.8 1.4 2.1 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 | 10.38 13.8 4.6 10 5.5 17 4.27 19 16 17 16 23 28 47 16 20 30 17 16 20 30 17 25 59 32 57 24 10 8.7 6.3 58 17 |
| 751008-6 751008-7 751008-7 751008-8 Mean (n=8) S.D. Maximum 84500-1 84500-2 84500-2 84500-2 84500-3 84500-3 84500-6 84500-7 84500-6 84500-7 84500-7 84500-7 84500-10 84500-11 84500-11 84500-12 84500-13 84500-14 84500-15 84500-16 84500-15 84500-16 84500-15 84500-16 84500-17 84500-18 Mean (n=18) S.D. Maximum Minimum Magnetite 751008Mt-1 751008Mt-2 Ilmenite 751003 Ilm/mix-2 | 504 541 95 218 209 541 8695 4360 3154 122 62 58 88 239 292 9385 2255 10015 197 291 2251 3495 10015 58 202 2251 3495 10015 58 | 3894 5396 5396 2098 3070 1856 5894 741 1565 1372 1482 2270 12573 6114 6252 1628 2420 2304 2437 1408 5493 26485 2039 1340 20000 2180 37122 2173 | 8717 7031 7367 9002 28124 497 486 551 1401 1399 14304 7517 9330 562 818 477 358 739 2321 16677 5683 45721 1368 846 6142 11073 45721 1368 846 6142 11073 45721 1368 846 6142 11073 45721 1368 846 6142 1358 | 18 15 15 16 14 19 15 <10.59 <14.53 <15.73 <15.73 <15.73 <15.73 <15.73 <15.73 <15.73 <13.20 <13.10 <13.13 <14.89 <18.57 <21.83 32.3 <13.20 <13.13 <13.52 52 27 71 32 13.04 12.27 147 29 <12 27 | 190 114 120 31 190 94 <130 <73 2398 224 44570 2544 44570 2544 301 <82 169 225 <67 <93 <97 22919 >50000 3933 799 150 7112 14085 44570 771 103 | 2.8 3.3 6.6 5.4 19 2.8 4.3 5.5 10 5.7 11 13 42 6.5 6.0 5.7 11 13 42 6.5 6.0 5.7 10 21 80 4.5 10 21 80 4.9 16 21 80 4.3 5.5 80 4.3 5.5 80 4.5 10 5.2 4.5 10 5.7 10 2.8 8 4.5 10 5.7 10 5.7 10 2.8 8 4.5 10 5.7 10 10 5.7 10 5.7 10 10 5.7 10 10 5.7 10 5.7 10 5.7 10 10 5.7 10 5.8 80 4.5 10 5.8 10 5.7 10 5.8 80 4.5 10 5.8 10 5.8 5.8 80 4.3 10 5.7 5.8 80 4.3 10 5.7 5.8 80 4.3 10 5.7 5.8 80 4.3 10 5.7 5.8 80 4.3 10 5.7 5.8 80 4.3 10 5.7 5.8 80 4.3 10 5.7 5.8 15.7 5.8 15.7 5.7 5.8 15.7 5.7 5.8 5.7 5.7 5.7 5.7 5.7 5.7 5.7 5.7 5.7 5.7 | 982 1859 3337 2793 9436 982 13100 1023 987 15896 2251 1614 892 1174 1728 1120 1922 5467 2087 17232 937 879 3277 4952 17232 879 1901 1781 | 570 630 649 99 787 457 722 680 661 713 756 782 797 746 744 725 764 693 681 756 693 681 756 693 681 756 692 736 47 7 726 851 661 702 688 308 249 | 48 36 25 16 48 2.95 57 63 66 98 74 76 64 66 50 41 47 48 191 139 191 51 50 80 46 191 41 29 26 7.1 4.1 | 169 166 178 69 295 77.25 57 59 64 71 148 128 117 68 56 55 57 60 56 208 1721 224 59 57 183 388 1721 55 100 181 390 178 | 13 13 13 14 22 11.74 5.9 5.8 8.0 9.0 13 6.0 6.2 6.0 6.2 6.0 5.2 5.4 13 6.3 5.9 7.4 2.8 14 5.1 18.89 16.98 2.9 1.3 | 7.8 5.33 7.27 7.6 2.4 13 5.33 7.5 6.3 7.7 9.2 9.4 8.7 5.5 8.0 7.7 6.6 7.7 8.5 8.0 7.7 6.6 7.7 6.5 8.0 7.7 6.6 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.5 8.0 7.7 6.5 8.5 8.0 7.7 6.5 8.5 8.0 7.7 6.5 8.5 8.0 7.7 6.5 8.5 8.0 7.7 6.5 8.5 8.0 7.7 6.5 8.5 8.0 7.7 6.5 8.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 6.5 8.0 7.7 8.5 8.0 7.7 6.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.1 11 7.1 7.5 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 8.5 8.0 7.7 7.5 8.0 7.5 7.5 8.0 7.5 8.0 7.5 7.5 7.5 8.0 7.5 7.5 8.0 7.5 8.0 7.5 7.5 7.5 8.0 7.5 7.5 7.5 7.5 8.0 7.5 7.5 7.5 8.0 7.5 7.5 7.5 7.5 8.0 7.5 7.5 7.5 7.5 7.5 7.5 7.5 7.5 | 0.87 0.71 0.84 0.84 0.94 0.52 <0.85 0.77 5.8 1.4 4.0 5.4 20 <0.78 1.7 2.6 <0.62 0.97 3.5 10.0 3.2 6.9 20 0.77 5.0 4.7 <0.69 5.0 4.7 <0.69 5.0 4.7 0.77 5.0 4.7 0.75 10.0 3.2 6.9 0.77 5.0 4.7 0.75 10.0 3.2 6.9 5.0 4.7 5.0 5.0 4.7 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 | 13.8 13.8 1.6 10 5.5 17 4.27 19 16 23 28 47 17 16 20 30 17 25 59 32 57 24 10 26 14 59 10 8.7 6.3 58 17 58 17 58 17 |

| | Ga | As | Sr | Y | Zr | Nb | Мо | Sn | Sb | Ва | La | Ce | Pr | Nd | Sm | Eu | Gd |
|---|---|---|---|--|--|--|---|---|--|--|--|--|---|--|--|---|---|
| | 8.8 | 0.88 | 0.25 | 0.43 | 1.32 | 244 | 0.49 | 484 | 0.78 | 1.0 | 0.53 | 0.81 | 0.06 | 0.14 | < 0.05 | < 0.01 | 0.09 |
| | 9.0 | <0.60 | 0.69 | 0.68 | 2.73 | 237 | 0.17 | 513 | 3.5 | 1.0 | 0.37 | 0.6 | 0.07 | 0.26 | 0.13 | <0.01 | <0.063 |
| | 10.9 | 0.40 ∠0.75 | 0.47 | 0.58 | 2.95 | 297 | 0.20 | 407 | 4.7 | 1 2 | 0.55 | 1.058 | 0.09 | 0.10 | <pre>0.15</pre> | 0.01 | <0.10 |
| | 9.6 | 0.81 | 0.26 | 0.95 | 2.46 | 871 | 1.5 | 1203 | 5.8 | 1.1 | 0.54 | 1.157 | 0.00 | 0.17 | 0.18 | < 0.01 | 0.08 |
| | 8.3 | <0.73 | 0.31 | 1.37 | 7.09 | 357 | 0.92 | 370 | 1.8 | 0.6 | 0.38 | 0.89 | 0.10 | 0.25 | 0.08 | 0.01 | 0.10 |
| | 13 | <0.64 | 0.41 | 0.94 | 2.53 | 429 | 4.0 | 1957 | 7.6 | 3.7 | 0.98 | 1.9 | 0.21 | 0.60 | 0.11 | <0.01 | 0.18 |
| | 15 | < 0.51 | 0.66 | 1.252 | 4.12 | 389 | 1.7 | 1112 | 16 | 5.9 | 1.2 | 2.2 | 0.25 | 0.61 | 0.16 | 0.02 | 0.19 |
| | 11 | 0.77 | 0.79 | 1.52 | 3.56 | 414 | 1.8 | 483 | 10 | 1.3 | 1.9 | 2.2 | 0.25 | 0.62 | 0.26 | 0.02 | 0.12 |
| | 14 | 0.90 | 0.05 | 2.59 | 5.40 12.65 | 205 | 23 | 1004 | 23 | 4.7 | 1.2 | 2.5 | 0.22 | 0.85 | 0.28 | <0.02 | 0.21 |
| | 12 | <0.61 | 1.09 | 2.68 | 8.54 | 428 | 3.2 | 1400 | 23 | 6.5 | 2.3 | 3.9 | 0.20 | 1.17 | 0.43 | 0.04 | 0.40 |
| | 19 | 1.09 | 1.4 | 2.63 | 6.11 | 323 | 5.0 | 1022 | 22 | 22 | 2.8 | 5.0 | 0.56 | 1.38 | 0.39 | 0.02 | 0.46 |
| | 16 | 5.06 | 0.628 | 4.96 | 6.3 | 309 | 2.0 | 1304 | 11 | 7.5 | 2.7 | 4.9 | 0.43 | 1.09 | 0.62 | 0.04 | 0.60 |
| | 14 | 1.86 | 1.42 | 2.62 | 7.6 | 273 | 4.6 | 1232 | 48 | 7.1 | 4.4 | 6.9 | 0.54 | 1.35 | 0.30 | 0.06 | 0.156 |
| | 19 | 1.23 | 1.69 | 5.05 | 17.98 | 389 | 6.4 | 12/1 | 31 | 15 25 | 2.8 | 5.9 | 0.58 | 1.86 | 0.60 | 0.03 | 0.59 |
| | 18 | 0.86 | 2.08 | 5.27 8.07 | 24.09 | 498 | 9.4 7.2 | 200 | 59 21 | 55 17 | 3.0 4 3 | 0.9 9 1 | 0.85 | 2.94 | 0.00 | 0.05 | 0.85 |
| | 15 | < 0.51 | 0.705 | 0.833 | 1.86 | 287 | 0.72 | 1627 | 8.5 | 26 | 1.6 | 1.8 | 0.21 | 0.63 | 0.19 | 0.01 | 0.21 |
| | 14 | 1.4 | 1.0 | 2.3 | 7.2 | 360 | 4.2 | 961 | 16 | 10 | 1.9 | 3.3 | 0.32 | 0.93 | 0.33 | 0.03 | 0.33 |
| | 3.4 | 1.2 | 0.77 | 2.1 | 6.6 | 145 | 6.0 | 476 | 13 | 10 | 1.4 | 2.7 | 0.25 | 0.83 | 0.25 | 0.02 | 0.30 |
| | 19 | 5.1 | 3.0 | 8.1 | 24 | 871 | 27 | 1957 | 48 | 35 | 5.0 | 9.1 | 0.88 | 2.9 | 0.96 | 0.09 | 1.1 |
| - | 9 | <0.97 | 0.25 | 0.02 | 0.24 | 677 | 0.00 | 1133 | 0.42 | 0.30 | 0.01 | 0.05 | 0.00 | 0.05 | 0.02 | 0.01 | 0.04 |
| | 9 | 2.3 | 0.05 | 0.07 | 0.15 | 369 | 0.15 | 1529 | 2.60 | 0.33 | 0.17 | 0.36 | 0.02 | 0.10 | 0.05 | 0.02 | 0.10 |
| | 13 | <0.83 | 0.59 | 0.29 | 0.80 | 308 | 171 | 1075 | 0.76 | 2.02 | 0.28 | 0.52 | 0.04 | 0.09 | 0.03 | 0.00 | 0.10 |
| | 9 | <1.52 | 0.07 | 0.06 | 0.06 | 351 | 6.5 | 801 | 0.74 | 0.71 | 0.06 | 0.07 | 0.02 | 0.08 | 0.04 | 0.02 | 0.03 |
| | 10 | <1.15 1 1 | 0.20 | 0.14 | 0.41 | 354 | 2.0 | 1445 | 1.65 | 0.29 | 0.15 | 0.32 | 0.03 | 0.13 | 0.06 | 0.02 | 0.11 |
| | 14 | < 0.98 | 0.15 | 0.05 | 0.12 | 461 | 0.04 | 594 | 0.17 | 0.46 | 0.01 | 0.01 | 0.02 | 0.00 | 0.05 | 0.01 | 0.05 |
| | 14 | <0.93 | 0 | 0.01 | 0.08 | 456 | 0.09 | 623 | 0.46 | 0.00 | 0.02 | 0.01 | 0.01 | 0.06 | 0.06 | 0.00 | 0.04 |
| | 12 | < 0.82 | 0.263 | 0.65 | 0.31 | 244 | 0.54 | 533 | 0.62 | 0.00 | 0.11 | 0.34 | 0.06 | 0.24 | 0.17 | 0.01 | 0.19 |
| | 9.7 | <0.91 | 0.243 | 0.39 | 1.4 | 260 | 0.27 | 1570 | 1.13 | 0.29 | 0.23 | 0.42 | 0.05 | 0.18 | 0.07 | 0.01 | 0.01 |
| | 2 | 0.83 | 0.18 | 0.21 | 0.45 | 126 | 54 | 398 | 0.35 | 0.52 | 0.13 | 0.35 | 0.03 | 0.10 | 0.00 | 0.01 | 0.05 |
| | 14 | 2.3 | 0.59 | 0.65 | 1.4 | 677 | 171 | 1570 | 2.6 | 2.02 | 0.46 | 1.17 | 0.08 | 0.24 | 0.17 | 0.03 | 0.19 |
| _ | 9.0 | 1.1 | 0.00 | 0.01 | 0.06 | 244 | 0.00 | 533 | 0.17 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.02 | 0.00 | 0.01 |
| | | | | | | | | | | | | | | | | | |
| | 12 | 47 | 32 | 19.2 | 77 | 113 | 3 64 | 174 | 53 | 3 81 | 36 08 | 52 13 | 4 38 | 11 28 | 2 4 8 | 0.22 | 2 66 |
| | 12 12 | 4.7 2.9 | 3.2 3.3 | 19.2 18.5 | 7.7 1.9 | 113 89 | 3.64 72 | 174 134 | 5.3 4.7 | 3.81 13.64 | 36.08 16.83 | 52.13 26.9 | 4.38 2.23 | 11.28 6.3 | 2.48 1.51 | 0.22 0.18 | 2.66 1.5 |
| | 12 12 16 | 4.7 2.9 2.0 | 3.2 3.3 1.0 | 19.2 18.5 4.3 | 7.7 1.9 3.4 | 113 89 15 | 3.64 72 7.55 | 174 134 49 | 5.3 4.7 2.2 | 3.81 13.64 2.3 | 36.08 16.83 2.47 | 52.13 26.9 4.55 | 4.38 2.23 0.376 | 11.28 6.3 1.29 | 2.48 1.51 0.383 | 0.22 0.18 0.07 | 2.66 1.5 0.7 |
| | 12 12 16 34 | 4.7 2.9 2.0 0.89 | 3.2 3.3 1.0 1.1 | 19.2 18.5 4.3 10.0 | 7.7 1.9 3.4 0.11 | 113 89 15 10 | 3.64 72 7.55 3.71 | 174 134 49 88 | 5.3 4.7 2.2 2.5 | 3.81 13.64 2.3 1.16 | 36.08 16.83 2.47 7.55 | 52.13 26.9 4.55 15.96 | 4.38 2.23 0.376 1.58 | 11.28 6.3 1.29 5.37 | 2.48 1.51 0.383 1.22 | 0.22 0.18 0.07 0.11 | 2.66 1.5 0.7 1.3 |
| | 12 12 16 34 22 | 4.7 2.9 2.0 0.89 <0.70 | 3.2 3.3 1.0 1.1 0.15 | 19.2 18.5 4.3 10.0 0.81 | 7.7 1.9 3.4 0.11 5.2 | 113 89 15 10 9 | 3.64 72 7.55 3.71 4.12 | 174 134 49 88 52 | 5.3 4.7 2.2 2.5 0.47 | 3.81 13.64 2.3 1.16 0.28 | 36.08 16.83 2.47 7.55 0.54 | 52.13 26.9 4.55 15.96 0.91 | 4.38 2.23 0.376 1.58 0.11 | 11.28 6.3 1.29 5.37 0.44 | 2.48 1.51 0.383 1.22 0.07 | 0.22 0.18 0.07 0.11 0.03 | 2.66 1.5 0.7 1.3 0.21 |
| | 12 12 16 34 22 24 | 4.7 2.9 2.0 0.89 <0.70 1.25 | 3.2 3.3 1.0 1.1 0.15 1.01 | 19.2 18.5 4.3 10.0 0.81 6.5 | 7.7 1.9 3.4 0.11 5.2 6.1 | 113 89 15 10 9 27 | 3.64 72 7.55 3.71 4.12 3.96 | 174 134 49 88 52 62 23 | 5.3 4.7 2.2 2.5 0.47 1.4 | 3.81 13.64 2.3 1.16 0.28 4.13 2.64 | 36.08 16.83 2.47 7.55 0.54 5.63 | 52.13 26.9 4.55 15.96 0.91 9.42 | 4.38 2.23 0.376 1.58 0.11 0.803 | 11.28 6.3 1.29 5.37 0.44 1.77 | 2.48 1.51 0.383 1.22 0.07 0.397 | 0.22 0.18 0.07 0.11 0.03 0.06 | 2.66 1.5 0.7 1.3 0.21 0.63 |
| | 12 12 16 34 22 24 12 16 | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2.1 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 | 113 89 15 10 9 27 34 27 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 | 174 134 49 88 52 62 23 48 | 5.3 4.7 2.2 2.5 0.47 1.4 0.64 1.3 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 0.84 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 | 52.13 26.9 4.55 15.96 0.91 9.42 8.12 5.29 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.69 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.337 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 | 2.66 1.5 0.7 1.3 0.21 0.63 1.53 0.47 |
| | 12 12 16 34 22 24 12 16 18 | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2.1 2 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 | 113 89 15 10 9 27 34 27 40 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 | 174 134 49 88 52 62 23 48 79 | 5.3 4.7 2.2 2.5 0.47 1.4 0.64 1.3 2 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 0.84 4 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 | 52.13 26.9 4.55 15.96 0.91 9.42 8.12 5.29 15 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.69 3.8 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.337 0.9 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 0.1 | 2.66 1.5 0.7 1.3 0.21 0.63 1.53 0.47 1.1 |
| | 12 16 34 22 24 12 16 18 7.7 | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2.1 2 1.3 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 | 113 89 15 10 9 27 34 27 40 39 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 | 174 134 49 88 52 62 23 48 79 51 | 5.3 4.7 2.2 2.5 0.47 1.4 0.64 1.3 2 2 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 0.84 4 4 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 12 | 52.13 26.9 4.55 15.96 0.91 9.42 8.12 5.29 15 17 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 1 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.69 3.8 3.6 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.337 0.9 0.8 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 0.1 0.1 | 2.66 1.5 0.7 1.3 0.21 0.63 1.53 0.47 1.1 0.8 |
| | 12 12 16 34 22 24 12 16 18 7.7 34 | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2.1 2 1.3 4.7 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 3.3 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 | 113 89 15 10 9 27 34 27 40 39 113 218 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 | 174 134 49 88 52 62 23 48 79 51 174 | 5.3 4.7 2.2 2.5 0.47 1.4 0.64 1.3 2 2 5 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 0.84 4 4 4 14 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 12 36 | 52.13 26.9 4.55 15.96 0.91 9.42 8.12 5.29 15 17 52 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 1 4 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.69 3.8 3.6 11.3 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.337 0.9 0.8 2.5 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 0.1 0.1 0.2 | 2.66 1.5 0.7 1.3 0.21 0.63 1.53 0.47 1.1 0.8 2.7 |
| _ | 12 12 16 34 22 24 12 16 18 7.7 34 11.61 124 | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2.1 2 1.3 4.7 0.89 <0.70 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.15 0.81 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 0.11 60 | 113 89 15 10 9 27 34 27 40 39 113 9.18 7 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 | 174 134 49 88 52 62 23 48 79 51 174 23.40 30 | 5.3 4.7 2.2 2.5 0.47 1.4 0.64 1.3 2 5 0.47 6.47 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 0.84 4 4 14 0.28 <0.49 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 12 36 0.54 0.32 | 52.13 26.9 4.55 15.96 0.91 9.42 8.12 5.29 15 17 52 0.91 0.89 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 1 4 0.11 0.10 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.69 3.8 3.6 11.3 0.44 0.21 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.337 0.9 0.8 2.5 0.07 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 0.1 0.1 0.2 0.03 | 2.66 1.5 0.7 1.3 0.21 0.63 1.53 0.47 1.1 0.8 2.7 0.21 0.41 |
| _ | 12 12 16 34 22 24 12 16 18 7.7 34 11.61 124 116 | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2.1 2 1.3 4.7 0.89 <0.70 <0.56 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.15 0.81 0.52 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 11 33 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 0.11 60 160 | 113 89 15 10 9 27 34 27 40 39 113 9.18 7 68 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.4 | 174 134 49 88 52 62 23 48 79 51 174 23.40 30 23 | 5.3 4.7 2.2 2.5 0.47 1.4 0.64 1.3 2 5 0.47 5 0.47 <0.35 <0.34 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 0.84 4 4 14 0.28 <0.49 <0.27 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 12 36 0.54 0.32 0.28 | 52.13 26.9 4.55 15.96 0.91 9.42 8.12 5.29 15 17 52 0.91 0.89 1.6 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 1 4 0.11 0.10 0.25 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.69 3.8 3.6 11.3 0.44 0.21 1.0 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.337 0.9 0.8 2.5 0.07 0.22 0.36 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 0.1 0.2 0.03 0.03 0.02 | 2.66 1.5 0.7 1.3 0.21 0.63 1.53 0.47 1.1 0.8 2.7 0.21 0.41 1.1 |
| - | 12 12 16 34 22 24 12 16 18 7.7 34 11.61 124 116 100 | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2.1 2 1.3 4.7 0.89 <0.70 <0.56 2.1 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.15 0.81 0.52 24 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 11 33 712 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 0.11 60 160 638 | 113 89 15 10 9 27 34 27 40 39 113 9.18 7 68 1013 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.4 1.7 | 174 134 49 88 52 62 23 48 79 51 174 23.40 30 23 25 | 5.3 4.7 2.2 2.5 0.47 1.4 0.64 1.3 2 2 5 0.47 <0.35 <0.34 <0.32 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 4 4 4 4 14 0.28 <0.49 <0.27 0.49 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 12 36 0.54 0.32 0.28 113.2 | 52.13 26.9 4.55 15.96 0.91 9.42 8.12 5.29 15 17 52 0.91 0.89 1.6 371 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 4 0.11 0.10 0.25 51 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.69 3.8 3.6 11.3 0.44 0.21 1.0 219 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.337 0.79 0.8 2.5 0.07 0.22 0.36 93 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 0.1 0.1 0.2 0.03 0.02 4.1 | 2.66 1.5 0.7 1.3 0.21 0.63 1.53 0.47 1.1 0.8 2.7 0.21 0.41 1.1 1.1 |
| - | 12 12 16 34 22 24 12 16 18 7.7 34 11.61 124 116 100 100 | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2.1 2 1.3 4.7 0.89 <0.70 <0.56 2.1 <0.53 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.15 0.81 0.52 24 5.1 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 11 33 712 130 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 0.11 60 160 638 115 5 (4) | 113 89 15 10 9 27 34 27 40 39 113 9.18 7 68 1013 448 447 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.4 1.7 1.2 | 174 134 49 88 52 62 23 48 79 51 174 23.40 30 23 25 25 25 25 | 5.3 4.7 2.2 0.47 1.4 0.64 1.3 2 5 0.47 <0.35 <0.34 <0.34 <0.42 0.44 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 0.84 4 4 14 0.28 <0.49 <0.27 0.49 0.49 0.49 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 12 36 0.54 0.32 0.28 113.2 20 | 52.13 26.9 4.55 15.96 0.91 9.42 8.12 5.29 15 17 52 0.91 0.89 1.6 371 72.3 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 1 4 0.11 0.10 0.25 51 10 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.69 3.8 3.6 11.3 0.44 0.21 1.0 219 40 0. 21 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.337 0.9 0.8 2.5 0.07 0.22 0.36 93 15 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 0.1 0.2 0.03 0.02 4.1 0.68 | 2.66 1.5 0.7 1.3 0.21 0.63 1.53 0.47 1.1 0.8 2.7 0.21 0.41 1.1 116 18 6 4 |
| - | 12 12 16 34 22 24 12 16 18 7.7 34 11.61 124 116 100 100 106 | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2.1 2 1.3 4.7 0.89 <0.70 <0.56 2.1 <0.53 1.1 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.15 0.81 0.52 24 5.1 3.3 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 11 33 712 130 252 46 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 0.11 60 160 638 115 564 179 | 113 89 15 10 9 27 40 39 113 9.18 7 68 1013 448 1013 448 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.4 1.7 1.2 0.43 1.0 | 174 134 49 88 52 62 23 48 79 51 174 23.40 23 25 25 25 23 33 | 5.3 4.7 2.2 0.47 1.4 0.64 1.3 2 5 0.47 <0.35 <0.34 <0.34 <0.34 <0.34 <0.34 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 0.84 4 4 14 0.28 <0.49 <0.27 0.49 0.43 0.23 0.57 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 12 36 0.54 0.32 0.28 113.2 20 3.4 18 | 52.13 26.9 4.55 15.96 0.91 9.42 8.12 5.29 15 17 52 0.91 0.89 1.6 371 72.3 11 6.0 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 4 0.11 0.10 0.25 51 10 1.6 0.92 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.69 3.8 3.6 11.3 0.44 0.21 1.0 219 40 7.6 3.0 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.337 0.9 0.8 2.5 0.07 0.22 0.36 93 15 3.64 1.24 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 0.1 0.2 0.03 0.02 4.1 0.68 0.07 | 2.66 1.5 0.7 1.3 0.21 0.63 1.53 0.47 1.1 0.8 2.7 0.21 0.47 1.1 0.8 2.7 0.21 0.47 1.1 0.8 2.7 0.21 0.47 1.1 0.63 1.1 0.63 1.1 1.1 0.8 2.7 0.21 0.63 1.1 0.63 1.1 0.63 1.1 0.8 2.7 0.21 0.47 1.1 0.8 2.7 0.21 0.1 1.1 0.21 0.21 0.21 0.47 1.1 0.21 0.21 0.21 0.47 1.1 0.21 0.21 0.21 0.1 1.1 0.21 0.21 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 |
| - | 12 12 16 34 22 24 12 16 18 7.7 34 11.61 100 100 100 108 84 | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2 1.3 4.7 0.89 <0.70 <0.50 2.1 <0.53 1.1 1.0 4.2 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.15 0.81 0.81 0.52 24 5.1 3.3 3.9 10 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 11 33 712 130 252 46 773 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 0.11 19 38 112 0.11 10 60 638 115 564 175 564 175 576 187 197 197 197 197 197 197 197 19 | 113 89 15 10 9 27 34 27 40 39 113 9.18 7 68 1013 448 117 407 329 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.4 1.7 1.2 0.43 1.0 2.2 | 174 134 49 88 52 62 23 48 79 51 174 23.40 30 23 25 25 23 33 49 | 5.3 4.7 2.2 0.47 1.4 0.64 1.3 2 2 5 0.47 <0.34 <0.42 0.44 <0.38 0.53 (0.40 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 0.84 4 4 14 0.28 <0.49 <0.27 0.49 <0.27 0.49 0.23 0.28 0.55 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 12 36 0.54 0.28 113.2 20 3.4 1.3 | 52.13 26.9 4.55 15.96 0.91 9.42 8.12 5.29 15 17 52 0.91 0.91 15 17 52 0.91 16 371 72.3 11 6.0 7.6 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 4 0.11 0.10 0.25 51 10 1.6 0.92 1.2 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.69 3.8 3.6 11.3 0.44 0.21 40 7.6 3.0 6.6 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.337 0.9 0.8 2.5 0.07 0.22 0.36 93 15 3.64 1.24 5.96 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.1 0.1 0.1 0.2 0.03 0.02 4.1 0.68 0.18 0.02 4.1 0.68 0.18 | 2.66 1.5 0.7 1.3 0.21 0.63 1.53 0.47 1.1 0.8 2.7 0.21 0.47 1.1 0.8 2.7 0.21 1.3 0.47 1.1 1.3 0.47 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 |
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| - | $\begin{array}{c} 12\\ 12\\ 16\\ 34\\ 22\\ 24\\ 12\\ 16\\ 18\\ \textbf{7.7}\\ \textbf{34}\\ \textbf{11.61}\\ 124\\ 116\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100$ | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2 1.3 4.7 0.89 <0.70 <0.56 2.1 <0.53 1.1 1.0 4.2 <0.52 <0.49 0.61 <0.70 <0.54 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.15 0.81 0.52 24 5.1 3.3 3.9 10 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 0.24 0.24 0.24 0.24 0.24 0.24 0.24 0.24 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 11 34 0.81 11 33 712 130 252 46 773 20 12 60 3.0 3.1 36 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 0.11 60 160 638 115 564 179 3997 105 53 53 5.5 6.7 41 | 113 89 15 10 9 27 34 27 40 39 113 9.18 7 68 1013 448 117 407 329 32 21 36 9.4 36 584 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.7 1.2 0.43 1.0 2.2 1.1 0.79 1.1 1.2 0.77 1.1 | 174 134 49 88 52 62 23 48 79 51 174 23.40 30 23 25 25 23 33 49 36 37 50 27 36 | 5.3 4.7 2.2 0.47 1.4 0.64 1.3 2 5 0.47 <0.35 <0.34 <0.42 0.44 <0.42 0.44 <0.38 0.53 <0.40 <0.27 <0.53 <0.41 <0.53 <0.53 <0.41 <0.53 <0.41 <0.53 <0.42 <0.53 <0.41 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.53 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.55 <0.5 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 0.4 4 4 14 0.28 <0.49 <0.27 0.49 <0.27 0.49 0.28 0.28 0.28 0.28 0.29 <0.27 0.49 0.28 0.28 0.28 0.28 0.29 <0.27 0.49 0.23 0.28 0.28 0.28 0.28 0.28 0.29 0.23 0.28 0.200 0.43 <0.000 <0.000 <0.000 0.55 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 12 36 0.54 0.54 0.54 0.54 12 36 0.54 12 36 0.54 13.2 20 3.4 1.3 1.1 1.7 11 0.49 2.5 5.5 | 52.13 26.9 4.55 15.96 0.91 9.42 8.12 5.29 15 17 52 0.91 0.89 1.6 371 72.3 11 6.0 7.6 5.1 1.5 33 4.6 7.4 21 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 4 0.10 0.25 51 10 1.6 0.92 1.2 0.06 0.17 4.7 0.30 0.63 2.8 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.67 3.8 3.6 11.3 0.44 0.21 1.0 2.19 40 7.6 3.0 6.6 0.59 0.48 23 0.44 2.1 10 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.397 0.74 0.397 0.74 0.39 0.8 2.5 0.07 0.22 0.36 93 15 3.64 1.24 5.96 0.21 0.39 8.79 0.30 0.30 0.39 8.79 0.30 0.63 4.31 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 0.1 0.1 0.2 0.03 0.02 4.1 0.68 0.18 0.02 4.1 0.68 0.18 0.02 0.43 0.00 0.02 0.43 0.01 0.01 0.21 | 2.66 1.5 0.7 1.3 0.21 0.47 1.1 0.8 2.7 0.21 0.41 1.1 116 18 6.4 1.9 18 0.78 0.76 12 0.30 1.1 5.9 |
| _ | $\begin{array}{c} 12\\ 12\\ 16\\ 34\\ 22\\ 24\\ 12\\ 16\\ 18\\ \textbf{7.7}\\ \textbf{34}\\ \textbf{11.61}\\ 124\\ 116\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100$ | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2 1.3 4.7 0.89 <0.70 <0.56 2.1 <0.53 1.1 1.0 4.2 <0.52 <0.49 0.61 <0.70 <0.54 0.54 1.6 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.15 0.81 0.52 24 5.1 3.3 3.9 10 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 11 33 712 130 252 46 773 20 12 60 3.0 12 60 3.0 11 36 11 36 11 37 12 13 12 13 12 13 12 13 12 13 12 13 12 13 11 33 712 130 252 46 11 30 12 10 12 10 12 10 12 10 12 12 10 11 13 11 13 11 13 11 13 11 13 12 11 13 12 11 13 12 11 13 12 11 13 12 11 13 12 11 13 12 11 13 12 11 13 12 11 13 12 11 13 12 13 11 13 12 12 10 12 12 13 13 11 13 12 12 13 12 13 13 13 13 13 13 13 13 13 13 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 0.11 60 160 638 115 564 179 3997 105 53 53 5.5 6.7 41 94 | 113 89 15 10 9 27 34 27 40 39 113 9.18 7 68 1013 448 117 407 329 32 21 36 9.4 36 584 178 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.7 1.2 0.43 1.0 2.2 1.1 0.79 1.1 1.2 0.77 1.1 | 174 134 49 88 52 62 23 48 79 51 174 23.40 30 23 25 25 23 33 49 36 37 50 27 36 28 | 5.3 4.7 2.2 0.47 1.4 0.64 1.3 2 5 0.47 0.47 0.47 0.47 0.44 0.44 0.44 0.44 0.44 0.44 0.53 0.40 0.53 0.41 0.53 0.41 0.53 0.41 0.53 0.41 0.53 0.41 0.53 0.41 0.53 0.41 0.53 0.42 0.53 0.42 0.53 0.41 0.53 0.42 0.53 0.42 0.53 0.42 0.53 0.42 0.53 0.43 0.53 0.441 0.53 0.451 0.53 0.451 0.53 0.451 0.53 0.451 0.53 0.451 0.53 0.411 0.53 0.411 0.53 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.53 0.411 0.59 0.53 0.41 0.59 0.53 0.41 0.59 0.53 0.41 0.59 0.53 0.41 0.59 0.53 0.41 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.51 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 0.4 4 4 14 0.28 4 4 14 0.28 0.49 0.28 0.28 0.29 0.27 0.49 0.28 0.28 0.28 0.29 0.23 0.49 0.28 0.200 0.49 0.28 0.28 0.200 0.49 0.28 0.28 0.28 0.29 0.23 0.200 0.200 0.23 0.000 0.000 0.000 0.52 0.21 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 12 0.32 0.28 113.2 20 3.4 1.8 1.3 1.1 1.7 11 0.49 2.5 5.5 2.2 | 52.13 26.9 4.55 15.96 0.91 9.42 8.12 5.29 15 17 52 0.91 0.89 1.6 371 72.3 11 6.0 7.6 5.1 1.5 33 4.6 7.4 21 4.2 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 4 0.10 0.25 51 10 1.6 0.92 1.2 0.06 0.17 4.7 0.300 0.63 2.8 0.61 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.67 3.8 3.6 11.3 0.44 0.21 1.0 2.19 40 7.6 3.0 6.6 0.59 0.48 23 0.54 2.1 10 4.0 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.397 0.74 0.397 0.74 0.307 0.74 0.307 0.74 0.307 0.74 0.307 0.74 0.307 0.22 0.36 93 15 3.64 1.24 5.96 0.21 0.39 8.79 0.303 4.31 2.11 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 0.1 0.2 0.03 0.02 4.1 0.68 0.18 0.07 0.36 0.02 0.43 0.02 0.43 0.01 0.01 0.21 0.03 | 2.66 1.5 0.7 1.3 0.21 0.47 1.1 0.8 2.7 0.21 0.41 1.1 116 18 6.4 1.9 18 6.4 1.9 18 0.76 12 0.30 1.1 5.9 2.7 |
| - | $\begin{array}{c} 12\\ 12\\ 16\\ 34\\ 22\\ 24\\ 12\\ 16\\ 18\\ \textbf{7.7}\\ \textbf{34}\\ \textbf{11.61}\\ 124\\ 116\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100$ | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2 1.3 4.7 0.89 <0.70 <0.56 2.1 <0.53 1.1 1.0 4.2 <0.52 <0.49 0.61 <0.70 <0.54 1.6 1.5 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.15 0.81 0.52 24 5.1 3.3 3.9 10 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 0.24 0.24 0.24 0.24 0.24 0.24 0.24 0.24 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 11 34 0.81 11 33 712 130 252 46 773 20 12 60 3.0 12 60 3.0 12 60 3.0 12 60 3.0 12 60 3.0 12 60 3.0 12 60 3.0 12 60 12 60 13 11 13 12 13 12 13 12 13 12 13 12 13 12 13 12 13 12 13 12 13 12 13 12 13 12 13 12 13 12 13 12 13 12 13 12 13 12 13 12 13 252 46 773 20 12 60 3.0 12 60 3.0 12 60 3.0 12 60 3.0 12 60 3.0 12 60 3.0 12 60 3.0 12 60 3.0 12 60 3.0 12 60 3.0 12 60 3.0 13 10 12 60 3.0 10 3.0 12 60 3.0 12 60 3.0 13 10 12 60 3.0 10 10 10 10 10 10 10 10 10 1 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 0.11 60 160 638 115 564 179 3997 105 53 53 53 5.5 6.7 41 94 75 | 113 89 15 10 9 27 34 27 40 39 113 9.18 7 68 1013 448 117 407 329 32 21 36 9.4 36 584 178 69 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.4 1.7 1.2 0.43 1.0 2.2 1.1 0.79 1.1 1.2 0.77 1.1 1.7 1.5 | 174 134 49 88 52 62 23 48 79 51 174 23,40 30 23 25 25 25 23 33 49 39 36 37 50 27 36 28 35 | 5.3 4.7 2.2 0.47 1.4 0.64 1.3 2 5 0.47 <0.35 <0.34 <0.42 0.44 <0.38 0.42 0.44 <0.42 0.44 <0.38 <0.42 <0.53 <0.41 <0.53 <0.41 <0.53 <0.41 <0.53 <0.41 <0.53 <0.41 <0.53 <0.42 <0.53 <0.41 <0.53 <0.41 <0.53 <0.41 <0.53 <0.41 <0.53 <0.42 <0.53 <0.41 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.41 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.41 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.42 <0.53 <0.40 <0.53 <0.40 <0.58 <0.40 <0.58 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 <0.40 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 4 4 4 4 4 6.28 4 4 4 2.3 4 0.28 0.28 0.27 0.49 0.49 0.28 0.27 0.49 0.28 0.55 <0.000 <0.000 <0.000 <0.000 <0.000 <0.21 0.52 0.52 0.52 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 12 0.32 0.28 113.2 20 3.4 1.8 1.3 1.1 1.7 11 0.49 2.5 5.5 5.5 2.2 20 | 52.13 26.9 4.55 15.96 0.91 9.42 8.12 5.29 15 17 52 0.89 1.6 371 72.3 11 6.0 7.6 5.1 1.5 33 4.6 7.4 21 4.2 52 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 4 0.10 0.25 51 10 1.6 0.92 1.2 0.06 0.17 4.7 0.300 0.63 2.8 0.61 6.7 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.67 3.8 3.6 11.3 0.44 0.21 1.0 2.19 40 7.6 3.0 6.6 0.59 0.48 23 0.54 2.1 10 4.0 28 28 28 28 28 28 28 28 28 28 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.337 0.9 0.8 2.5 0.07 0.22 0.36 93 15 3.64 1.24 5.96 0.21 0.39 8.79 0.30 0.63 4.31 2.11 12.30 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 0.1 0.05 0.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 0.36 0.07 0.36 0.02 0.43 0.01 0.02 0.43 0.01 0.01 0.21 0.03 0.02 0.43 0.02 0.43 0.02 0.43 0.02 0.43 0.02 0.43 0.02 0.43 0.05 0.55 0.55 0.55 0.55 0.55 0.55 0.5 | 2.66 1.5 0.7 1.3 0.21 0.47 1.1 0.8 2.7 0.21 0.47 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1. |
| - | 12 12 16 34 22 24 12 16 18 7.7 34 11.61 124 116 100 100 100 100 100 100 100 100 100 | $\begin{array}{c} 4.7\\ 2.9\\ 2.0\\ 0.89\\ <0.70\\ 1.25\\ 1.1\\ 2\\ 1.3\\ 4.7\\ 0.89\\ <0.70\\ <0.56\\ 2.1\\ <0.53\\ 1.1\\ 1.0\\ <0.53\\ 1.1\\ 1.0\\ <0.52\\ <0.49\\ 0.61\\ <0.70\\ <0.54\\ 1.6\\ 1.5\\ 1.4\\ 0.77\end{array}$ | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.15 0.81 0.52 24 5.1 3.3 3.9 10 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.43 0.24 0.24 5.1 0.5 5.1 0.5 5.1 0.5 5.1 0.5 5.1 0.5 5.1 0.5 5.1 0.5 5.1 0.5 5.1 0.5 5.1 0.5 5.1 0.5 5.1 0.5 5.1 0.5 5.1 0.5 5.2 0.5 5.5 0.5 5.5 0.5 5.5 0.5 5.5 0.5 5.5 0.5 5.5 0.5 5.5 0.5 5.5 0.5 5.5 0.5 5.5 0.5 5.5 0.5 5.5 0.5 0 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 11 34 0.81 11 33 712 130 252 46 773 20 12 60 3.0 12 60 3.0 12 60 3.1 36 110 145 200 222 232 24 24 252 20 3.1 36 110 252 20 3.1 20 20 20 20 20 20 20 20 20 20 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 0.11 60 160 638 115 564 179 3997 105 53 53 5.5 6.7 41 94 75 104 94 75 104 94 75 104 105 105 105 105 105 105 105 105 | 113 89 15 10 9 27 34 27 40 39 113 9.18 7 68 1013 448 117 407 329 32 21 36 9.4 36 584 178 69 380 106 106 106 107 107 108 108 108 109 108 109 108 109 109 109 100 100 100 100 100 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.7 1.2 0.43 1.0 2.2 1.1 0.79 1.1 1.2 0.77 1.1 1.7 1.5 0.92 6.4 | 174 134 49 88 52 62 23 48 79 51 174 23,40 30 23 25 25 23 33 49 39 36 37 50 27 36 28 35 41 24 | 5.3 4.7 2.2 2.5 0.47 1.4 0.64 1.3 2 5 0.47 0.47 0.47 0.47 0.44 0.42 0.44 0.42 0.44 0.42 0.44 0.53 0.41 0.53 0.47 0.53 0.41 0.53 0.41 0.53 0.42 0.53 0.41 0.53 0.41 0.64 0.53 0.42 0.53 0.41 0.64 0.53 0.42 0.53 0.41 0.64 0.53 0.42 0.53 0.41 0.64 0.53 0.42 0.53 0.41 0.53 0.42 0.53 0.41 0.53 0.41 0.53 0.41 0.53 0.41 0.53 0.42 0.53 0.41 0.53 0.41 0.53 0.42 0.53 0.42 0.53 0.44 0.53 0.44 0.53 0.45 0.53 0.45 0.53 0.45 0.53 0.46 0.53 0.46 0.53 0.47 0.53 0.46 0.53 0.47 0.53 0.46 0.53 0.47 0.53 0.47 0.53 0.48 0.53 0.47 0.53 0.48 0.53 0.47 0.53 0.42 0.53 0.44 0.53 0.44 0.53 0.42 0.53 0.44 0.53 0.44 0.53 0.44 0.53 0.44 0.53 0.45 0.53 0.46 0.53 0.47 0.53 0.48 0.54 0.53 0.42 0.53 0.42 0.53 0.44 0.58 0.42 0.53 0.42 0.53 0.42 0.53 0.42 0.53 0.42 0.54 0.55 0.54 0.55 0.56 0.55 0.56 0.56 0.56 0.57 0.98 0.57 0.56 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 4 4 4 4 4 6.28 4 4 4 6.28 4 4 6.28 6.200 6.22 0.21 0.52 2.00 6.52 2.00 6.52 2.00 6.52 2.00 6.52 2.00 6.55 7.55 7.55 7.55 7.55 7.55 7.55 7.55 7.55 7.52 7.55 7.55 7.55 7.52 7.55 7 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 12 0.28 113.2 20 3.4 1.8 1.3 1.1 1.7 11 0.49 2.5 5.5 5.5 2.2 20 2.1 41 | 52.13 26.9 4.55 0.91 9.42 8.12 5.29 15 17 52 0.89 1.6 371 72.3 11 6.0 7.6 5.1 1.5 33 4.6 7.4 21 4.2 52 52 52 52 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 4 0.10 0.25 51 10 1.6 0.92 1.2 0.06 0.17 4.7 0.300 0.63 2.8 0.61 6.7 0.70 20 | 11.28 6.3 1.29 5.37 0.44 1.77 2.4 1.67 3.8 3.6 11.3 0.44 0.21 1.0 2.19 40 7.6 3.0 6.6 0.59 0.48 2.3 0.54 2.1 10 4.0 28 2.7 74 | 2.48 1.51 0.383 1.22 0.07 0.397 0.74 0.337 0.9 0.8 2.5 0.07 0.22 0.36 93 1.5 3.64 1.24 5.96 0.21 0.39 8.79 0.30 0.30 0.30 4.31 2.11 12.30 0.84 2.4 2.4 2.4 2.4 2.4 2.4 2.4 2. | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 0.1 0.05 0.1 0.03 0.02 4.1 0.03 0.02 4.1 0.68 0.18 0.07 0.36 0.02 0.43 0.01 0.02 0.43 0.01 0.21 0.03 0.02 0.43 0.01 0.14 0.15 0.16 0.12 0.10 0.11 0.15 0.11 0.15 0.11 0.11 0.11 | 2.66 1.5 0.7 1.3 0.21 0.47 1.1 0.8 2.7 0.21 0.47 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1. |
| _ | $\begin{array}{c} 12\\ 12\\ 16\\ 34\\ 22\\ 24\\ 12\\ 16\\ \textbf{18}\\ \textbf{7.7}\\ \textbf{34}\\ \textbf{11.61}\\ 124\\ 116\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100\\ 100$ | $\begin{array}{c} 4.7\\ 2.9\\ 0.89\\ <0.70\\ 1.25\\ 1.1\\ 2.1\\ 2\\ 1.3\\ 4.7\\ 0.89\\ <0.70\\ <0.56\\ 2.1\\ <0.53\\ 1.1\\ 1.0\\ 4.2\\ <0.53\\ 1.1\\ 1.0\\ 4.2\\ <0.52\\ <0.49\\ 0.61\\ <0.70\\ <0.54\\ 0.54\\ 1.6\\ 1.5\\ 1.4\\ 0.77\\ 0.92\end{array}$ | 3.2 3.3 1.0 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.81 0.52 24 5.1 3.3 3.9 10 0.43 0.24 5.1 3.3 0.24 5.1 3.3 0.24 5.1 3.3 0.24 5.2 0.48 8.5 8.5 8.5 8.7 0.31 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 11 33 712 130 252 46 773 20 12 60 3.0 3.1 10 12 60 3.0 12 60 3.1 12 12 12 12 12 12 12 12 12 1 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 0.11 60 160 638 115 564 179 3997 105 53 5.5 6.7 41 94 75 107 94 33 | 113 89 15 10 9 27 40 39 113 9.18 7 68 1013 448 107 329 32 21 36 9.4 36 9.4 36 584 178 69 380 103 105 10 10 10 10 10 10 10 10 10 10 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.4 1.7 1.2 0.43 1.0 2.2 1.1 0.79 1.1 1.2 0.77 1.1 1.7 1.5 0.92 6.4 0.30 | 174 134 49 88 52 62 23 48 79 51 174 23.40 30 23 25 25 23 33 49 30 37 50 27 36 37 50 27 36 28 35 41 34 22 | 5.3 4.7 2.2 2.5 0.47 1.4 0.64 1.3 2 2 5 0.47 <0.35 <0.35 <0.34 <0.35 <0.34 <0.42 0.44 <0.38 <0.33 <0.40 <0.27 <0.53 <0.40 <0.27 <0.53 <0.40 <0.27 <0.53 <0.40 <0.27 <0.53 <0.40 <0.27 <0.53 <0.40 <0.27 <0.53 <0.40 <0.27 <0.53 <0.40 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 | 3.81 13.64 2.3 1.16 0.28 4.13 3.64 4 4 4 4 4 4 0.28 <0.49 <0.27 0.49 <0.27 0.49 <0.27 0.49 <0.27 0.49 <0.27 0.49 0.28 0.55 <<0.00 <0.00 <0.00 <0.00 <0.00 <0.00 <0.00 <0.00 <0.22 0.55 <0.00 0.55 <0.00 0.52 0.21 0.52 0.27 0.55 <0.00 0.52 0.21 0.52 0.27 0.55 <0.00 0.52 0.21 0.52 0.21 0.52 0.27 0.55 <0.00 0.55 0.21 0.00 0.55 0.21 0.55 0.21 0.55 0.21 0.55 0.21 0.55 0.22 0.55 0.21 0.55 0.00 0.55 0.21 0.55 0.22 0.55 0.21 0.55 0.22 0.22 0.22 0.22 0.22 0.23 0.22 0.23 0.22 0.23 0.23 | 36.08 16.83 2.47 7.55 0.54 5.63 4.36 2.65 10 12 36 0.32 0.28 113.2 20 3.4 1.3 1.1 1.7 11 0.49 2.5 5.5 2.2 20 2.1 41 5 | 52.13 26.9 4.55 0.91 9.42 8.12 5.29 15 17 52 0.89 1.6 371 72.3 11 6.0 7.6 5.1 1.5 33 4.6 7.4 21 4.2 52 5.9 136 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 1 4 0.10 0.25 51 10 0.63 1.2 0.06 0.17 4.7 0.30 0.63 2.8 0.61 6.7 0.70 20 0.23 | $\begin{array}{c} 11.28\\ 6.3\\ 1.29\\ 5.37\\ 0.44\\ 1.77\\ 2.4\\ 1.69\\ \textbf{3.8}\\ \textbf{3.6}\\ \textbf{11.3}\\ \textbf{0.44}\\ 0.21\\ 1.0\\ 219\\ 40\\ 7.6\\ 3.0\\ 6.6\\ 0.59\\ 0.48\\ 23\\ 0.54\\ 2.1\\ 10\\ 0.54\\ 2.1\\ 10\\ 4.0\\ 28\\ 2.7\\ 74\\ 0.73\\ \end{array}$ | 2.48 1.51 0.383 1.22 0.07 0.397 0.397 0.307 0.9 0.8 2.5 0.07 0.22 0.36 93 15 3.64 1.24 5.96 0.21 0.39 8.79 0.30 0.63 4.31 2.11 12.30 0.84 34 0.25 | 0.22 0.18 0.07 0.11 0.03 0.06 0.11 0.05 0.1 0.05 0.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 0.43 0.01 0.01 0.01 0.01 0.01 0.01 0.02 0.03 0.03 | 2.66 1.5 0.7 1.3 0.21 0.63 1.53 0.47 1.1 0.8 2.7 0.21 0.41 1.1 116 18 6.4 1.9 18 0.76 12 0.30 1.1 5.9 2.7 16 1.2 46 0,71 |
| - | 12 12 16 34 22 24 12 16 18 7.7 34 11.61 124 116 100 100 106 108 84 120 142 128 155 118 60 96 66 91 114 100 107 | 4.7 2.9 0.89 <0.70 1.25 1.1 2.1 3 4.7 0.89 <0.70 <0.56 2.1 <0.53 1.1 4.2 <0.52 <0.49 0.61 <0.70 <0.54 0.61 <0.70 <0.54 1.5 1.4 0.77 0.92 <1.4 | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.15 0.81 0.52 24 5.1 3.3 0.48 0.43 0.43 0.43 0.43 0.48 8.9 3.4 49 8.5 8.7 0.31 7.2 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 11 33 712 130 252 46 773 20 12 60 3.0 3.1 36 110 145 20 222 14 145 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 60 160 638 115 564 179 3997 105 53 5.5 6.7 41 94 75 107 94 33 355 | 113 89 15 10 9 27 40 39 113 9.1 10 9 27 40 39 113 448 1013 448 1013 448 107 329 32 21 36 9.4 36 584 178 69 380 106 13 214 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.4 1.7 1.2 0.43 1.0 2.2 1.1 0.79 1.1 1.2 0.77 1.1 1.2 0.77 1.1 1.2 0.77 1.1 1.2 0.79 1.1 1.2 0.71 4.12 3.05 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5. | 174 134 49 88 52 62 23 48 79 51 174 23.40 30 23 25 25 23 33 49 30 23 33 49 39 36 37 50 27 36 28 35 41 34 22 23 33 | 5.3 4.7 2.2 2.5 0.47 1.4 0.64 1.3 2 2 5 0.47 (0.35 <0.34 <0.35 <0.34 <0.42 0.44 <0.38 0.53 <0.40 <0.27 <0.53 <0.40 <0.27 <0.53 <0.41 <0.38 0.53 <0.40 <0.27 <0.53 <0.40 <0.55 <0.40 <0.35 <0.34 <0.35 <0.40 <0.35 <0.34 <0.42 0.40 <0.55 <0.40 <0.35 <0.40 <0.35 <0.40 <0.35 <0.40 <0.35 <0.34 <0.42 0.40 <0.55 <0.40 <0.55 <0.40 <0.35 <0.40 <0.35 <0.40 <0.35 <0.40 <0.55 <0.40 <0.55 <0.40 <0.55 <0.40 <0.55 <0.40 <0.55 <0.40 <0.55 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 <0.57 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0.03 0.02 0.43 0.01 0.01 0.02 0.43 0.01 0.01 0.02 0.43 0.01 0.03 0.02 0.43 0.01 0.03 0.02 0.43 0.01 0.03 0.02 0.43 0.01 0.03 0.02 0.14 0.03 0.03 0.02 0.14 0.03 0.03 0.02 0.14 0.03 0.03 0.02 4.1 0.03 0.03 0.02 4.1 0.03 0.03 0.02 4.1 0.03 0.03 0.02 4.1 0.03 0.03 0.02 4.1 0.03 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 0.03 0.03 | 2.66 1.5 0.7 1.3 0.21 0.63 1.53 0.47 1.1 0.8 2.7 0.41 1.1 116 18 0.41 1.1 116 18 0.41 1.9 18 0.76 12 0.30 1.1 5.9 2.7 1.6 1.2 4.6 0.71 1.4 1.2 4.6 0.71 1.4 1.2 1.6 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.1 1.6 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.2 1.2 1.2 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.2 4.6 0.71 1.4 1.1 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.1 1.2 1.1 1.1 1.2 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 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| - | 12 12 16 34 22 24 12 16 18 7.7 34 11.6 100 100 106 108 84 120 142 128 155 118 60 96 66 91 114 100 107 24 | 4.7 2.9 2.0 0.89 <0.70 1.25 1.1 2 1.3 4.7 0.89 <0.70 <0.56 2.1 <0.53 1.1 1.0 4.2 <0.52 <0.49 0.61 <0.70 <0.54 0.54 1.5 1.4 0.77 0.92 1.4 1.0 | 3.2 3.3 1.0 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.15 0.81 0.52 24 5.1 3.3 0.48 0.43 0.43 0.43 0.43 0.43 0.43 0.48 8.9 3.4 49 8.5 8.7 0.31 0.42 12 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 13 712 130 252 46 773 20 12 60 3.0 3.1 36 110 145 20 222 14 145 230 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 0.11 60 160 638 115 564 179 3997 105 53 5.5 6.7 41 94 75 107 94 33 355 926 | 113 89 15 10 9 27 40 39 113 9.1 8 1013 448 1013 448 1013 448 107 329 32 21 36 9.4 36 584 178 69 380 106 13 214 269 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.4 1.7 1.2 0.43 1.0 2.2 1.1 0.77 1.1 1.2 0.77 1.1 1.2 0.77 1.1 1.2 0.77 1.1 1.2 0.70 1.1 1.2 0.77 1.1 1.2 0.70 1.1 1.2 0.70 1.1 1.2 0.70 1.1 1.2 0.70 1.1 1.2 0.70 1.1 1.2 0.70 1.1 1.2 0.70 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130 12 12 130 12 12 130 12 12 130 12 12 130 12 12 130 12 12 130 12 130 12 12 130 252 12 12 130 252 14 17 20 222 14 100 222 14 100 222 12 100 222 12 100 222 130 222 130 230 232 130 252 145 200 222 145 200 222 145 200 222 145 230 73 200 222 145 230 73 200 222 145 230 73 200 222 145 230 73 20 222 145 230 73 230 73 230 232 145 230 73 230 73 230 73 230 73 230 73 230 73 230 73 20 222 145 230 73 230 73 230 73 230 73 230 73 230 73 230 73 230 73 230 73 230 7 7 7 7 7 7 7 7 7 7 7 7 7 | 7.7 1.9 3.4 0.11 5.2 6.1 112 14 19 38 112 0.11 19 38 115 564 179 3997 105 53 5.5 6.7 41 94 75 107 94 33 355 926 3997 | 113 89 15 10 9 27 40 39 113 9.13 9.13 40 7 68 1013 448 107 329 32 21 36 9.4 36 584 178 69 380 106 13 214 269 1013 10 10 10 10 10 10 10 10 10 10 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.4 1.7 1.2 0.43 1.0 2.2 1.1 0.77 1.1 1.2 0.77 1.1 1.2 0.77 1.1 1.2 0.77 1.1 1.2 0.72 1.1 1.2 0.72 1.1 1.2 0.73 1.4 1.2 0.43 1.0 2.2 1.1 1.2 0.75 1.4 1.2 0.43 1.0 2.2 1.1 0.43 1.0 2.2 1.1 0.43 1.0 2.2 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| - | 12 12 16 34 22 24 12 16 18 7.7 34 11.61 124 116 100 100 100 100 100 100 100 100 100 | 4.7 2.9 0.89 <0.70 1.25 1.1 2.1 3 4.7 0.89 <0.70 <0.56 2.1 <0.53 1.1 1.0 4.2 <0.53 1.1 1.0 4.2 <0.52 0.61 <0.70 <0.54 0.54 0.54 0.54 0.54 0.55 1.4 1.0 4.2 0.54 0.55 1.4 1.0 4.2 0.55 1.4 1.0 5.5 1.4 1.5 1.4 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 1.0 4.2 0.55 1.1 0.55 0.55 1.1 1.0 0.55 0.55 0. | 3.2 3.3 1.0 1.1 0.15 1.01 0.82 1.01 1.4 1.1 3.3 0.15 0.81 0.81 0.81 0.81 0.43 0.24 2.2 0.13 0.43 0.24 2.2 0.13 0.48 8.9 3.4 49 8.5 8.7 0.31 7.2 12 49 0.13 0.011 0.096 101 60 | 19.2 18.5 4.3 10.0 0.81 6.5 34 6.7 13 11 34 0.81 11 33 712 130 252 46 773 20 12 60 3.0 3.1 12 60 3.0 3.1 13 11 33 712 13 10 252 46 773 20 12 60 3.0 3.1 10 252 46 773 20 12 60 3.0 3.1 10 252 46 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1013 7.1 1.3 2.7 1.7 1.5 8439 | 3.64 72 7.55 3.71 4.12 3.96 3.05 4.3 13 24 72 3.05 1.4 1.4 1.4 1.7 1.2 0.43 1.0 2.2 1.1 0.79 1.1 1.2 0.77 1.1 1.2 0.77 1.1 1.7 1.5 0.92 6.4 0.30 1.4 1.3 6.4 0.30 1.4 1.3 6.4 0.30 1.4 1.2 2.7 1.2 | 174 134 49 88 52 62 23 48 79 51 174 23,40 30 23 25 25 25 25 25 23 33 49 39 36 37 50 27 36 27 36 28 35 41 34 22 33 8.3 50 22.10 22.10 | 5.3 4.7 2.2 2.5 0.47 1.4 0.64 1.3 2 2 5 0.47 (0.35 <0.34 <0.42 0.44 <0.38 0.53 <0.40 <0.27 <0.53 <0.40 <0.27 <0.53 <0.40 <0.27 <0.50 0.40 <0.50 0.40 0.40 <0.50 0.40 0.40 <0.50 0.41 <0.39 <0.57 0.41 <0.39 <0.57 0.41 <0.39 <0.57 0.41 <0.39 <0.57 0.41 <0.39 <0.57 0.41 <0.39 <0.57 0.41 <0.39 <0.57 0.41 <0.39 <0.57 0.41 <0.39 <0.57 0.41 <0.39 <0.57 0.41 <0.39 <0.57 0.41 <0.39 <0.57 0.41 <0.57 0.41 <0.57 0.41 <0.57 0.41 <0.57 0.41 <0.57 0.41 <0.50 <0.41 <0.50 <0.41 <0.50 <0.41 <0.50 <0.41 <0.50 <0.41 <0.50 <0.41 <0.50 <0.57 0.41 <0.50 <0.41 <0.50 <0.41 <0.50 <0.41 <0.50 <0.41 <0.50 <0.41 <0.50 <0.41 <0.50 <0.41 <0.50 <0.41 <0.50 <0.41 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72.3 11 6.0 7.6 5.1 1.5 33 4.6 7.4 21 4.2 52 5.9 136 18 42 89 371 7.3 33 4.6 7.4 21 4.2 52 5.9 138 4.5 5.9 138 4.5 5.9 5.9 138 4.5 5.9 5.9 5.9 5.9 5.9 5.9 5.9 5.9 5.9 5 | 4.38 2.23 0.376 1.58 0.11 0.803 0.62 0.44 1 4 0.11 0.10 0.25 51 10 1.6 0.92 51 10 1.6 0.17 4.7 0.30 0.63 2.8 0.61 6.7 0.70 20 0.23 5.7 12 0.06 0.23 5.7 12 0.01 0.06 0.23 5.7 12 0.06 0.23 5.7 12 0.06 0.23 5.7 12 0.06 0.23 5.7 12 0.06 0.11 0.06 0.11 0.06 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 0.11 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0.02 0.43 0.01 0.03 0.02 0.43 0.01 0.01 0.03 0.02 0.43 0.01 0.01 0.02 0.43 0.01 0.01 0.02 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 4.1 0.03 0.02 0.03 0.03 | 2.66 1.5 0.7 1.3 0.21 0.63 1.53 0.47 1.1 0.8 2.7 0.21 0.41 1.1 116 18 6.4 1.9 18 0.76 12 0.30 1.1 5.9 2.7 16 1.2 46 0.71 14 28 116 0.30 0.12 55 33 |

| Тb | Dy | Но | Er | Tm | Yb | Lu | ΣREY | Hf | Та | w | ²⁰⁶ Pb | ²⁰⁷ Pb | ²⁰⁸ Pb | Th | U |
|---|--|--|--|--|---|--|--|--|--|--|--|---|--|---|---|
| < 0.01 | 0.08 | 0.02 | 0.07 | 0.02 | 0.14 | 0.04 | 2.4 | 0.07 | 46 | 4082 | 2.9 | 0.86 | 1.2 | 2.5 | 1.7 |
| 0.03 | 0.16 | 0.06 | 0.13 | 0.02 | 0.18 | 0.03 | 2.7 | 0.15 | 16 | 2676 | 3.7 | 0.87 | 1.8 | 4.0 | 2.0 |
| 0.01 | 0.18 | 0.04 | 0.12 | 0.02 | 0.13 | 0.01 | 3.0 | 0.08 | 34 | 341 | 5.2 | 2.21 | 2.7 | 3.8 | 2.7 |
| 0.01 | 0.17 | 0.02 | 0.00 | 0.02 | 0.14 | 0.03 | 3.3 4 0 | 0.10 | 43 54 | 2810 | 5.1 | 1.5 | 2.2 | 5.5 4.8 | 2.5 |
| 0.02 | 0.22 | 0.04 | 0.19 | 0.06 | 0.34 | 0.07 | 4.1 | 0.09 | 76 | 2223 | 3.7 | 1.3 | 1.8 | 2.6 | 3.0 |
| 0.03 | 0.20 | 0.06 | 0.21 | 0.04 | 0.30 | 0.02 | 5.8 | 0.15 | 8.7 | 4061 | 7.0 | 2.3 | 3.1 | 7.9 | 4.5 |
| 0.06 | 0.28 | 0.08 | 0.29 | 0.04 | 0.36 | 0.05 | 7.1 | 0.23 | 37 | 395 | 11 | 3.0 | 4.7 | 7.5 | 7.3 |
| 0.05 | 0.25 | 0.06 | 0.23 | 0.05 | 0.40 | 0.06 | 8.0 | 0.12 | 92 | 1362 | 13 | 7.3 | 7.9 | 6.4 | 6.8 |
| 0.08 | 0.34 | 0.08 | 0.25 | 0.07 | 0.41 | 0.06 | 8.2 | 0.24 | 54 | 3209 | 13 | 3.1 | 4.6 | 6.9 | 8.4 |
| 0.07 | 0.54 | 0.10 | 0.56 | 0.11 | 0.56 | 0.11 | 9.4 13 | 0.52 | 25 102 | 2566 | 17 | 5.5 5.3 | 7.0 | 0.9 11 | 0.4 12 |
| 0.11 | 0.61 | 0.11 | 0.37 | 0.10 | 0.49 | 0.11 | 15 | 0.34 | 9.5 | 2475 | 24 | 6.5 | 10 | 17 | 17 |
| 0.12 | 0.74 | 0.16 | 0.57 | 0.11 | 0.75 | 0.12 | 18 | 0.26 | 11 | 3381 | 24 | 7.9 | 10 | 15 | 17 |
| 0.08 | 0.70 | 0.10 | 0.55 | 0.07 | 0.72 | 0.12 | 19 | 0.21 | 45 | 2202 | 42 | 20 | 21 | 10 | 21 |
| 0.11 | 1.1 | 0.20 | 0.87 | 0.18 | 1.2 | 0.22 | 21 | 0.59 | 44 | 1524 | 28 | 6.3 | 10 | 20 | 21 |
| 0.18 | 1.5 | 0.21 | 0.79 | 0.19 | 1.2 | 0.19 | 29 | 0.43 | 28 | 1150 | 3/ | 8.8 0.1 | 14 16 | 34 11 | 26 |
| 0.20 | 0.23 | 0.03 | 0.11 | 0.27 | 0.24 | 0.04 | 6.2 | 0.80 | 54 10 | 4022 | 54 10 | 3.0 | 4.2 | 5.7 | 8.0 |
| 0.08 | 0.50 | 0.10 | 0.37 | 0.08 | 0.55 | 0.09 | 11 | 0.25 | 40 | 2135 | 16 | 5.1 | 7.0 | 11 | 10 |
| 0.06 | 0.43 | 0.09 | 0.30 | 0.07 | 0.48 | 0.08 | 9.1 | 0.19 | 27 | 1290 | 12 | 4.5 | 5.5 | 10 | 8.0 |
| 0.26 | 1.6 | 0.37 | 1.1 | 0.27 | 2.0 | 0.34 | 33 | 0.80 | 102 | 4082 | 42 | 20 | 21 | 41 | 26 |
| 0.01 | 0.08 | 0.02 | 0.06 | 0.02 | 0.13 | 0.01 | 2.4 | 0.07 | 8.7 | 150 | 2.9 | 0.86 | 1.2 | 2.5 | 1.7 |
| 0.01 | 0.05 | 0.00 | 0.05 | 0.01 | 0.05 | 0.00 | 0.52 | 0.04 | 14.0 | 5603 | 0.55 | 0.10 | 0.10 | 0.10 | 0.10 |
| 0.01 | 0.03 | 0.01 | 0.02 | 0.01 | 0.04 | 0.01 | 1.56 | 0.10 | 24.7 | 280 | 2.43 | 0.85 | 1.04 | 0.43 | 0.54 |
| 0.00 | 0.00 | 0.00 | 0.02 | 0.01 | 0.04 | 0.00 | 0.46 | 0.00 | 47.8 | 880 | 0.41 | 0.20 | 0.25 | 0.08 | 0.08 |
| 0.05 | 0.05 | 0.01 | 0.02 | 0.00 | 0.04 | 0.02 | 1.16 | 0.04 | 5.6 | 2268 | 1.15 | 0.31 | 0.53 | 0.48 | 0.22 |
| 0.01 | 0.09 | 0.02 | 0.09 | 0.01 | 0.10 | 0.03 | 2.82 | 0.05 | 6.5 | 2798 | 3.62 | 1.82 | 2.02 | 1.97 | 0.65 |
| 0.01 | 0.04 | 0.01 | 0.01 | 0.01 | 0.03 | 0.01 | 0.31 | 0.06 | 1.9 | 180 | 0.09 | 0.18 | 0.08 | 0.01 | 0.01 |
| 0.00 | 0.02 | 0.01 | 0.02 | 0.00 | 0.05 | 0.00 | 2.05 | 0.04 | 4.0 | 552 152 | 1.49 | 0.05 | 0.05 | 2 17 | 0.02 |
| 0.01 | 0.09 | 0.01 | 0.05 | 0.01 | 0.12 | 0.01 | 1.67 | 0.06 | 5.1 | 4986 | 3.02 | 1.25 | 1.49 | 2.28 | 0.37 |
| 0.01 | 0.05 | 0.01 | 0.04 | 0.01 | 0.05 | 0.01 | 1.16 | 0.06 | 12 | 2342 | 1.5 | 0.60 | 0.71 | 0.77 | 0.27 |
| 0.02 | 0.03 | 0.01 | 0.03 | 0.01 | 0.03 | 0.01 | 0.86 | 0.04 | 14 | 2373 | 1.2 | 0.58 | 0.65 | 0.96 | 0.26 |
| 0.05 | 0.09 | 0.04 | 0.10 | 0.02 | 0.12 | 0.03 | 2.82 | 0.15 | 48 | 5942 | 3.6 | 1.8 | 2.0 | 2.3 | 0.66 |
| 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.29 | 0.00 | 1.9 | 152 | 0.09 | 0.05 | 0.05 | 0.01 | 0.01 |
| 0.52 | 3.51 | 0.76 | 3.16 | 0.75 | 6.43 | 1.23 | 145 | 0.35 | 16.71 | 45 | 65.8 | 33.4 | 32.9 | 7.9 | 20 |
| 0.31 | 2.86 | 0.71 | 2.94 | 0.66 | 5.96 | 1.16 | 89 | 0.08 | 2.56 | 283 | 98.7 | 41.8 | 41.3 | 3.0 | 36 |
| 0.12 | 0.673 | 0.17 | 0.58 | 0.13 | 0.91 | 0.207 | 17 | 0.25 | 1.66 | 11 | 25.5 | 13.3 | 15.1 | 9.5 | 5.62 |
| 0.24 | 1.7 | 0.34 | 1.40 | 0.29 | 2.30 | 0.445 | 50 | 0.04 | 0.174 | 15 | 23.1 | 12.8 | 12.9 | 0.2 | 1.45 |
| 0.02 | 0.249 | 0.04 | 0.21 | 0.04 | 1 98 | 0.052 | 4 30 | 0.15 | 0.78 | 0.45 | 4.0 23 5 | 0.9 | 2.3 1/1.6 | 15.5 | 0.46 |
| 0.10 | 4.72 | 1.33 | 5.05 | 1.08 | 9.35 | 1.82 | 76 | 5.11 | 8.01 | 2.1 | 21.5 | 10.3 | 13.4 | 30.5 | 7.20 |
| 0.13 | 1.1 | 0.20 | 0.83 | 0.18 | 1.35 | 0.258 | 22 | 0.50 | 1.91 | 12 | 17.2 | 7.3 | 9.2 | 15.8 | 3.17 |
| 0.2 | 2.0 | 0.5 | 1.9 | 0.4 | 3.6 | 0.7 | 54 | 0.8 | 4.4 | 47 | 35 | 16 | 18 | | 10 |
| 0.2 | 1.6 | 0.4 | 4 7 | ~ . | | ~ ~ | 17 | 17 | | ~~ | ~ 4 | | 10 | 12 | |
| 0.02 | | 1 2 | I./ E 1 | 0.4 | 5.5 | 0.6 | 1/1 | I./ E 1 | 5.5 17 | 37 | 31 | 14 | 13 | 12 9 20 | 12 |
| 0.20 | 0.25 | 1.3 0.04 | 5.1 0.21 | 0.4 1.1 0.04 | 3.3 9.4 0.29 | 0.6 1.8 0.05 | 47 145 4.01 | 5.1 0.04 | 5.5 17 0.17 | 97 283 0.45 | 31 99 4.03 | 14 42 0.9 | 13 41 2.33 | 12 9 30 0.23 | 12 36 0.46 |
| | 0.25 1.8 | 1.3 0.04 0.51 | 5.1 0.21 2.5 | 0.4 1.1 0.04 0.52 | 9.4 0.29 5.1 | 0.6 1.8 0.05 0.79 | 145 4.01 25 | 5.1 0.04 2.4 | 5.5 17 0.17 0.7 | 283 0.45 0.04 | 31 99 4.03 7.1 | 14 42 0.9 1.0 | 13 41 2.33 1.9 | 12 9 30 0.23 27 | 12 36 0.46 13 |
| 0.43 | 0.25 1.8 4.6 | 1.3 0.04 0.51 1.4 | 5.1 0.21 2.5 6.7 | 0.4 1.1 0.04 0.52 1.3 | 9.4 0.29 5.1 12 | 0.6 1.8 0.05 0.79 1.60 | 145 4.01 25 66 | 5.1 0.04 2.4 7.1 | 5.5 17 0.17 0.7 2.2 | 283 0.45 0.04 0.11 | 31 99 4.03 7.1 12 | 14 42 0.9 1.0 2.1 | 13 41 2.33 1.9 3.0 | 12 9 30 0.23 27 56 | 12 36 0.46 13 22 |
| 0.43 19 | 0.25 1.8 4.6 110 | 1.3 0.04 0.51 1.4 20 | 5.1 0.21 2.5 6.7 57 | 0.4 1.1 0.04 0.52 1.3 8.7 | 3.3 9.4 0.29 5.1 12 57 | 0.6 1.8 0.05 0.79 1.60 8.9 | 145 4.01 25 66 1962 | 5.1 0.04 2.4 7.1 20 | 5.5 17 0.17 0.7 2.2 9.8 | 283 0.45 0.04 0.11 1.15 | 31 99 4.03 7.1 12 57 | 14 42 0.9 1.0 2.1 9.2 | 13 41 2.33 1.9 3.0 14 | 12 9 30 0.23 27 56 1981 | 12 36 0.46 13 22 42 |
| 0.43 19 2.7 1.6 | 0.25 1.8 4.6 110 18 16 | 1.3 0.04 0.51 1.4 20 4.1 4.5 | 5.1 0.21 2.5 6.7 57 11 20 | 0.4 1.1 0.04 0.52 1.3 8.7 1.6 4.3 | 3.3 9.4 0.29 5.1 12 57 11 39 | 0.6 1.8 0.05 0.79 1.60 8.9 1.5 6.4 | 145 4.01 25 66 1962 355 378 | 5.1 0.04 2.4 7.1 20 3.4 19 | 5.5 17 0.17 0.7 2.2 9.8 2.9 3.3 | 97 283 0.45 0.04 0.11 1.15 0.52 1.2 | 31 99 4.03 7.1 12 57 25 25 27 | 14 42 0.9 1.0 2.1 9.2 4.4 3.6 | 13 41 2.33 1.9 3.0 14 6.1 8 7 | 12 9 30 0.23 27 56 1981 307 163 | 12 36 0.46 13 22 42 16 49 |
| 0.43 19 2.7 1.6 0.6 | 0.25 1.8 4.6 110 18 16 4.7 | 1.3 0.04 0.51 1.4 20 4.1 4.5 1.5 | 1.7 5.1 0.21 2.5 6.7 57 11 20 6.2 | 0.4 1.1 0.04 0.52 1.3 8.7 1.6 4.3 1.3 | 3.3 9.4 0.29 5.1 12 57 11 39 12 | 0.6 1.8 0.05 0.79 1.60 8.9 1.5 6.4 1.9 | 145 4.01 25 66 1962 355 378 89 | 5.1 0.04 2.4 7.1 20 3.4 19 9.3 | 5.5 17 0.17 0.7 2.2 9.8 2.9 3.3 21 | 97 283 0.45 0.04 0.11 1.15 0.52 1.2 7.2 | 31 99 4.03 7.1 12 57 25 27 66 | 14 42 0.9 1.0 2.1 9.2 4.4 3.6 8.4 | 13 41 2.33 1.9 3.0 14 6.1 8.7 14 | 12 9 30 0.23 27 56 1981 307 163 96 | 12 36 0.46 13 22 42 16 49 25 |
| 0.43 19 2.7 1.6 0.6 7.8 | 0.25 1.8 4.6 110 18 16 4.7 79 | 1.3 0.04 0.51 1.4 20 4.1 4.5 1.5 24 | 1.7 5.1 0.21 2.5 6.7 57 11 20 6.2 118 | 0.4 1.1 0.04 0.52 1.3 8.7 1.6 4.3 1.3 27 | 3.3 9.4 0.29 5.1 12 57 11 39 12 221 | 0.6 1.8 0.05 0.79 1.60 8.9 1.5 6.4 1.9 35 | 145 4.01 25 66 1962 355 378 89 1326 | 5.1 0.04 2.4 7.1 20 3.4 19 9.3 125 | 5.5 17 0.17 2.2 9.8 2.9 3.3 21 21 | 97 283 0.45 0.04 0.11 1.15 0.52 1.2 7.2 2.1 | 31 99 4.03 7.1 12 57 25 27 66 93 | 14 42 0.9 1.0 2.1 9.2 4.4 3.6 8.4 13.2 | 13 41 2.33 1.9 3.0 14 6.1 8.7 14 22 | 12 9 30 0.23 27 56 1981 307 163 96 886 | 12 36 0.46 13 22 42 16 49 25 401 |
| 0.43 19 2.7 1.6 0.6 7.8 0.34 | 0.25 1.8 4.6 110 18 16 4.7 79 3.4 | 1.3 0.04 0.51 1.4 20 4.1 4.5 1.5 24 0.96 | 1.7 5.1 0.21 2.5 6.7 57 11 20 6.2 118 4.1 | 0.4 1.1 0.04 0.52 1.3 8.7 1.6 4.3 1.3 27 0.79 | 3.3 9.4 0.29 5.1 12 57 11 39 12 221 7.70 | 0.6 1.8 0.05 0.79 1.60 8.9 1.5 6.4 1.9 35 1.3 | 145 4.01 25 66 1962 355 378 89 1326 46 | 5.1 0.04 2.4 7.1 20 3.4 19 9.3 125 5.6 | 5.5 17 0.17 2.2 9.8 2.9 3.3 21 21 1.0 | 97 283 0.45 0.04 0.11 1.15 0.52 1.2 7.2 2.1 0.16 | 31 99 4.03 7.1 12 57 25 27 66 93 7.8 | 14 42 0.9 1.0 2.1 9.2 4.4 3.6 8.4 13.2 1.1 | 13 41 2.33 1.9 3.0 14 6.1 8.7 14 22 2.1 | 12 9 30 0.23 27 56 1981 307 163 96 886 36 | 12 36 0.46 13 22 42 16 49 25 401 17 |
| 0.43 19 2.7 1.6 0.6 7.8 0.34 0.13 | 0.25 1.8 4.6 110 18 16 4.7 79 3.4 1.4 | 1.3 0.04 0.51 1.4 20 4.1 4.5 1.5 24 0.96 0.36 | 1.7 5.1 0.21 2.5 6.7 57 11 20 6.2 118 4.1 2.0 | 0.4 1.1 0.04 0.52 1.3 8.7 1.6 4.3 1.3 27 0.79 0.44 0.44 | 3.3 9.4 0.29 5.1 12 57 11 39 12 221 7.70 5.72 | 0.6 1.8 0.05 0.79 1.60 8.9 1.5 6.4 1.9 35 1.3 0.53 0.53 | 145 4.01 25 66 1962 355 378 89 1326 46 27 | 5.1 0.04 2.4 7.1 20 3.4 19 9.3 125 5.6 3.3 | 5.3 17 0.17 2.2 9.8 2.9 3.3 21 21 1.0 0.78 | 97 283 0.45 0.04 0.11 1.15 0.52 1.2 7.2 2.1 0.16 0.11 | 31 99 4.03 7.1 12 57 25 27 66 93 7.8 3.1 | 14 42 0.9 1.0 2.1 9.2 4.4 3.6 8.4 13.2 1.1 1.1 | 13 41 2.33 1.9 3.0 14 6.1 8.7 14 22 2.1 1.0 0 | 12 9 30 0.23 27 56 1981 307 163 96 886 36 20 | 12 36 0.46 13 22 42 16 49 25 401 17 11 |
| 0.43 19 2.7 1.6 0.6 7.8 0.34 0.13 1.96 | 0.25 1.8 4.6 110 18 16 4.7 79 3.4 1.4 1.4 11 0.27 | 1.3 0.04 0.51 1.4 20 4.1 4.5 1.5 24 0.96 0.36 2.3 0.00 | 1.7 5.1 0.21 2.5 6.7 57 11 20 6.2 118 4.1 2.0 6.2 118 4.1 2.0 6.2 | 0.4 1.1 0.04 0.52 1.3 8.7 1.6 4.3 1.3 27 0.79 0.44 0.86 0.07 | 3.3 9.4 0.29 5.1 12 57 11 39 12 221 7.70 5.72 6.35 0.70 | 0.6 1.8 0.79 1.60 8.9 1.5 6.4 1.9 35 1.3 0.53 0.58 0.10 | 145 4.01 25 66 1962 355 378 89 1326 46 27 183 11 | 5.1 0.04 2.4 7.1 20 3.4 19 9.3 125 5.6 3.3 2.2 0.20 | 5.5 17 0.17 2.2 9.8 2.9 3.3 21 1.0 0.78 1.2 0.00 | 97 283 0.45 0.04 0.11 1.15 0.52 1.2 7.2 7.2 2.1 0.16 0.11 0.08 0.11 | 31 99 4.03 7.1 12 57 25 27 66 93 7.8 3.1 15 15 | 14 42 0.9 1.0 2.1 9.2 4.4 3.6 8.4 13.2 1.1 1.1 2.6 0.2 | 13 41 2.33 1.9 3.0 14 6.1 8.7 14 22 2.1 1.0 3.7 0.42 | 12 9 30 0.23 27 56 1981 307 163 96 886 36 20 260 | 12 36 0.46 13 22 42 16 49 25 401 17 11 5.9 |
| 0.43 19 2.7 1.6 0.6 7.8 0.34 0.13 1.96 0.14 0.11 | 0.25 1.8 4.6 110 18 16 4.7 79 3.4 1.4 11 0.27 0.84 | 1.3 0.04 0.51 1.4 20 4.1 4.5 1.5 24 0.96 0.36 0.36 0.39 0.09 0.09 | 1.7 5.1 0.21 2.5 6.7 57 11 20 6.2 118 4.1 2.0 6.2 0.40 0.41 | 0.4 1.1 0.04 0.52 1.3 8.7 1.6 4.3 1.3 27 0.79 0.44 0.86 0.07 0.14 | 3.3 9.4 0.29 5.1 12 57 11 39 12 221 7.70 5.72 6.35 0.70 0 54 | 0.6 1.8 0.79 1.60 8.9 1.5 6.4 1.9 35 1.3 0.53 0.88 0.10 0.09 | 145 4.01 25 66 1962 355 378 89 1326 46 27 183 11 20 | 1.7 5.1 0.04 2.4 7.1 20 3.4 19 9.3 125 5.6 3.3 2.2 0.30 <0.209 | 5.5 17 0.17 0.7 2.2 9.8 2.9 3.3 21 21 1.0 0.78 1.2 0.09 1.2 | 97 283 0.45 0.04 0.11 1.15 0.52 1.2 7.2 2.1 0.16 0.11 0.06 0.11 0.03 | 31 99 4.03 7.1 12 57 25 27 66 93 7.8 3.1 15 1.5 5.6 | 14 42 0.9 1.0 2.1 9.2 4.4 3.6 8.4 13.2 1.1 1.1 2.6 0.3 0.8 | 13 41 2.33 1.9 3.0 14 6.1 8.7 14 22 2.1 1.0 3.7 0.43 1.6 | 12 9 30 0.23 27 56 1981 307 163 96 886 36 20 260 6 6 10 | 12 36 0.46 13 22 42 16 49 25 401 17 11 5.9 1.3 16 |
| 0.43 19 2.7 1.6 0.6 7.8 0.34 0.13 1.96 0.14 0.11 1.02 | 0.25 1.8 4.6 110 18 16 4.7 79 3.4 1.4 1.4 11 0.27 0.84 6.4 | 1.3 0.04 0.51 1.4 20 4.1 4.5 1.5 24 0.96 0.36 0.36 0.30 0.09 0.09 1.2 | 1.7 5.1 0.21 2.5 6.7 57 11 20 6.2 118 4.1 2.0 6.2 0.40 0.41 3.3 | 0.4 1.1 0.04 0.52 1.3 8.7 1.6 4.3 1.3 27 0.79 0.44 0.86 0.07 0.14 0.45 | 3.3 9.4 0.29 5.1 12 57 11 39 12 221 7.70 5.72 6.35 0.70 0.54 3.09 | 0.6 1.8 0.79 1.60 8.9 1.5 6.4 1.9 35 1.3 0.53 0.53 0.88 0.10 0.09 0.46 | 145 4.01 25 66 1962 355 378 89 1326 46 27 183 11 20 102 | 1.7 5.1 0.04 2.4 7.1 20 3.4 19 9.3 125 5.6 3.3 2.2 0.30 <0.209 1.6 | 5.5 17 0.17 2.2 9.8 2.9 3.3 21 21 1.0 0.78 1.2 0.09 1.2 63 | 97 283 0.45 0.45 0.41 1.15 0.52 1.2 7.2 2.1 0.16 0.11 0.10 0.67 | 31 99. 4.03 7.1 12 57 25 27 66 93 7.8 3.1 15 1.5 5.6 94 | 14 42 0.9 1.0 2.1 9.2 4.4 3.6 8.4 13.2 1.1 1.1 2.6 0.3 0.8 14 | 13 41 2.33 1.9 3.0 14 6.1 8.7 14 22 2.1 1.0 3.7 0.43 1.6 17 | 12 9 30 0.23 27 56 1981 307 163 96 886 36 20 260 6 10 215 | 12 36 0.46 13 22 42 16 49 25 401 17 11 5.9 1.3 1.6 8,9 |
| 0.43 19 2.7 1.6 0.6 7.8 0.34 0.13 1.96 0.14 0.11 1.02 0.68 | 0.25 1.8 4.6 110 18 16 4.7 79 3.4 1.4 1.4 1.4 1.4 0.27 0.84 6.4 5.0 | 1.3 0.04 0.51 1.4 20 4.1 4.5 1.5 24 0.96 0.36 2.3 0.09 1.2 1.2 | 1.7 5.1 0.21 2.5 6.7 57 11 20 6.2 118 4.1 2.0 6.2 0.40 0.41 3.3 5.4 | 0.4 1.1 0.04 0.52 1.3 8.7 1.6 4.3 1.3 27 0.79 0.44 0.86 0.07 0.14 0.45 1.07 | 3.3 9.4 0.29 5.1 12 57 11 39 12 221 7.70 5.72 6.35 0.70 0.54 3.09 9.39 | 0.6 1.8 0.79 1.60 8.9 1.5 6.4 1.9 35 1.3 0.53 0.88 0.10 0.09 0.46 1.6 | 47 145 4.01 25 66 1962 355 378 89 1326 46 27 183 11 20 102 150 | 1.7 5.1 0.04 2.4 7.1 20 3.4 19 9.3 125 5.6 3.3 2.2 0.30 <0.209 1.6 4.7 | 5.5 17 0.17 0.7 2.2 9.8 2.9 3.3 21 21 1.0 0.78 1.2 0.09 1.2 63 7.4 | 97 283 0.45 0.04 0.11 1.15 0.52 1.2 7.2 2.1 0.16 0.11 0.08 0.11 0.08 0.11 0.67 6.8 | 31 99 4.03 7.1 12 57 25 27 66 93 7.8 3.1 15 1.5 1.5 5.6 94 33 | 14 42 0.9 1.0 2.1 9.2 4.4 3.6 8.4 13.2 1.1 1.1 2.6 0.3 0.8 14 5 | 13 41 2.33 1.9 3.0 14 6.1 8.7 14 22 2.1 1.0 3.7 0.43 1.6 17 10 10 | 12 9 30 0.23 27 56 1981 307 163 96 886 36 20 260 6 10 215 28 | 12 36 0.46 13 22 42 16 49 25 401 17 11 5.9 1.3 1.6 8.9 23 |
| 0.43 19 2.7 1.6 0.6 7.8 0.34 0.13 1.96 0.14 0.11 1.02 0.68 3.15 | 0.25 1.8 4.6 110 18 16 4.7 79 3.4 1.4 1.4 1.4 1.4 1.4 1.4 6.4 5.0 23 | 1.3 0.04 0.51 1.4 20 4.1 4.5 1.5 24 0.96 0.36 2.3 0.09 1.2 4.8 | 1.7 5.1 0.21 2.5 6.7 57 11 20 6.2 118 4.1 2.0 6.2 0.40 0.41 3.3 5.4 17 | 0.4 1.1 0.04 0.52 1.3 8.7 1.6 4.3 1.3 27 0.79 0.44 0.86 0.07 0.14 0.45 1.07 2.43 | 3.3 9.4 0.29 5.1 12 57 11 39 12 221 7.70 5.72 6.35 0.70 0.54 3.09 9.39 20 | 0.6 1.8 0.79 1.60 8.9 1.5 6.4 1.9 35 1.3 0.53 0.88 0.10 0.09 0.46 1.6 3.3 0.53 | 145 4.01 25 66 1962 355 378 89 1326 46 27 183 11 20 102 150 354 | 1.7 5.1 0.04 2.4 7.1 20 3.4 19 9.3 125 5.6 3.3 2.2 0.30 <0.209 1.6 4.7 2.9 | 5.3 17 0.17 0.7 2.2 9.8 2.9 3.3 21 21 1.0 0.78 1.2 63 7.4 3.2 | 97 283 0.45 0.04 0.11 1.15 0.52 1.2 7.2 2.1 0.16 0.11 0.08 0.11 0.08 0.11 0.067 6.8 1.3 | 31 99 4.03 7.1 12 57 25 27 66 93 7.8 3.1 15 1.5 5.6 94 33 26 | 14 42 0.9 1.0 2.1 9.2 4.4 3.6 8.4 13.2 1.1 1.1 2.6 0.3 0.8 14 5 5.25 | 13 41 2.33 1.9 3.0 14 6.1 8.7 14 22 2.1 1.0 3.7 0.43 1.6 17 10 8.8 | 12 9 30 0.23 27 56 1981 307 163 96 886 36 20 260 6 10 215 28 140 | 12 36 0.46 13 22 42 16 49 25 401 17 11 5.9 1.3 1.6 8.9 23 11 |
| 0.43 19 2.7 1.6 0.6 7.8 0.34 0.13 1.96 0.14 0.11 1.02 0.68 3.15 0.27 | 0.25 1.8 4.6 110 18 16 4.7 79 3.4 1.4 1.4 1.4 1.4 1.4 1.4 1.2 0.84 6.4 5.0 23 2.2 27 | 1.3 0.04 0.51 1.4 20 4.1 4.5 1.5 24 0.96 0.36 2.3 0.09 0.09 0.09 1.2 1.2 4.8 0.4 0.51 1.4 0.51 1.4 0.51 1.4 0.51 1.4 0.51 1.5 24 0.96 0.36 0.36 0.36 0.99 0.09 0.09 1.2 1.2 1.2 4.8 0.4 0.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.6 1.6 1.6 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.7 1.71 1.71.71.71.71.71.71.71.7 | 1.7 5.1 0.21 2.5 6.7 57 11 20 6.2 118 4.1 2.0 6.2 0.40 0.41 3.3 5.4 17 2.46 17 | 0.4 1.1 0.04 0.52 1.3 8.7 1.6 4.3 1.3 27 0.79 0.44 0.86 0.07 0.14 0.45 1.07 2.43 0.44 0.45 | 3.3 9.4 0.29 5.1 12 57 11 39 12 221 7.70 5.72 6.35 0.70 0.54 3.09 9.39 20 4.4 | 0.6 1.8 0.79 1.60 8.9 1.5 6.4 1.9 35 1.3 0.53 0.88 0.10 0.09 0.46 1.6 3.3 0.63 1.0 | 47 145 4.01 25 66 1962 355 378 89 1326 46 27 183 102 150 354 44 660 | 1.7 5.1 0.04 2.4 7.1 20 3.4 19 9.3 125 5.6 3.3 2.2 0.30 <0.209 1.6 4.7 2.9 4.0 2.6 | 5.3 17 0.17 2.2 9.8 2.9 3.3 21 21 1.0 0.78 1.2 63 7.4 3.2 17 20 | 97 283 0.45 0.04 0.11 1.15 0.52 1.2 7.2 2.1 0.16 0.11 0.08 0.11 0.08 0.11 0.00 0.67 6.8 1.3 20 0.010 | 31 99 4.03 7.1 12 57 25 27 66 93 7.8 3.1 15 1.5 5.6 94 33 26 94 | 14 42 0.9 1.0 2.1 9.2 4.4 3.6 8.4 13.2 1.1 1.1 2.6 0.3 0.8 14 5 5.25 11 | 13 41 2.33 1.9 3.0 14 6.1 8.7 14 22 2.1 1.0 3.7 0.43 1.6 17 10 8.8 23 14 | 12 9 30 0.23 27 56 1981 307 163 96 886 36 20 260 6 10 215 28 140 48 777 | 12 36 0.46 13 22 42 16 49 25 401 17 11 5.9 1.3 1.6 8.9 23 11 64 23 |
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| 0.43 19 2.7 1.6 0.6 7.8 0.34 0.13 1.96 0.14 0.11 1.02 0.68 3.15 0.27 6.87 0.19 2.6 4.8 19 0.11 0.11 0.01 0.02 | 0.25 1.8 4.6 110 18 16 4.7 79 3.4 1.4 0.27 0.84 6.4 5.0 23 2.2 37 2.1 18 30 110 0.27 0.04 0.14 | 1.3 0.04 0.51 1.4 20 4.1 4.5 1.5 24 0.96 2.3 0.09 1.2 1.2 4.8 0.47 7.1 0.32 4.2 6.9 0.09 0.01 | 1.7 5.1 0.21 2.5 6.7 57 11 20 6.2 118 4.1 2.0 6.2 0.40 0.41 3.3 5.4 17 1.60 16 29 118 0.40 0.40 0.41 0.21 0.40 0.41 0.21 0.40 0.41 0.21 0.40 0.41 0.21 0.40 0.41 0.41 0.41 0.40 0.41 0.46 0.41 0.46 0.41 0.46 0.40 0.41 0.46 0.46 0.40 0.41 0.40 0.41 0.46 0.40 0.41 0.46 0.40 0.41 0.46 0.46 0.40 0.41 0.46 0.46 0.46 0.40 | 0.4 1.1 0.04 0.52 1.3 8.7 1.6 4.3 1.3 27 0.79 0.44 0.86 0.07 0.14 0.45 1.07 2.43 0.49 3.0 6.2 27 0.79 0.49 3.0 6.2 0.79 0.07 0.02 0.08 | 3.3 9.4 0.29 5.1 12 57 11 39 12 221 7.70 5.72 6.35 0.70 0.54 3.09 9.39 20 4.4 13 4.4 13 4.4 24 51 221 0.54 | 0.6 1.8 0.79 1.60 8.9 1.5 6.4 1.9 35 1.3 0.53 0.53 0.46 1.6 3.3 0.63 1.9 0.71 3.7 8.1 35 0.09 0.71 3.7 8.1 35 0.09 0.71 3.7 8.1 35 0.09 0.71 0.71 0.71 0.71 0.71 0.72 0.72 0.79 0.71 0.77 0.71 0.77 0.71 0.77 0.71 0.71 0.71 0.77 0.09 0.71 0.71 0.71 0.71 0.09 0.71 0.71 0.71 0.09 0.71 0.71 0.09 0.71 0.09 0.71 0.71 0.09 0.00 0.09 0.71 0.09 0.71 0.09 0.00 0.09 0.71 0.00 | 145 4.01 25 66 1962 355 378 89 1326 46 27 183 11 20 102 150 354 659 44 659 44 325 522 11.36 | 1.7 5.1 0.04 2.4 7.1 20 3.4 19 9.3 125 5.6 3.3 2.2 0.30 <0.209 1.6 4.7 2.9 4.0 3.6 2.7 13 29 125 0.30 <0.209 1.6 4.7 13 29 125 0.30 <0.209 1.6 4.7 13 29 105 0.30 0.09 0.0 | 5.3 17 0.17 2.2 9.8 2.9 3.3 21 1.0 0.78 1.2 0.09 1.2 63 7.4 3.2 17 2.0 0.655 8.8 15 63 0.09 0.18 0.37 | 97 283 0.45 0.04 0.11 1.15 0.52 1.2 7.2 2.1 0.16 0.11 0.067 6.8 1.3 20 0.10 0.27 2.36 5.0 20 0.04 | 31 99 4.03 7.1 12 57 25 27 66 93 7.8 3.1 15 1.5 5.6 94 33 26 94 33 26 94 33 26 94 33 26 94 31 94 31 1.5 5.9 34 31 30 3.0 1.5 3.0 | 14 42 0.9 1.0 2.1 9.2 4.4 3.6 8.4 13.2 1.1 1.1 2.6 0.3 0.8 14 5 5.25 11 8.7 0.81 5.1 4.5 14 0.33 0.567 1.7 | 13 41 2.33 1.9 3.0 14 6.1 8.7 14 2.1 1.0 3.7 0.43 1.6 17 10 8.8 23 14 2.1 1.6 17 0.43 1.5 8.5 7.4 23 0.43 0.81 1.8 | 12 9 30 0.23 27 56 1981 307 163 96 886 36 20 260 6 10 215 28 140 48 772 16 282 494 1981 6.43 0.77 1.0 | 12 36 0.46 13 22 42 16 49 25 401 17 11 5.9 1.3 1.6 8.9 23 11 64 7.6 6.8 40 92 401 1.3 1.6 8.9 23 11 64 7.6 6.8 40 92 0.25 0.60 |
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| 0.43 19 2.7 1.6 0.6 7.8 0.34 0.13 1.96 0.14 0.11 1.02 0.68 3.15 0.27 6.87 0.19 2.6 4.8 19 0.11 0.01 0.02 14 8.2 | 0.25 1.8 4.6 110 18 16 4.7 79 3.4 1.4 11 0.27 0.84 6.4 5.0 23 7 2.1 18 30 110 0.27 0.84 6.4 5.0 23 7 2.1 18 30 110 111 0.27 0.84 6.4 5.0 23 37 2.1 18 30 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 111 10 10 110 100 110 100 110 100 110 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 10 | 1.3 0.04 0.51 1.4 20 4.1 4.5 1.5 24 0.96 0.36 2.3 0.09 0.09 1.2 1.2 4.8 0.47 7.1 0.32 4.2 6.9 24 0.09 0.01 0.05 25 16 | 1.7 5.1 0.21 2.5 6.7 57 11 20 6.2 118 4.1 2.0 6.2 0.40 0.41 3.3 5.4 17 2.46 17 1.60 16 29 118 0.40 0.41 0.21 0.40 0.41 3.3 5.4 17 1.60 16 29 18 0.40 0.41 0.40 0.41 0.41 0.40 0.41 0.40 0.41 0.40 0.41 0.40 0.41 0.40 0.40 0.41 0.40 0.40 0.41 0.40 0.40 0.41 0.40 0.40 0.41 0.40 0.41 0.40 0.40 0.41 0.40 0.40 0.40 0.41 0.40 0.55 | 0.4 1.1 0.04 0.52 1.3 8.7 1.6 4.3 1.3 27 0.79 0.44 0.45 1.07 2.43 0.44 2.20 0.49 3.0 6.2 27 0.07 0.02 0.08 19 11 | 3.3 9.4 0.29 5.1 12 57 11 39 12 221 7.70 5.72 6.35 0.70 0.54 3.09 9.39 20 0.54 3.09 9.39 20 0.54 3.09 9.39 20 0.54 3.09 9.39 20 0.54 3.09 9.39 20 0.54 3.09 9.39 20 0.54 3.09 9.39 20 0.54 3.09 9.39 20 0.54 3.09 9.39 20 0.54 3.09 9.39 20 0.54 3.09 9.39 20 0.54 3.09 9.39 20 0.54 3.09 20 20 1.0 5.75 0.75 0.70 0.54 3.09 20 0.54 3.02 0.54 0.54 3.02 0.54 0.55 0.54 0.55 0.55 0.55 0.55 0.55 | 0.6 1.8 0.79 1.60 8.9 1.5 6.4 1.9 35 1.3 0.53 0.88 0.10 0.09 0.46 1.6 3.3 0.63 1.9 0.71 3.7 8.1 35 0.09 0.277 0.066 19 11 | 4,7 4.01 25 66 1962 355 378 89 1326 46 27 183 11 20 102 150 354 44 659 44 659 44 525 1962 1.3 3.5 2487 1399 | 1.7 5.1 0.04 2.4 7.1 20 3.4 19 9.3 125 5.6 3.3 2.2 0.30 <0.209 1.6 4.7 2.9 125 0.30 <0.209 1.6 4.7 2.9 125 0.30 0.19 0.09 10.24 2.1 | 5.5 17 0.17 2.2 9.8 2.9 3.3 21 21 1.0 0.7 2.2 9.8 2.9 3.3 21 21 1.2 0.09 1.2 63 7.4 3.2 17 2.0 0.65 8.8 15 63 0.09 0.18 0.37 2681 1267 | 97 283 0.45 0.04 0.11 1.15 0.52 1.2 7.2 2.1 0.16 0.11 0.067 6.8 1.3 20 0.10 0.27 2.36 5.0 0.04 0.23 1.5 1236 601 | 31 99 4.03 7.1 12 57 25 27 66 93 7.8 3.1 15 1.5 5.6 94 33 26 79 48 5.9 34 32 79 48 5.9 34 1.06 3.0 1141 357 | 14 42 0.9 1.0 2.1 9.2 4.4 3.6 8.4 13.2 1.1 2.6 0.3 0.8 14 5 5.25 11 8.7 0.81 5.1 4.5 14 0.33 0.5667 1.7 432 152 | 13 41 2.33 1.9 3.0 14 6.1 8.7 14 2.1 1.0 3.7 0.43 1.6 17 10 8.8 23 14 2.5 7.4 23 0.81 1.8 446 167 | 12 9 30 0.23 27 56 1981 307 163 96 886 36 20 260 6 10 215 28 140 48 772 16 282 494 48 772 16 282 494 1981 6.43 0.77 1.0 381 181 | 12 36 0.46 13 22 42 16 49 25 401 17 11 5.9 1.3 1.6 8.9 23 11 64 7.6 6.8 40 92 401 1.3 0.25 0.60 826 203 |

<u>Early hematite</u> (analysed in samples 845007 and 751008) replaces accessory magnetite and is characterised by strong enrichment in REE and Y (hereafter REY). The chondrite-normalised REE-fractionation trend (Figure 9a) is distinct, with a convex trend and a particularly strong negative Eu-anomaly (albeit somewhat smaller in sample 751008).

A second, <u>later hematite generation</u> occurs along veinlets and has a bladed appearance. This generation contains much lower Σ REY, and features a flatter chondrite-normalised REY-fractionation trend (Figure 9b), as well as a smaller, negative Eu-anomaly and negative Y-anomaly. The trends for sample 751008 appear relatively noisy due to the very low absolute REY concentrations. The Y-anomaly can readily be explained by the co-existence with hydrothermal fluorite (see below), as well as xenotime and other hydrothermal REY-bearing minerals into which Y will preferentially partition.

The two generations of hematite contain very different concentrations of other common, minor constituents. Figure 10a and b shows how the two generations may be



Figure 9 REY Fractionation trends for hematite and fluorite (a-d) and BSE images (e-f) showing the two textural types of hematite. See text for further details.

discriminated in terms of (Th+U) and U vs. (W+Sn+Mo). Note that Th concentrations are particularly high in this generation. The early generation has much higher (Th+U) but the second generation is characterised by enrichment of the granitophile elements by several orders of magnitude. The excellent correlation between (Th+U) and REY is depicted in Figure 10c. The much lower U and Th concentrations in the second generation hematite also relates to the presence of minerals such as coffinite into which Th and U will preferentially partition. Excellent discriminations between the two groups are seen on the plots of Ni vs. Cr (Figure 10d), V vs. Nb (Figure 10e), Mn vs. Co (Figure 10f) and Cr vs. Ti (Figure 10g). These differences are efficiently summarised in a final plot (Figure 10h), in which the relative enrichment in granitophile elements (U+Th+Sn+W+Mo) in the second generation contrasts with enrichment in transition elements (Co, Ni, Mn, Zn) in the early magnetite.

LA-ICP-MS element maps of the second generation of hematite typically occurring along veins (Figure 11) confirm the presence of elements of interest within the hematite, notably Sn, W, Nb, Ta, U and Th, as well as other elements more common in hematite such as Ti and V. The maps also show zonation with sets of zones perpendicular to the long axis of each lamella with respect to W, Sn, Nb, Ta, V. In contrast, other elements show heterogeneity relative to the overall aggregate of hematite, i.e., marked depletion in REY (Ce and Y shown), U and Th in the coarser lamellae. The two types of element distribution can be attributed to (i) primary growth and (ii) superimposed overprint, respectively. Potassium feldspar at the top of the map contains some albite which is seen to be a carrier of Sr and Ga; Ba is present in both types of feldspar.



Figure 10 Geochemical discriminant diagrams for different types of hematite. See text for further details.


Figure 11 LA-ICP-MS element maps of bladed hematite (sample 751008). Note internal compositional zonation (sets of zones perpendicular to the long axis of each lamellae) with respect to Ti, Sn, W, Nb, Ta and V. Note that part of the aggregate is depleted in Ce, Y, U and Th. Note also partial replacement of Ba-bearing K-Feldspar (at the top) by albite. Scale bars are counts per second. Log scale bars are used for elements; Al, Nb, Sn, Ta, Ti, U V, W and Y. The log scale bars are 10^n where *n* is the number on the scale bar.

MAGNETITE AND ILMENITE

Trace element patterns for accessory magnetite are distinct, and broadly reflect partitioning with co-existing ilmenite. Analysed ilmenite is present as relicts undergoing decomposition to rutile. The mineral carries high concentrations of REY (Table 2). Chondrite-normalised REY-fractionation trends (Figure 9d) are flat with a strong negative Eu-anomaly.

| | Mg | Al | Si | Р | Sc | Ti | v | Cr | Mn | Fe | Со | Ni | Cu | Zn | Ga | As | Sr | Y | Zr | Nb | Мо | Sn | Sb | |
|---|--|---|--|--|--|---|--|---|---|--|---|---|---|--|---|---|--|---|---|---|---|--|---|--|
| 845007Fluor-1 | 24 | <0.43 | 194 | <15 | < 0.14 | <4.1 | <0.09 | <0.92 | 19 | 485 | 5.6 | 0.11 | <0.85 | <1.2 | <0.00 | <0.82 | 5.9 | 688 | <0.07 | 0.05 | 0.73 | <0.08 | <0.10 | |
| 845007Fluor-2 | 28 | 0.97 | 197 | <17 | <0.17 | <4.8 | <0.11 | <0.45 | 16 | 638 | <0.15 | 0.32 | 1.9 | <2.5 | <0.09 | 1.3 | 6.9 | 710 | <0.00 | 0.18 | 0.14 | 0.39 | <0.17 | |
| 845007Fluor-3 | 27 | 4.5 | 325 | <12 | 0.21 | 12 | <0.07 | <0.55 | 19 | 659 | 1.8 | 0.59 | 1.2 | 46 | < 0.00 | 0.67 | 5.5 | 909 | 6.3 | 10 | 0.21 | 0.19 | <0.06 | |
| 845007Fluor-4 | 19 | 33 | <127 | <12 | <0.15 | <3.8 | <0.12 | <1.0 | 17 | 514 | 1.5 | <0.37 | <0.62 | <1.1 | <0.00 | <0.85 | 5.4 | 936 | <0.25 | 0.20 | 7.0 | <0.07 | 0.10 | |
| 845007Fluor-5 | 2385 | 3743 | 5013 | 13 | 3.6 | 29 | 4.7 | 0.42 | 49 | 6770 | 0.78 | 1.0 | 4.7 | 5.3 | 4.3 | <0.62 | 7.2 | 892 | 2.8 | 13 | 6.7 | 0.44 | <0.11 | |
| 845007Fluor-6 | 17 | 0.99 | <134 | <15 | 0.20 | 4.0 | <0.13 | <0.90 | 15 | 540 | 0.16 | 0.50 | <0.87 | <1.5 | <0.12 | <0.80 | 5.1 | 1036 | <0.00 | 0.03 | 0.30 | 0.09 | <0.12 | |
| 845007Fluor-7 | 17 | <0.38 | 174 | <13 | <0.18 | 4.1 | 0.27 | 0.48 | 18 | 484 | 2.3 | <0.45 | <1.1 | 1.4 | < 0.00 | <0.72 | 4.9 | 1070 | 0.02 | 0.13 | 0.18 | 0.07 | <0.06 | |
| 845007Fluor-8 | 6261 | 8102 | 10502 | <19 | 2.7 | 9.1 | 15 | <0.71 | 89 | 15947 | 27 | 1.4 | 2.31 | 8.4 | 12 | 1.3 | 11 | 1157 | <2.6 | 2.0 | 0.11 | 0.86 | <0.14 | |
| 845007Fluor-9 | 14 | 2.8 | 204 | <19 | 0.28 | <5.2 | <0.11 | <0.74 | 15 | 539 | 1.2 | <0.46 | 3.5 | 22 | <0.07 | <0.85 | 7.1 | 1248 | <0.00 | 0.08 | 0.15 | <0.09 | <0.14 | |
| 845007Fluor-10 | 12 | 89 | 533 | <13 | 0.32 | 4.7 | <0.07 | <0.53 | 13 | 452 | 0.27 | 0.08 | 1.2 | <1.2 | 0.08 | 0.84 | 12 | 1330 | 2.3 | 0.50 | 8.7 | 0.07 | 0.06 | |
| 845007Fluor-11 | 210 | 311 | 909 | 14 | 0.54 | <3.4 | 0.35 | <0.40 | 24 | 1024 | 0.51 | 0.50 | <0.69 | <1.4 | 0.65 | 1.1 | 5.2 | 1303 | <0.06 | 0.53 | 0.31 | 0.11 | <0.06 | |
| 845007Fluor-12 | 28 | 8332 | 18304 | <19 | 0.55 | <4.1 | 0.37 | <1.2 | 13 | 775 | 0.45 | 0.33 | <1.3 | 2.3 | 2.4 | <0.87 | 12.7 | 1437 | 22 | 3.9 | 0.09 | 0.19 | <0.18 | |
| 845007Fluor-13 | 415 | 474 | 630 | <14 | 0.43 | <3.0 | 1.1 | <0.64 | 19 | 1532 | 0.64 | 0.25 | 1.5 | 2.6 | 1.1 | 0.71 | 7.4 | 1619 | 0.14 | 0.20 | 0.02 | 0.10 | <0.13 | |
| 845007Fluor-14 | 23 | <0.53 | 144 | <17 | 0.30 | <3.6 | 0.05 | 0.75 | 20 | 617 | <0.17 | 0.50 | <0.84 | <1.5 | <0.08 | <0.78 | 7.0 | 1836 | <0.00 | 0.10 | 0.11 | <0.07 | <0.12 | |
| 845007Fluor-15 | 17 | <0.56 | <155 | 23 | <0.21 | <4.4 | <0.05 | <1.1 | 15 | 592 | 15 | 0.39 | <1.3 | 6.0 | <0.00 | <0.94 | 8.1 | 1898 | 0.02 | 0.09 | 0.12 | <0.09 | <0.11 | |
| 845007Fluor-16 | 14 | 0.82 | 180 | <15 | 0.15 | 5.9 | <0.09 | <0.84 | 14 | 547 | 0.08 | 0.43 | 3.2 | <1.8 | <0.08 | <0.70 | 8.3 | 1945 | 1.5 | 0.09 | 0.10 | <0.09 | <0.09 | |
| 845007Fluor-17 | 13 | <0.42 | <135 | <16 | 0.33 | <3.7 | <0.09 | <0.59 | 14 | 551 | 2.0 | 0.29 | <0.83 | <1.7 | <0.06 | 1.4 | 9.1 | 1993 | <0.05 | 0.15 | 0.04 | <0.08 | <0.11 | |
| Mean (n=17) | 560 | 1758 | 2870 | 17 | 0.80 | 9.8 | 3.1 | 0.55 | 23 | 1922 | 4.0 | 0.48 | 2.4 | 12 | 3.4 | 1.1 | 7.6 | 1295 | 4.4 | 1.8 | 1.5 | 0.25 | 0.08 | |
| S.D. | 1577 | 3196 | 5517 | 5.4 | 1.1 | 9.0 | 5.3 | 0.18 | 19 | 3914 | 7.5 | 0.35 | 1.3 | 15 | 4.5 | 0.32 | 2.3 | 432 | 7.6 | 3.8 | 2.9 | 0.25 | 0.03 | |
| Maximum | 6261 | 8332 | 18304 | 23 | 3.6 | 29 | 15 | 0.75 | 89 | 15947 | 27 | 1.4 | 4.7 | 46 | 12 | 1.4 | 13 | 1993 | 22 | 13 | 8.7 | 0.86 | 0.10 | |
| Minimum | 12 | 0.82 | 144 | 13 | 0.15 | 4.0 | 0.05 | 0.42 | 13 | 452 | 0.08 | 0.08 | 1.2 | 1.4 | 0.08 | 0.67 | 4.9 | 688 | 0.02 | 0.03 | 0.02 | 0.07 | 0.06 | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ва | La | Ce | Pr | Nd | Sm | Eu | Gd | Тb | Dy | Но | Er | Tm | Yb | Lu | ΣREY | Hf | Та | w | ²⁰⁶ Pb | ²⁰⁷ Pb | ²⁰⁸ Pb | Th | U |
| 845007Fluor-1 | Ba 0.14 | La 17 | Ce 40 | Pr 5.6 | Nd 28 | Sm 11 | Eu 0.23 | Gd 21 | Tb 3.4 | Dy 26 | Ho 7.1 | Er 26 | Tm 3.7 | Yb 28 | Lu 4.3 | ΣREY 909 | Hf <0.04 | Ta 0.01 | W 23 | ²⁰⁶ Pb 0.32 | ²⁰⁷ Pb <0.03 | ²⁰⁸ Pb 0.07 | Th 0.24 | U 0.28 |
| 845007Fluor-1 845007Fluor-2 | Ba 0.14 0.13 | La 17 15 | Ce 40 45 | Pr 5.6 6.8 | Nd 28 34 | Sm 11 12 | Eu 0.23 0.28 | Gd 21 20 | Tb 3.4 3.3 | Dy 26 27 | Ho 7.1 6.6 | Er 26 25 | Tm 3.7 3.9 | Yb 28 30 | Lu 4.3 5.2 | ΣREY 909 943 | Hf <0.04 0.03 | Ta 0.01 <0.00 | W 23 16 | ²⁰⁶ Pb 0.32 0.38 | ²⁰⁷ Pb <0.03 | ²⁰⁸ Pb 0.07 0.09 | Th 0.24 0.21 | U 0.28 0.31 |
| 845007Fluor-1 845007Fluor-2 845007Fluor-3 | Ba 0.14 0.13 <0.00 | La 17 15 20 | Ce 40 45 54 | Pr 5.6 6.8 8.4 | Nd 28 34 42 | Sm 11 12 16 | Eu 0.23 0.28 0.26 | Gd 21 20 29 | Tb 3.4 3.3 4.5 | Dy 26 27 34 | Ho 7.1 6.6 8.2 | Er 26 25 30 | Tm 3.7 3.9 5.0 | Yb 28 30 38 | Lu 4.3 5.2 7.0 | ΣREY 909 943 1206 | Hf <0.04 0.03 0.30 | Ta 0.01 <0.00 1.8 | W 23 16 17 | ²⁰⁶ Pb 0.32 0.38 5.6 | ²⁰⁷ Pb <0.03 0.06 0.95 | ²⁰⁸ Pb 0.07 0.09 1.5 | Th 0.24 0.21 14 | U 0.28 0.31 25 |
| 845007Fluor-1 845007Fluor-2 845007Fluor-3 845007Fluor-4 | Ba 0.14 0.13 <0.00 <0.00 | La 17 15 20 16 | Ce 40 45 54 44 | Pr 5.6 6.8 8.4 7.5 | Nd 28 34 42 39 | Sm 11 12 16 17 | Eu 0.23 0.28 0.26 0.28 | Gd 21 20 29 29 | Tb 3.4 3.3 4.5 4.4 | Dy 26 27 34 33 | Ho 7.1 6.6 8.2 8.2 | Er 26 25 30 29 | Tm 3.7 3.9 5.0 4.7 | Yb 28 30 38 37 | Lu 4.3 5.2 7.0 6.5 | ΣREY 909 943 1206 1212 | Hf <0.04 0.03 0.30 <0.00 | Ta 0.01 <0.00 1.8 0.01 | W 23 16 17 18 | ²⁰⁶ Pb 0.32 0.38 5.6 0.34 | ²⁰⁷ Pb <0.03 0.06 0.95 0.08 | ²⁰⁸ Pb 0.07 0.09 1.5 0.11 | Th 0.24 0.21 14 0.22 | U 0.28 0.31 25 0.16 |
| 845007Fluor-1 845007Fluor-2 845007Fluor-3 845007Fluor-4 845007Fluor-5 | Ba 0.14 0.13 <0.00 <0.00 2.22 | La 17 15 20 16 31 | Ce 40 45 54 44 77 | Pr 5.6 6.8 8.4 7.5 11 | Nd 28 34 42 39 52 | Sm 11 12 16 17 20 | Eu 0.23 0.28 0.26 0.28 0.42 | Gd 21 20 29 29 32 | Tb 3.4 3.3 4.5 4.4 4.8 | Dy 26 27 34 33 35 | Ho 7.1 6.6 8.2 8.2 8.2 8.7 | Er 26 25 30 29 31 | Tm 3.7 3.9 5.0 4.7 4.5 | Yb 28 30 38 37 34 | Lu 4.3 5.2 7.0 6.5 5.7 | ΣREY 909 943 1206 1212 1239 | Hf <0.04 0.03 0.30 <0.00 0.10 | Ta 0.01 <0.00 1.8 0.01 1.3 | W 23 16 17 18 20 | ²⁰⁶ Pb 0.32 0.38 5.6 0.34 6.6 | 207 Pb <0.03 0.06 0.95 0.08 1.2 | ²⁰⁸ Pb 0.07 0.09 1.5 0.11 2.0 | Th 0.24 0.21 14 0.22 34 | U 0.28 0.31 25 0.16 31 |
| 845007Fluor-1 845007Fluor-2 845007Fluor-3 845007Fluor-4 845007Fluor-5 845007Fluor-6 | Ba 0.14 0.13 <0.00 <0.00 2.22 <0.00 | La 17 15 20 16 31 18 | Ce 40 45 54 44 77 49 | Pr 5.6 6.8 8.4 7.5 11 8.1 | Nd 28 34 42 39 52 43 | Sm 11 12 16 17 20 18 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 | Gd 21 20 29 29 32 30 | Tb 3.4 3.3 4.5 4.4 4.8 4.8 | Dy 26 27 34 33 35 35 | Ho 7.1 6.6 8.2 8.2 8.7 9.3 | Er 26 25 30 29 31 33 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 | Yb 28 30 38 37 34 45 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 | ΣREY 909 943 1206 1212 1239 1342 | Hf <0.04 0.03 0.30 <0.00 0.10 0.04 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 | W 23 16 17 18 20 17 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 | 207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 | ²⁰⁸Pb 0.07 0.09 1.5 0.11 2.0 0.08 | Th 0.24 0.21 14 0.22 34 0.25 | U 0.28 0.31 25 0.16 31 0.20 |
| 845007Fluor-1 845007Fluor-2 845007Fluor-3 845007Fluor-4 845007Fluor-5 845007Fluor-6 845007Fluor-7 | Ba 0.14 0.13 <0.00 <0.00 2.22 <0.00 <0.32 | La 17 15 20 16 31 18 19 | Ce 40 45 54 44 77 49 50 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 | Nd 28 34 42 39 52 43 41 | Sm 11 12 16 17 20 18 17 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.31 | Gd 21 20 29 29 32 30 31 | Tb 3.4 3.3 4.5 4.4 4.8 4.8 5.0 | Dy 26 27 34 33 35 35 35 36 | Ho 7.1 6.6 8.2 8.2 8.7 9.3 9.0 | Er 26 25 30 29 31 33 32 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 | Yb 28 30 38 37 34 45 45 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 | Σ REY 909 943 1206 1212 1239 1342 1375 | Hf <0.04 0.03 0.30 <0.00 0.10 0.04 <0.04 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 <0.00 | W 23 16 17 18 20 17 17 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 | <pre>207Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10</pre> | ²⁰⁸Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 | Th 0.24 0.21 14 0.22 34 0.25 0.24 | U 0.28 0.31 25 0.16 31 0.20 0.15 |
| 845007Fluor-1 845007Fluor-2 845007Fluor-3 845007Fluor-4 845007Fluor-5 845007Fluor-6 845007Fluor-7 845007Fluor-8 | Ba 0.14 0.13 <0.00 <0.00 2.22 <0.00 <0.32 1.0 | La 17 15 20 16 31 18 19 17 | Ce 40 45 54 44 77 49 50 46 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 8.2 | Nd 28 34 42 39 52 43 41 48 | Sm 11 12 16 17 20 18 17 17 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.31 0.29 | Gd 21 20 29 29 32 30 31 30 | Tb 3.4 3.3 4.5 4.4 4.8 5.0 4.9 | Dy 26 27 34 33 35 35 36 38 | Ho 7.1 6.6 8.2 8.2 8.7 9.3 9.0 10 | Er 26 25 30 29 31 33 32 36 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 6.1 | Yb 28 30 38 37 34 45 45 54 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 10 | Σ REY 909 943 1206 1212 1239 1342 1375 1482 | Hf <0.04 0.03 0.30 <0.00 0.10 0.04 <0.04 <0.162 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 <0.00 0.52 | W 23 16 17 18 20 17 17 14 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 4.2 | <pre>207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10 0.60</pre> | ²⁰⁸Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 1.1 | Th 0.24 0.21 14 0.22 34 0.25 0.24 0.59 | U 0.28 0.31 25 0.16 31 0.20 0.15 1.33 |
| 845007Fluor-1 845007Fluor-2 845007Fluor-3 845007Fluor-4 845007Fluor-5 845007Fluor-6 845007Fluor-7 845007Fluor-8 845007Fluor-9 | Ba 0.14 0.13 <0.00 <0.00 2.22 <0.00 <0.32 1.0 <0.41 | La 17 15 20 16 31 18 19 17 18 | Ce 40 45 54 44 77 49 50 46 48 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 8.2 8.3 | Nd 28 34 42 39 52 43 41 48 47 | Sm 11 12 16 17 20 18 17 17 18 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.31 0.29 0.26 | Gd 21 20 29 29 32 30 31 30 29 | Tb 3.4 3.3 4.5 4.4 4.8 4.8 5.0 4.9 5.0 | Dy 26 27 34 33 35 35 35 36 38 38 | Ho 7.1 6.6 8.2 8.2 8.7 9.3 9.0 10 10 | Er 26 25 30 29 31 33 32 36 37 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 6.1 6.6 | Yb 28 30 38 37 34 45 45 54 55 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 10 10 | Σ REY 909 943 1206 1212 1239 1342 1375 1482 1579 | Hf <0.04 0.03 0.30 <0.00 0.10 0.04 <0.04 <0.04 <0.04 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 <0.00 0.52 <0.00 | W 23 16 17 18 20 17 17 14 13 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 4.2 <0.06 | <pre>207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10 0.60 0.07</pre> | ²⁰⁸Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 1.1 0.06 | Th 0.24 0.21 14 0.22 34 0.25 0.24 0.59 0.18 | U 0.28 0.31 25 0.16 31 0.20 0.15 1.33 0.09 |
| 845007Fl uor-1 845007Fl uor-2 845007Fl uor-3 845007Fl uor-4 845007Fl uor-5 845007Fl uor-6 845007Fl uor-8 845007Fl uor-9 845007Fl uor-10 | Ba 0.14 0.13 <0.00 <0.00 2.22 <0.00 <0.32 1.0 <0.41 0.10 | La 17 15 20 16 31 18 19 17 18 18 | Ce 40 45 54 44 77 49 50 46 48 45 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 8.2 8.3 7.9 | Nd 28 34 42 39 52 43 41 48 47 45 | Sm 11 12 16 17 20 18 17 17 18 19 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.31 0.29 0.26 0.38 | Gd 21 20 29 32 30 31 30 29 29 | Tb 3.4 3.3 4.5 4.4 4.8 5.0 4.9 5.0 5.0 | Dy 26 27 34 33 35 35 36 38 38 38 39 | Ho 7.1 6.6 8.2 8.2 8.7 9.3 9.0 10 10 10 | Er 26 25 30 29 31 33 32 36 37 36 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 6.1 6.6 6.3 | Yb 28 30 38 37 34 45 45 54 55 55 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 10 10 10 | Σ REY 909 943 1206 1212 1239 1342 1375 1482 1579 1656 | Hf <0.04 0.03 0.30 <0.00 0.10 0.04 <0.04 <0.04 <0.04 <0.00 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 <0.00 0.52 <0.00 0.07 | W 23 16 17 18 20 17 17 14 13 13 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 4.2 <0.06 0.85 | <pre>207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10 0.60 0.07 0.27</pre> | 208 Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 1.1 0.06 0.39 | Th 0.24 0.21 14 0.22 34 0.25 0.24 0.59 0.18 0.30 | U 0.28 0.31 25 0.16 31 0.20 0.15 1.33 0.09 1.8 |
| 845007Fl uor-1 845007Fl uor-2 845007Fl uor-3 845007Fl uor-4 845007Fl uor-5 845007Fl uor-6 845007Fl uor-7 845007Fl uor-8 845007Fl uor-10 845007Fl uor-10 | Ba 0.14 0.13 <0.00 2.22 <0.00 <0.32 1.0 <0.41 0.10 <0.00 | La 17 15 20 16 31 18 19 17 18 18 23 | Ce 40 45 54 44 77 49 50 46 48 45 57 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 8.2 8.3 7.9 8.3 | Nd 28 34 42 39 52 43 41 48 47 45 46 | Sm 11 12 16 17 20 18 17 17 18 19 22 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.31 0.29 0.26 0.38 0.32 | Gd 21 20 29 32 30 31 30 29 29 29 37 | Tb 3.4 3.3 4.5 4.4 4.8 5.0 4.9 5.0 5.0 6.3 | Dy 26 27 34 33 35 35 36 38 38 39 46 | Ho 7.1 6.6 8.2 8.2 8.7 9.3 9.0 10 10 10 11 | Er 26 25 30 29 31 33 32 36 37 36 40 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 6.1 6.6 6.3 6.2 | Yb 28 30 38 37 34 45 45 54 55 55 51 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 10 10 10 8.3 | Σ REY 909 943 1206 1212 1239 1342 1375 1482 1579 1656 1666 | Hf <0.04 0.03 0.00 0.10 0.04 <0.04 <0.04 <0.00 0.04 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 <0.00 0.52 <0.00 0.07 0.04 | W 23 16 17 18 20 17 17 14 13 13 21 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 4.2 <0.06 0.85 0.69 | <pre>207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10 0.60 0.07 0.27 0.06</pre> | 208 Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 1.1 0.06 0.39 0.11 | Th 0.24 0.21 14 0.22 34 0.25 0.24 0.59 0.18 0.30 0.29 | U 0.28 0.31 25 0.16 31 0.20 0.15 1.33 0.09 1.8 1.6 |
| 845007Fl uor-1 845007Fl uor-2 845007Fl uor-3 845007Fl uor-4 845007Fl uor-5 845007Fl uor-6 845007Fl uor-7 845007Fl uor-9 845007Fl uor-11 845007Fl uor-11 | Ba 0.14 0.13 <0.00 2.22 <0.00 <0.32 1.0 <0.41 0.10 <0.00 1.1 | La 17 15 20 16 31 18 19 17 18 18 23 19 | Ce 40 45 54 44 77 49 50 46 48 45 57 49 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 8.2 8.3 7.9 8.3 8.6 | Nd 28 34 42 39 52 43 41 48 47 45 46 48 | Sm 11 12 16 17 20 18 17 17 18 19 22 19 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.29 0.26 0.38 0.32 0.41 | Gd 21 20 29 32 30 31 30 29 29 37 33 | Tb 3.4 3.3 4.5 4.4 4.8 5.0 4.9 5.0 5.0 6.3 5.3 | Dy 26 27 34 33 35 35 36 38 38 39 46 41 | Ho 7.1 6.6 8.2 8.2 8.7 9.3 9.0 10 10 10 10 11 11 | Er 26 25 30 29 31 33 32 36 37 36 40 41 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 6.1 6.6 6.3 6.2 7.4 | Yb 28 30 38 37 34 45 54 55 51 60 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 10 10 10 8.3 12 | Σ REY 909 943 1206 1212 1239 1342 1375 1482 1579 1656 1666 1792 | Hf <0.04 0.03 0.30 <0.00 0.10 0.04 <0.04 <0.04 <0.00 0.04 0.63 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 <0.00 0.52 <0.00 0.07 0.04 0.65 | W 23 16 17 18 20 17 17 14 13 13 21 12 | <pre>206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 4.2 <0.06 0.85 0.69 2.6</pre> | <pre>207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10 0.60 0.07 0.27 0.06 0.77</pre> | 208 Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 1.1 0.06 0.39 0.11 0.90 | Th 0.24 0.21 14 0.22 34 0.25 0.24 0.59 0.18 0.30 0.29 5.0 | U 0.28 0.31 25 0.16 31 0.20 0.15 1.33 0.09 1.8 1.6 4.3 |
| 845007Fl uor-1 845007Fl uor-2 845007Fl uor-3 845007Fl uor-4 845007Fl uor-5 845007Fl uor-6 845007Fl uor-7 845007Fl uor-9 845007Fl uor-11 845007Fl uor-11 845007Fl uor-12 | Ba 0.14 0.13 <0.00 2.22 <0.00 <0.32 1.0 <0.41 0.10 <0.00 1.1 <0.28 | La 17 15 20 16 31 18 19 17 18 18 23 19 22 | Ce 40 45 54 44 77 49 50 46 48 45 57 49 56 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 8.2 8.3 7.9 8.3 8.6 9.3 | Nd 28 34 42 39 52 43 41 48 47 45 46 48 52 | Sm 11 12 16 17 20 18 17 17 18 19 22 19 20 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.29 0.26 0.38 0.32 0.41 0.40 | Gd 21 20 29 32 30 31 30 29 29 37 33 33 | Tb 3.4 3.3 4.5 4.4 4.8 5.0 4.9 5.0 5.0 6.3 5.3 5.7 | Dy 26 27 34 33 35 35 36 38 38 38 39 46 41 42 | Ho 7.1 6.6 8.2 8.2 8.7 9.3 9.0 10 10 10 10 11 11 11 | Er 26 25 30 29 31 33 32 36 37 36 40 41 44 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 6.1 6.6 6.3 6.2 7.4 8.2 | Yb 28 30 38 37 34 45 55 51 60 74 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 10 10 10 8.3 12 15 | Σ REY 909 943 1206 1212 1239 1342 1375 1482 1579 1656 1666 1792 2012 | Hf <0.04 0.03 0.30 <0.00 0.10 0.04 <0.04 <0.04 <0.00 0.04 0.03 <0.033 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 <0.00 0.52 <0.00 0.07 0.04 0.65 0.01 | W 23 16 17 18 20 17 17 14 13 13 21 12 11 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 4.2 <0.06 0.85 0.69 2.6 0.60 | <pre>207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10 0.60 0.07 0.27 0.06 0.77 0.07</pre> | 208 Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 1.1 0.06 0.39 0.11 0.90 0.18 | Th 0.24 0.21 14 0.22 34 0.25 0.24 0.59 0.18 0.30 0.29 5.0 0.19 | U 0.28 0.31 25 0.16 31 0.20 0.15 1.33 0.09 1.8 1.6 4.3 0.14 |
| 845007Fl uor-1 845007Fl uor-2 845007Fl uor-3 845007Fl uor-4 845007Fl uor-5 845007Fl uor-6 845007Fl uor-7 845007Fl uor-9 845007Fl uor-10 845007Fl uor-11 845007Fl uor-12 845007Fl uor-13 | Ba 0.14 0.13 <0.00 2.22 <0.00 <0.32 1.0 <0.41 0.10 <0.00 1.1 <0.28 <0.48 | La 17 15 20 16 31 18 19 17 18 18 23 19 22 34 | Ce 40 45 54 44 77 49 50 46 48 45 57 49 56 85 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 8.2 8.3 7.9 8.3 8.6 9.3 13 | Nd 28 34 42 39 52 43 41 48 47 45 46 48 52 68 | Sm 11 12 16 17 20 18 17 17 18 19 22 19 20 25 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.29 0.26 0.38 0.32 0.41 0.40 0.42 | Gd 21 20 29 32 30 31 30 29 29 37 33 33 41 | Tb 3.4 3.3 4.5 4.4 4.8 5.0 4.9 5.0 5.0 6.3 5.3 5.7 7.4 | Dy 26 27 34 33 35 36 38 38 38 39 46 41 42 52 | Ho 7.1 6.6 8.2 8.7 9.3 9.0 10 10 10 11 11 11 12 14 | Er 26 25 30 29 31 33 32 36 37 36 40 41 44 54 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 6.1 6.6 6.3 6.2 7.4 8.2 10 | Yb 28 30 38 37 34 45 55 51 60 74 93 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 10 10 10 8.3 12 15 18 | Σ REY 909 943 1206 1212 1239 1342 1375 1482 1579 1656 1666 1792 2012 2351 | Hf <0.04 0.03 0.30 <0.00 0.10 0.04 <0.04 <0.04 0.04 0.04 0.03 <0.033 <0.00 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 <0.00 0.52 <0.00 0.07 0.04 0.65 0.01 0.02 | W 23 16 17 18 20 17 17 14 13 13 21 12 11 17 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 4.2 <0.66 0.85 0.69 2.6 0.60 0.20 | <pre>207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10 0.60 0.07 0.27 0.06 0.77 0.07 0.07</pre> | 208 Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 1.1 0.06 0.39 0.11 0.90 0.18 0.12 | Th 0.24 0.21 14 0.22 34 0.25 0.24 0.59 0.18 0.30 0.29 5.0 0.19 0.34 | U 0.28 0.31 25 0.16 31 0.20 0.15 1.33 0.09 1.8 1.6 4.3 0.14 0.17 |
| 845007Fl uor-1 845007Fl uor-2 845007Fl uor-3 845007Fl uor-4 845007Fl uor-5 845007Fl uor-6 845007Fl uor-7 845007Fl uor-10 845007Fl uor-11 845007Fl uor-12 845007Fl uor-13 845007Fl uor-14 | Ba 0.14 0.13 <0.00 2.22 <0.00 <0.32 1.0 <0.41 0.10 <0.00 1.1 <0.28 <0.48 <0.00 | La 17 15 20 16 31 18 19 17 18 18 23 19 22 34 33 | Ce 40 45 54 44 77 49 50 46 48 45 57 49 56 85 81 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 8.2 8.3 7.9 8.3 8.6 9.3 13 13 | Nd 28 34 42 39 52 43 41 48 47 45 46 48 52 68 69 | Sm 11 12 16 17 20 18 17 17 18 19 22 19 20 25 27 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.29 0.26 0.38 0.32 0.41 0.40 0.42 0.39 | Gd 21 20 29 32 30 31 30 29 29 37 33 33 41 45 | Tb 3.4 3.3 4.5 4.4 4.8 5.0 4.9 5.0 5.0 6.3 5.3 5.7 7.4 7.3 | Dy 26 27 34 33 35 36 38 38 39 46 41 42 52 57 | Ho 7.1 6.6 8.2 8.7 9.3 9.0 10 10 10 11 11 11 12 14 14 | Er 26 25 30 29 31 33 32 36 37 36 40 41 44 54 57 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 6.1 6.6 6.3 6.2 7.4 8.2 10 11 | Yb 28 30 38 37 34 45 55 54 55 51 60 74 93 96 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 10 10 10 8.3 12 15 18 19 | Σ REY 909 943 1206 1212 1342 1375 1482 1579 16566 1666 1792 2012 2351 2428 | Hf <0.04 0.03 0.30 <0.00 0.10 0.04 <0.062 0.04 <0.00 0.04 0.03 <0.033 <0.00 <0.00 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 <0.00 0.52 <0.00 0.07 0.04 0.65 0.01 0.02 <0.00 | W 23 16 17 18 20 17 17 14 13 13 21 12 11 17 15 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 4.2 <0.66 0.85 0.69 2.6 0.60 0.20 0.15 | <pre>207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10 0.60 0.07 0.27 0.06 0.77 0.07 0.07 0.07 0.07</pre> | 208 Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 1.1 0.06 0.39 0.11 0.90 0.18 0.12 0.04 | Th 0.24 0.21 14 0.22 34 0.25 0.24 0.59 0.18 0.30 0.29 5.0 0.19 0.34 0.33 | U 0.28 0.31 25 0.16 31 0.20 0.15 1.33 0.09 1.8 1.6 4.3 0.14 0.17 0.17 |
| 845007Fl uor-1 845007Fl uor-2 845007Fl uor-3 845007Fl uor-4 845007Fl uor-5 845007Fl uor-6 845007Fl uor-7 845007Fl uor-10 845007Fl uor-11 845007Fl uor-11 845007Fl uor-13 845007Fl uor-14 | Ba 0.14 0.13 <0.00 2.22 <0.00 <0.32 1.0 <0.41 0.10 <0.00 1.1 <0.28 <0.48 <0.00 <0.00 <0.00 | La 17 15 20 16 31 18 19 17 18 18 23 19 22 34 33 32 | Ce 40 45 54 44 77 49 50 46 48 45 57 49 56 85 81 75 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 8.2 8.3 7.9 8.3 8.6 9.3 13 13 13 | Nd 28 34 42 39 52 43 41 48 47 45 46 48 52 68 69 63 | Sm 11 12 16 17 20 18 17 17 18 19 22 19 20 25 27 24 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.29 0.26 0.38 0.32 0.41 0.40 0.42 0.39 0.37 | Gd 21 20 29 32 30 31 30 29 29 37 33 33 41 45 39 | Tb 3.4 3.3 4.5 4.4 4.8 5.0 4.9 5.0 5.0 6.3 5.3 5.7 7.4 7.3 7.0 | Dy 26 27 34 33 35 36 38 38 39 46 41 42 52 57 56 | Ho 7.1 6.6 8.2 8.7 9.3 9.0 10 10 10 11 11 11 12 14 14 15 | Er 26 25 30 29 31 33 32 36 37 36 40 41 44 54 57 55 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 6.1 6.6 6.3 6.2 7.4 8.2 10 11 10 | Yb 28 30 38 37 34 45 55 51 60 74 93 96 99 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 10 10 10 8.3 12 15 18 19 20 | Σ REY 909 943 1206 1212 1342 1375 1482 1579 16566 1666 1792 2012 2351 2428 2453 | Hf <0.04 0.03 0.30 <0.00 0.10 0.04 <0.162 0.04 <0.00 0.04 0.03 <0.033 <0.00 <0.00 <0.05 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 <0.00 0.52 <0.00 0.07 0.04 0.65 0.01 0.02 <0.00 0.01 | W 23 16 17 18 20 17 17 14 13 13 21 11 17 15 12 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 4.2 <0.06 0.69 2.6 0.60 0.20 0.15 0.34 | <pre>207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10 0.60 0.07 0.27 0.06 0.77 0.07 0.07 0.07 0.07 0.07 0.0</pre> | 208 Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 1.1 0.06 0.39 0.11 0.90 0.18 0.12 0.04 0.13 | Th 0.24 0.21 14 0.22 34 0.25 0.24 0.59 0.18 0.30 0.29 5.0 0.19 0.34 0.33 0.64 | U 0.28 0.31 25 0.16 31 0.20 0.15 1.33 0.09 1.8 1.6 4.3 0.14 0.17 0.17 0.23 |
| 845007Fl uor-1 845007Fl uor-2 845007Fl uor-3 845007Fl uor-4 845007Fl uor-5 845007Fl uor-6 845007Fl uor-7 845007Fl uor-9 845007Fl uor-10 845007Fl uor-12 845007Fl uor-12 845007Fl uor-14 845007Fl uor-15 | Ba 0.14 0.13 <0.00 2.22 <0.00 <0.32 1.0 <0.41 0.10 <0.00 1.1 <0.28 <0.48 <0.00 <0.00 <0.45 | La 17 15 20 16 31 18 19 17 18 18 23 19 22 34 33 32 35 | Ce 40 45 54 44 77 49 50 46 48 45 57 49 56 85 81 75 82 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 8.2 8.3 7.9 8.3 8.6 9.3 13 13 13 13 | Nd 28 34 42 39 52 43 41 48 47 45 46 48 52 68 69 63 69 | Sm 11 12 16 17 20 18 17 17 18 19 22 19 20 25 27 24 26 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.29 0.26 0.38 0.32 0.41 0.40 0.42 0.39 0.37 0.36 | Gd 21 20 29 32 30 31 30 29 29 37 33 33 41 45 39 44 | Tb 3.4 3.3 4.5 4.4 4.8 5.0 5.0 6.3 5.0 6.3 5.7 7.4 7.3 7.0 8.1 | Dy 26 27 34 33 35 36 38 38 39 46 41 42 52 57 56 59 | Ho 7.1 6.6 8.2 8.7 9.3 9.0 10 10 10 10 11 11 12 14 14 15 16 | Er 26 25 30 29 31 33 32 36 37 36 40 41 44 54 57 55 61 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 6.1 6.6 6.3 6.2 7.4 8.2 10 11 10 11 | Yb 28 30 38 37 34 45 55 55 55 51 60 74 93 96 99 104 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 10 10 10 8.3 12 15 18 19 20 21 | Σ REY 909 943 1206 1212 1342 1375 1482 1579 1656 1666 1666 1792 2012 2351 2428 2453 2543 | Hf <0.04 0.03 0.00 0.10 0.04 <0.04 <0.162 0.04 <0.00 0.04 0.03 <0.03 <0.00 <0.00 <0.05 0.01 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 <0.00 0.52 <0.00 0.07 0.04 0.65 0.01 0.02 <0.00 0.01 <0.02 | W 23 16 17 18 20 17 14 13 21 13 21 11 17 15 12 13 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 4.2 <0.06 0.69 2.6 0.60 0.20 0.15 0.34 0.40 | <pre>207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10 0.60 0.07 0.27 0.06 0.77 0.07 0.07 0.07 0.07 0.07 0.0</pre> | 208 Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 1.1 0.06 0.39 0.11 0.90 0.18 0.12 0.04 0.13 0.16 | Th 0.24 0.21 14 0.22 34 0.25 0.24 0.59 0.18 0.30 0.29 5.0 0.19 0.34 0.33 0.64 0.29 | U 0.28 0.31 25 0.16 31 0.20 0.15 1.33 0.09 1.8 1.6 4.3 0.14 0.17 0.17 0.23 0.17 |
| 845007Fl uor-1 845007Fl uor-2 845007Fl uor-3 845007Fl uor-4 845007Fl uor-5 845007Fl uor-6 845007Fl uor-7 845007Fl uor-9 845007Fl uor-10 845007Fl uor-12 845007Fl uor-13 845007Fl uor-14 845007Fl uor-15 845007Fl uor-15 845007Fl uor-17 Mean (n=17) | Ba 0.14 0.13 <0.00 2.22 <0.00 <0.32 1.0 <0.41 0.10 <0.00 1.1 <0.28 <0.48 <0.00 <0.00 <0.45 0.78 | La 17 15 20 16 31 18 19 17 18 18 23 19 22 34 33 22 35 23 | Ce 40 45 54 44 77 49 50 46 48 45 57 49 56 85 81 75 82 58 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 8.2 8.3 7.9 8.3 8.6 9.3 13 13 13 13 13 9.2 | Nd 28 34 42 39 52 43 41 48 47 45 46 48 52 68 69 63 69 49 | Sm 11 12 16 17 20 18 17 17 18 19 22 19 20 25 27 24 26 19 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.29 0.26 0.38 0.32 0.41 0.40 0.42 0.39 0.37 0.36 0.34 | Gd 21 20 29 30 31 30 29 29 37 33 33 41 45 39 44 32 | Tb 3.4 3.3 4.5 4.4 4.8 5.0 5.0 5.0 6.3 5.7 7.4 7.3 7.0 8.1 5.4 | Dy 26 27 34 33 35 36 38 39 46 41 42 52 57 56 59 41 | Ho 7.1 6.6 8.2 8.7 9.3 9.0 10 10 10 10 11 11 12 14 14 15 16 11 | Er 26 25 30 29 31 33 32 36 37 36 40 41 44 54 57 55 61 39 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 6.1 6.6 6.3 6.2 7.4 8.2 10 11 10 11 7 | Yb 28 30 38 37 34 45 45 55 51 60 74 93 96 99 104 59 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 10 10 10 8.3 12 15 18 19 20 21 11 | Σ REY 909 943 1206 1212 1342 1375 1482 1579 1656 1666 1792 2012 2351 2428 2453 2543 1658 | Hf <0.04 0.03 0.00 0.10 0.04 <0.04 <0.04 <0.04 0.04 0.04 0.03 <0.03 <0.00 <0.00 <0.00 0.01 0.15 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 <0.00 0.52 <0.00 0.07 0.04 0.65 0.01 0.02 <0.00 0.01 <0.02 0.01 | W 23 16 17 18 20 17 14 13 21 12 11 17 15 12 13 16 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 4.2 <0.06 0.69 2.6 0.60 0.20 0.15 0.34 0.40 1.5 | <pre>207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10 0.60 0.07 0.27 0.06 0.77 0.07 0.07 0.07 0.07 0.07 0.0</pre> | 208 Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 1.1 0.06 0.39 0.11 0.90 0.18 0.12 0.04 0.13 0.16 0.42 | Th 0.24 0.21 14 0.22 34 0.25 0.24 0.59 0.18 0.30 0.29 5.0 0.19 0.34 0.33 0.64 0.29 3.3 | U 0.28 0.31 25 0.16 31 0.20 0.15 1.33 0.09 1.8 1.6 4.3 0.14 0.17 0.17 0.23 0.17 4.0 |
| 845007Fl uor-1 845007Fl uor-2 845007Fl uor-3 845007Fl uor-4 845007Fl uor-5 845007Fl uor-7 845007Fl uor-7 845007Fl uor-19 845007Fl uor-11 845007Fl uor-13 845007Fl uor-13 845007Fl uor-15 845007Fl uor-14 845007Fl uor-15 845007Fl uor-17 Mean (n=17) S.D. | Ba 0.14 0.13 <0.00 2.22 <0.00 <0.32 1.0 <0.41 0.10 <0.00 1.1 <0.28 <0.48 <0.00 <0.00 <0.00 <0.45 0.78 0.84 | La 17 15 20 16 31 18 19 17 18 18 23 19 22 34 33 22 35 23 7.2 | Ce 40 45 54 44 77 49 50 46 48 45 57 49 56 85 81 75 82 58 16 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 8.2 8.3 7.9 8.3 8.6 9.3 13 13 13 13 13 9.2 2.3 | Nd 28 34 42 39 52 43 41 48 47 45 46 48 52 68 69 63 69 49 12 | Sm 11 12 16 17 20 18 17 17 18 19 22 19 20 25 27 24 26 19 26 19 4.5 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.29 0.26 0.38 0.32 0.41 0.40 0.42 0.39 0.37 0.36 0.34 0.06 | Gd 21 20 29 30 31 30 29 37 33 33 41 45 39 44 32 7.1 | Tb 3.4 3.3 4.5 4.4 4.8 5.0 4.9 5.0 6.3 5.7 7.4 7.3 7.0 8.1 5.4 1.4 | Dy 26 27 34 33 35 36 38 39 46 41 42 52 57 56 59 41 10 | Ho 7.1 6.6 8.2 8.7 9.3 9.0 10 10 10 10 11 11 12 14 14 15 16 11 2.8 | Er 26 25 30 29 31 33 32 36 37 36 40 41 44 57 55 61 39 11 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 6.1 6.6 6.3 6.2 7.4 8.2 10 11 10 11 7 2.5 | Yb 28 30 38 37 34 45 55 55 51 60 74 93 96 99 104 59 25 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 10 10 10 8.3 12 15 18 19 20 21 11 5.4 | Σ REY 909 943 1206 1212 1342 1375 1482 1579 1656 1666 1666 16792 2012 2351 2428 2453 2543 1658 530 | Hf <0.04 0.03 0.00 0.10 0.04 <0.04 <0.04 <0.04 <0.04 0.04 0.04 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 <0.00 0.52 <0.00 0.07 0.04 0.65 0.01 0.02 <0.00 0.01 <0.02 0.01 <0.02 0.40 0.62 | W 23 16 17 18 20 17 17 14 13 21 12 11 17 15 12 13 16 3.2 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 4.2 <0.06 0.85 0.60 0.20 0.15 0.34 0.40 1.5 2.1 | <pre>207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10 0.60 0.77 0.07 0.07 0.07 0.07 0.07 0.0</pre> | 208 Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 1.1 0.06 0.39 0.11 0.90 0.18 0.12 0.04 0.13 0.16 0.42 0.59 | Th 0.24 0.21 14 0.22 34 0.25 0.24 0.59 0.18 0.30 0.29 5.0 0.19 0.34 0.33 0.64 0.29 3.3 8.5 | U 0.28 0.31 25 0.16 31 0.20 0.15 1.33 0.09 1.8 1.6 4.3 0.14 0.17 0.17 0.23 0.17 4.0 9.2 |
| 845007Fl uor-1 845007Fl uor-2 845007Fl uor-3 845007Fl uor-4 845007Fl uor-5 845007Fl uor-7 845007Fl uor-7 845007Fl uor-18 845007Fl uor-11 845007Fl uor-13 845007Fl uor-15 845007Fl uor-15 845007Fl uor-16 845007Fl uor-17 Mean (n=17) S.D. Maximum | Ba 0.14 0.13 <0.00 2.22 <0.00 <0.32 1.0 <0.41 0.10 <0.00 1.1 <0.28 <0.48 <0.00 <0.00 <0.00 <0.45 0.78 0.84 2.2 | La 17 15 20 16 31 18 19 17 18 18 23 19 22 34 33 22 35 23 7.2 35 | Ce 40 45 54 44 77 49 50 46 48 45 57 49 56 85 81 75 82 58 16 85 | Pr 5.6 6.8 8.4 7.5 11 8.1 7.9 8.2 8.3 7.9 8.3 8.6 9.3 13 13 13 13 13 9.2 2.3 13 | Nd 28 34 42 39 52 43 41 48 47 45 46 48 52 68 69 63 69 49 12 69 | Sm 11 12 16 17 20 18 17 17 18 19 22 19 20 25 27 24 26 19 26 19 4.5 27 | Eu 0.23 0.28 0.26 0.28 0.42 0.31 0.29 0.26 0.38 0.32 0.41 0.40 0.42 0.39 0.37 0.36 0.34 0.36 0.34 0.06 0.42 | Gd 21 20 29 32 30 31 30 29 29 37 33 33 41 45 39 44 32 7.1 45 | Tb 3.4 3.3 4.5 4.4 4.8 5.0 4.9 5.0 6.3 5.7 7.4 7.3 7.0 8.1 5.4 1.4 8.1 | Dy 26 27 34 33 35 36 38 39 46 41 42 52 57 56 59 41 10 59 | Ho 7.1 6.6 8.2 8.7 9.3 9.0 10 10 10 10 11 11 12 14 14 15 16 11 2.8 16 | Er 26 25 30 29 31 33 32 36 37 36 40 41 44 57 55 61 39 11 61 | Tm 3.7 3.9 5.0 4.7 4.5 5.3 5.5 6.1 6.6 6.3 6.2 7.4 8.2 10 11 10 11 7 2.5 11 | Yb 28 30 38 37 34 45 45 55 51 60 74 93 96 99 104 59 25 104 | Lu 4.3 5.2 7.0 6.5 5.7 8.1 7.9 10 10 10 8.3 12 15 18 19 20 21 11 5.4 21 | Σ REY 909 943 1206 1212 1342 1375 1482 1579 1656 1666 1666 16792 2012 2351 2428 2453 2543 1658 530 2543 | Hf <0.04 0.03 0.00 0.10 0.04 <0.04 <0.04 <0.04 <0.04 0.04 0.04 | Ta 0.01 <0.00 1.8 0.01 1.3 <0.00 0.52 <0.00 0.7 0.04 0.65 0.01 0.02 <0.00 0.01 <0.02 0.01 <0.02 0.40 0.62 1.8 | W 23 16 17 18 20 17 17 14 13 21 12 11 17 15 12 13 16 3.2 23 | 206 Pb 0.32 0.38 5.6 0.34 6.6 0.37 0.24 4.2 <0.06 0.85 0.69 2.6 0.60 0.20 0.15 0.34 0.40 1.5 2.1 6.6 | <pre>207 Pb <0.03 0.06 0.95 0.08 1.2 0.09 0.10 0.60 0.07 0.27 0.06 0.77 0.07 0.07 0.07 0.07 0.07 0.0</pre> | 208 Pb 0.07 0.09 1.5 0.11 2.0 0.08 0.13 1.1 0.06 0.39 0.11 0.90 0.18 0.12 0.04 0.13 0.16 0.42 0.59 2.0 | Th 0.24 0.21 14 0.22 34 0.25 0.24 0.59 0.18 0.29 5.0 0.19 0.34 0.33 0.64 0.29 3.3 8.5 34 | U 0.28 0.31 25 0.16 31 0.20 0.15 1.33 0.09 1.8 1.6 4.3 0.14 0.17 0.17 0.17 0.23 0.17 4.0 9.2 31 |

| | Mg | Al | Si | Р | Sc | Ti | v | Cr | Mn | Fe | Со | Ni | Cu | Zn | Ga | As | Sr | Y | Zr | Nb | Mo | Sn | Sb | |
|--|---|--|--|--|--|---|--|---|---|---|---|---|---|---|---|--|---|---|---|---|--|---|---|--|
| 751002Flvein-1 | 2.5 | 1.9 | <175 | 27 | <0.17 | 5.4 | <0.07 | <0.99 | <0.86 | 93 | 0.2 | < 0.00 | 1.5 | 5.2 | <0.09 | 21 | 10 | 36 | 0.31 | <0.12 | 0.23 | <0.09 | <0.34 | |
| 751002Flvein-2 | 4.9 | 223 | 837 | 121 | <0.23 | <2.1 | <0.15 | <1.6 | 17 | 1416 | <0.19 | <0.85 | 56 | 401 | 0.12 | 23 | 14 | 57 | 0.21 | < 0.00 | 0.19 | <0.13 | <0.40 | |
| 751002Flvein-3 | 3.9 | <0.73 | 890 | <34 | <0.23 | <3.7 | 0.25 | <1.7 | 1.3 | 95 | < 0.00 | <0.98 | <1.1 | 17 | <0.11 | 30 | 16 | 45 | 0.10 | 0.05 | 0.10 | <0.12 | <0.30 | |
| 751002Flvein-4 | 4.0 | 2.1 | <126 | <20 | 0.11 | 1.9 | 0.08 | <1.0 | 0.73 | 102 | 0.2 | 1.3 | 1.9 | 2.4 | <0.00 | 21 | 15 | 39 | <0.00 | 9.1 | 0.23 | <0.11 | 0.31 | |
| 751002Flvein-5 | 4.8 | 4.9 | 616 | 46 | <0.11 | <2.05 | <0.08 | 1.8 | 0.72 | 120 | 0.5 | 1.2 | <0.62 | 22 | <0.06 | 38 | 12 | 51 | 0.13 | <0.00 | < 0.06 | 0.68 | <0.18 | |
| 751002Flvein-6 | 3.5 | 4.8 | 431 | 53 | 0.66 | <3.0 | < 0.00 | <0.59 | <0.69 | 86 | 0.24 | <0.39 | <0.90 | 1.3 | <0.11 | <0.76 | 15 | 134 | <0.06 | <0.04 | 0.14 | <0.11 | 0.25 | |
| 751002Flvein-7 | 2.0 | 3.5 | 131 | <18 | <0.10 | <3.0 | <0.06 | 1.2 | 0.60 | 163 | <0.06 | <0.31 | 2.7 | 19 | <0.06 | 0.67 | 15 | 234 | <0.05 | <0.00 | 0.10 | <0.06 | <0.16 | |
| 751002Flvein-8 | 3.5 | 9.0 | <106 | <17 | <0.11 | <0.99 | 0.16 | 0.62 | 0.51 | 116 | 0.25 | <0.40 | <0.75 | 12 | <0.08 | 1.8 | 13 | 191 | <0.00 | <0.03 | 0.28 | <0.07 | <0.18 | |
| 751002Flvein-9 | 4.0 | 3.0 | <148 | <22 | <0.14 | <3.2 | <0.06 | <0.85 | <0.72 | 97 | <0.07 | 0.49 | <1.0 | 80 | <0.11 | 3.1 | 22 | 92 | 1.2 | 0.05 | <0.07 | <0.10 | 0.17 | |
| 751002Flvein-1 | 2.4 | 5.9 | 270 | 81 | 0.3 | <2.2 | <0.06 | <0.79 | 1.1 | 130 | 0.13 | < 0.00 | 1.74 | 48 | <0.08 | 54 | 17 | 84 | <0.00 | 0.07 | 0.96 | 0.08 | 1.1 | |
| Mean (n=10) | 3.6 | 29 | 529 | 66 | 0.36 | 3.6 | 0.16 | 1.2 | 3.2 | 242 | 0.25 | 0.98 | 13 | 61 | 0.12 | 21 | 15 | 96 | 0.39 | 2.3 | 0.28 | 0.38 | 0.46 | |
| S.D. | 1.0 | 73 | 306 | 37 | 0.28 | 2.5 | 0.09 | 0.59 | 6.2 | 413 | 0.13 | 0.43 | 24 | 122 | | 18 | 3.2 | 69 | 0.47 | 4.5 | 0.28 | 0.42 | 0.43 | |
| Maximum | 4.9 | 223 | 890 | 121 | 0.66 | 5.4 | 0.25 | 1.8 | 17 | 1416 | 0.50 | 1.3 | 56 | 401 | 0.12 | 54 | 22 | 234 | 1.2 | 9.1 | 0.96 | 0.68 | 1.1 | |
| Minimum | 2.0 | 1.9 | 131 | 27 | 0.11 | 1.9 | 0.08 | 0.62 | 0.51 | 86 | 0.13 | 0.49 | 1.5 | 1.3 | 0.12 | 0.67 | 10 | 36 | 0.10 | 0.05 | 0.10 | 0.08 | 0.17 | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ва | La | Ce | Pr | Nd | Sm | Eu | Gd | Tb | Dy | Но | Er | Tm | Yb | Lu | ΣREY | Hf | Та | w | ²⁰⁶ Pb | ²⁰⁷ Pb | ²⁰⁸ Pb | Th | U |
| 751002Flvein-1 | Ba <0.00 | La 2.0 | Ce 0.31 | Pr 1.3 | Nd 6.6 | Sm 1.6 | Eu 0.11 | Gd 1.9 | Tb 0.19 | Dy 1.4 | Ho 0.19 | Er 0.76 | Tm 0.11 | Yb 9.1 | Lu 0.07 | Σ REY 61 | Hf 0.05 | Ta 0.01 | W 0.34 | ²⁰⁶ Рb 0.14 | ²⁰⁷ Pb 1.0 | ²⁰⁸ Pb <0.028 | Th 0.02 | U 0.04 |
| 751002Flvein-1 751002Flvein-2 | Ba <0.00 7.0 | La 2.0 19 | Ce 0.31 0.25 | Pr 1.3 4.4 | Nd 6.6 18 | Sm 1.6 2.7 | Eu 0.11 0.15 | Gd 1.9 2.9 | Tb 0.19 0.41 | Dy 1.4 2.2 | Ho 0.19 0.50 | Er 0.76 1.5 | Tm 0.11 0.26 | Yb 9.1 1.4 | Lu 0.07 0.33 | Σ REY 61 110 | Hf 0.05 <0.00 | Ta 0.01 <0.00 | W 0.34 0.44 | ²⁰⁶ Pb 0.14 1.1 | ²⁰⁷ Pb 1.0 0.61 | 208 Pb <0.028 0.53 | Th 0.02 0.07 | U 0.04 0.71 |
| 751002Flvein-1 751002Flvein-2 751002Flvein-3 | Ba <0.00 7.0 <0.63 | La 2.0 19 2.8 | Ce 0.31 0.25 0.37 | Pr 1.3 4.4 1.8 | Nd 6.6 18 9.4 | Sm 1.6 2.7 2.3 | Eu 0.11 0.15 0.21 | Gd 1.9 2.9 2.0 | Tb 0.19 0.41 0.34 | Dy 1.4 2.2 1.3 | Ho 0.19 0.50 0.42 | Er 0.76 1.5 0.86 | Tm 0.11 0.26 0.18 | Yb 9.1 1.4 1.4 | Lu 0.07 0.33 0.21 | Σ REY 61 110 68 | Hf 0.05 <0.00 0.15 | Ta 0.01 <0.00 <0.02 | W 0.34 0.44 0.24 | ²⁰⁶ Pb 0.14 1.1 0.23 | ²⁰⁷ Pb 1.0 0.61 0.51 | ²⁰⁸ Pb <0.028 0.53 0.62 | Th 0.02 0.07 0.04 | U 0.04 0.71 0.25 |
| 751002Flvein-1 751002Flvein-2 751002Flvein-3 751002Flvein-4 | Ba <0.00 7.0 <0.63 0.36 | La 2.0 19 2.8 3.6 | Ce 0.31 0.25 0.37 0.56 | Pr 1.3 4.4 1.8 1.7 | Nd 6.6 18 9.4 8.6 | Sm 1.6 2.7 2.3 2.2 | Eu 0.11 0.15 0.21 0.19 | Gd 1.9 2.9 2.0 1.2 | Tb 0.19 0.41 0.34 0.20 | Dy 1.4 2.2 1.3 1.2 | Ho 0.19 0.50 0.42 0.28 | Er 0.76 1.5 0.86 0.77 | Tm 0.11 0.26 0.18 0.13 | Yb 9.1 1.4 1.4 0.9 | Lu 0.07 0.33 0.21 0.14 | ΣREY 61 110 68 61 | Hf 0.05 <0.00 0.15 <0.04 | Ta 0.01 <0.00 <0.02 0.03 | W 0.34 0.44 0.24 0.14 | ²⁰⁶ Pb 0.14 1.1 0.23 0.15 | ²⁰⁷ Pb 1.0 0.61 0.51 0.05 | ²⁰⁸ Pb <0.028 0.53 0.62 0.04 | Th 0.02 0.07 0.04 0.03 | U 0.04 0.71 0.25 0.04 |
| 751002Flvein-1 751002Flvein-2 751002Flvein-3 751002Flvein-4 751002Flvein-5 | Ba <0.00 7.0 <0.63 0.36 0.43 | La 2.0 19 2.8 3.6 2.4 | Ce 0.31 0.25 0.37 0.56 0.16 | Pr 1.3 4.4 1.8 1.7 1.3 | Nd 6.6 18 9.4 8.6 7.5 | Sm 1.6 2.7 2.3 2.2 2.3 | Eu 0.11 0.15 0.21 0.19 0.15 | Gd 1.9 2.9 2.0 1.2 2.8 | Tb 0.19 0.41 0.34 0.20 0.36 | Dy 1.4 2.2 1.3 1.2 1.9 | Ho 0.19 0.50 0.42 0.28 0.45 | Er 0.76 1.5 0.86 0.77 1.3 | Tm 0.11 0.26 0.18 0.13 0.23 | Yb 9.1 1.4 1.4 0.9 1.5 | Lu 0.07 0.33 0.21 0.14 0.31 | Σ REY 61 110 68 61 73 | Hf 0.05 <0.00 0.15 <0.04 0.05 | Ta 0.01 <0.00 <0.02 0.03 <0.01 | W 0.34 0.44 0.24 0.14 0.38 | ²⁰⁶ Рb 0.14 1.1 0.23 0.15 0.49 | 207 Pb 1.0 0.61 0.51 0.05 0.22 | ²⁰⁸ Pb <0.028 0.53 0.62 0.04 0.61 | Th 0.02 0.07 0.04 0.03 0.03 | U 0.04 0.71 0.25 0.04 0.27 |
| 751002Flvein-1 751002Flvein-2 751002Flvein-3 751002Flvein-4 751002Flvein-5 751002Flvein-6 | Ba <0.00 7.0 <0.63 0.36 0.43 <0.00 | La 2.0 19 2.8 3.6 2.4 24 | Ce 0.31 0.25 0.37 0.56 0.16 76 | Pr 1.3 4.4 1.8 1.7 1.3 5.3 | Nd 6.6 18 9.4 8.6 7.5 15 | Sm 1.6 2.7 2.3 2.2 2.3 2.5 | Eu 0.11 0.15 0.21 0.19 0.15 0.36 | Gd 1.9 2.9 2.0 1.2 2.8 3.5 | Tb 0.19 0.41 0.34 0.20 0.36 0.51 | Dy 1.4 2.2 1.3 1.2 1.9 4.9 | Ho 0.19 0.50 0.42 0.28 0.45 1.3 | Er 0.76 1.5 0.86 0.77 1.3 4.7 | Tm 0.11 0.26 0.18 0.13 0.23 0.91 | Yb 9.1 1.4 1.4 0.9 1.5 9.3 | Lu 0.07 0.33 0.21 0.14 0.31 1.5 | Σ REY 61 110 68 61 73 284 | Hf 0.05 <0.00 0.15 <0.04 0.05 <0.00 | Ta 0.01 <0.00 <0.02 0.03 <0.01 <0.00 | W 0.34 0.44 0.24 0.14 0.38 0.04 | 205 Pb 0.14 1.1 0.23 0.15 0.49 0.14 | 207 Pb 1.0 0.61 0.51 0.05 0.22 0.18 | <pre>208 Pb <0.028 0.53 0.62 0.04 0.61 0.06</pre> | Th 0.02 0.07 0.04 0.03 0.03 0.02 | U 0.04 0.71 0.25 0.04 0.27 0.54 |
| 751002Flvein-1 751002Flvein-2 751002Flvein-3 751002Flvein-4 751002Flvein-5 751002Flvein-6 751002Flvein-7 | Ba <0.00 | La 2.0 19 2.8 3.6 2.4 24 9.2 | Ce 0.31 0.25 0.37 0.56 0.16 76 33 | Pr 1.3 4.4 1.8 1.7 1.3 5.3 3.4 | Nd 6.6 18 9.4 8.6 7.5 15 15 | Sm 1.6 2.7 2.3 2.2 2.3 2.5 3.2 | Eu 0.11 0.15 0.21 0.19 0.15 0.36 0.46 | Gd 1.9 2.9 2.0 1.2 2.8 3.5 5.8 | Tb 0.19 0.41 0.34 0.20 0.36 0.51 1.1 | Dy 1.4 2.2 1.3 1.2 1.9 4.9 11 | Ho 0.19 0.50 0.42 0.28 0.45 1.3 3.0 | Er 0.76 1.5 0.86 0.77 1.3 4.7 13 | Tm 0.11 0.26 0.18 0.13 0.23 0.91 2.2 | Yb 9.1 1.4 1.4 0.9 1.5 9.3 21.3 | Lu 0.07 0.33 0.21 0.14 0.31 1.5 3.4 | Σ REY 61 110 68 61 73 284 358 | Hf 0.05 <0.00 0.15 <0.04 0.05 <0.00 0.05 | Ta 0.01 <0.00 <0.02 0.03 <0.01 <0.00 <0.00 | W 0.34 0.44 0.24 0.14 0.38 0.04 0.35 | 205 Pb 0.14 1.1 0.23 0.15 0.49 0.14 <0.02 | 207 Pb 1.0 0.61 0.51 0.05 0.22 0.18 <0.04 | <pre>208 Pb <0.028 0.53 0.62 0.04 0.61 0.06 0.18</pre> | Th 0.02 0.07 0.04 0.03 0.03 0.02 0.03 | U 0.04 0.71 0.25 0.04 0.27 0.54 0.02 |
| 751002Flvein-1 751002Flvein-2 751002Flvein-3 751002Flvein-4 751002Flvein-5 751002Flvein-6 751002Flvein-7 751002Flvein-8 | Ba <0.00 7.0 <0.63 0.36 0.43 <0.00 0.86 <0.00 | La 2.0 19 2.8 3.6 2.4 24 9.2 9.0 | Ce 0.31 0.25 0.37 0.56 0.16 76 33 25 | Pr 1.3 4.4 1.8 1.7 1.3 5.3 3.4 2.6 | Nd 6.6 18 9.4 8.6 7.5 15 15 12 | Sm 1.6 2.7 2.3 2.2 2.3 2.5 3.2 2.9 | Eu 0.11 0.15 0.21 0.19 0.15 0.36 0.46 0.40 | Gd 1.9 2.9 2.0 1.2 2.8 3.5 5.8 4.1 | Tb 0.19 0.41 0.34 0.20 0.36 0.51 1.1 0.84 | Dy 1.4 2.2 1.3 1.2 1.9 4.9 11 8.3 | Ho 0.19 0.50 0.42 0.28 0.45 1.3 3.0 2.3 | Er 0.76 1.5 0.86 0.77 1.3 4.7 13 10 | Tm 0.11 0.26 0.18 0.13 0.23 0.91 2.2 1.9 | Yb 9.1 1.4 1.4 0.9 1.5 9.3 21.3 17 | Lu 0.07 0.33 0.21 0.14 0.31 1.5 3.4 2.8 | ΣREY 61 110 68 61 73 284 358 289 | Hf 0.05 <0.00 0.15 <0.04 0.05 <0.00 0.05 <0.00 | Ta 0.01 <0.00 <0.02 0.03 <0.01 <0.00 <0.00 <0.00 <0.00 <0.02 | W 0.34 0.44 0.24 0.14 0.38 0.04 0.35 0.42 | 205 Pb 0.14 1.1 0.23 0.15 0.49 0.14 <0.02 0.18 | 207 Pb 1.0 0.61 0.51 0.05 0.22 0.18 <0.04 <0.03 | <pre>208 Pb <0.028 0.53 0.62 0.04 0.61 0.06 0.18 0.02</pre> | Th 0.02 0.07 0.04 0.03 0.03 0.02 0.03 <0.01 | U 0.04 0.71 0.25 0.04 0.27 0.54 0.02 0.17 |
| 751002Flvein-1 751002Flvein-2 751002Flvein-3 751002Flvein-4 751002Flvein-5 751002Flvein-6 751002Flvein-7 751002Flvein-8 751002Flvein-9 | Ba <0.00 7.0 <0.63 0.36 0.43 <0.00 0.86 <0.00 <0.00 | La 2.0 19 2.8 3.6 2.4 24 9.2 9.0 38 | Ce 0.31 0.25 0.37 0.56 0.16 76 33 25 72 | Pr 1.3 4.4 1.8 1.7 1.3 5.3 3.4 2.6 9.7 | Nd 6.6 18 9.4 8.6 7.5 15 15 12 36 | Sm 1.6 2.7 2.3 2.2 2.3 2.5 3.2 2.9 4.4 | Eu 0.11 0.15 0.21 0.19 0.15 0.36 0.46 0.40 0.27 | Gd 1.9 2.9 2.0 1.2 2.8 3.5 5.8 4.1 4.1 | Tb 0.19 0.41 0.34 0.20 0.36 0.51 1.1 0.84 0.49 | Dy 1.4 2.2 1.3 1.2 1.9 4.9 11 8.3 3.5 | Ho 0.19 0.50 0.42 0.28 0.45 1.3 3.0 2.3 0.89 | Er 0.76 1.5 0.86 0.77 1.3 4.7 13 10 4.2 | Tm 0.11 0.26 0.18 0.13 0.23 0.91 2.2 1.9 0.79 | Yb 9.1 1.4 0.9 1.5 9.3 21.3 17 7.1 | Lu 0.07 0.33 0.21 0.14 0.31 1.5 3.4 2.8 1.0 | ΣREY 61 110 68 61 73 284 358 289 274 | Hf 0.05 <0.00 0.15 <0.04 0.05 <0.00 0.05 <0.00 0.06 | Ta 0.01 <0.00 <0.02 0.03 <0.01 <0.00 <0.00 <0.00 <0.02 0.02 | W 0.34 0.44 0.24 0.14 0.38 0.04 0.35 0.42 0.09 | 206 Pb 0.14 1.1 0.23 0.15 0.49 0.14 <0.02 0.18 0.93 | 207 Pb 1.0 0.61 0.51 0.05 0.22 0.18 <0.04 <0.03 0.86 | 208 Pb <0.028 0.53 0.62 0.04 0.61 0.06 0.18 0.02 0.30 | Th 0.02 0.07 0.04 0.03 0.03 0.02 0.03 <0.01 0.04 | U 0.04 0.71 0.25 0.04 0.27 0.54 0.02 0.17 0.72 |
| 751002Flvein-1 751002Flvein-2 751002Flvein-3 751002Flvein-4 751002Flvein-5 751002Flvein-6 751002Flvein-7 751002Flvein-8 751002Flvein-9 751002Flvein-1 | Ba <0.00 7.0 <0.63 0.36 0.43 <0.00 0.86 <0.00 <0.00 <0.00 | La 2.0 19 2.8 3.6 2.4 24 9.2 9.0 38 9.6 | Ce 0.31 0.25 0.37 0.56 0.16 76 33 25 72 0.66 | Pr 1.3 4.4 1.8 1.7 1.3 5.3 3.4 2.6 9.7 3.7 | Nd 6.6 18 9.4 8.6 7.5 15 15 12 36 18 | Sm 1.6 2.7 2.3 2.2 2.3 2.5 3.2 2.9 4.4 4.1 | Eu 0.11 0.15 0.21 0.19 0.15 0.36 0.46 0.40 0.27 0.38 | Gd 1.9 2.9 2.0 1.2 2.8 3.5 5.8 4.1 4.1 4.9 | Tb 0.19 0.41 0.34 0.20 0.36 0.51 1.1 0.84 0.49 0.54 | Dy 1.4 2.2 1.3 1.2 1.9 4.9 11 8.3 3.5 3.9 | Ho 0.19 0.50 0.42 0.28 0.45 1.3 3.0 2.3 0.89 0.77 | Er 0.76 1.5 0.86 0.77 1.3 4.7 13 10 4.2 2.3 | Tm 0.11 0.26 0.13 0.23 0.91 2.2 1.9 0.79 0.42 | Yb 9.1 1.4 0.9 1.5 9.3 21.3 17 7.1 4.1 | Lu 0.07 0.33 0.21 0.14 0.31 1.5 3.4 2.8 1.0 0.69 | Σ REY 61 110 68 61 73 284 358 289 274 138 | Hf 0.05 <0.00 0.15 <0.04 0.05 <0.00 0.05 <0.00 0.06 <0.00 | Ta 0.01 <0.02 0.03 <0.01 <0.00 <0.00 <0.00 <0.02 0.02 0.02 0.02 | W 0.34 0.44 0.24 0.14 0.38 0.04 0.35 0.42 0.09 1.5 | 205 Pb 0.14 1.1 0.23 0.15 0.49 0.14 <0.02 0.18 0.93 3.0 | 207 Pb 1.0 0.61 0.51 0.22 0.18 <0.04 <0.03 0.86 1.44 | <pre>208 Pb <0.028 0.53 0.62 0.04 0.61 0.06 0.18 0.02 0.30 1.75</pre> | Th 0.02 0.07 0.04 0.03 0.03 0.02 0.03 <0.01 0.04 0.21 | U 0.04 0.71 0.25 0.04 0.27 0.54 0.02 0.17 0.72 2.59 |
| 751002Flvein-1 751002Flvein-2 751002Flvein-3 751002Flvein-4 751002Flvein-5 751002Flvein-6 751002Flvein-7 751002Flvein-8 751002Flvein-9 751002Flvein-1 Mean (n=10) | Ba <0.00 7.0 <0.63 0.36 0.43 <0.00 0.86 <0.00 <0.00 <0.00 2.2 | La 2.0 19 2.8 3.6 2.4 2.4 9.2 9.0 38 9.6 12 | Ce 0.31 0.25 0.37 0.56 0.16 76 33 25 72 0.66 21 | Pr 1.3 4.4 1.8 1.7 1.3 5.3 3.4 2.6 9.7 3.7 3.5 | Nd 6.6 18 9.4 8.6 7.5 15 15 12 36 18 18 15 | Sm 1.6 2.7 2.3 2.2 2.3 2.5 3.2 2.9 4.4 4.1 2.8 | Eu 0.11 0.15 0.21 0.19 0.15 0.36 0.46 0.40 0.27 0.38 0.27 | Gd 1.9 2.9 2.0 1.2 2.8 3.5 5.8 4.1 4.1 4.9 3.3 | Tb 0.19 0.41 0.34 0.20 0.36 0.51 1.1 0.84 0.49 0.54 0.5 | Dy 1.4 2.2 1.3 1.2 1.9 4.9 11 8.3 3.5 3.9 3.9 | Ho 0.19 0.50 0.42 0.28 0.45 1.3 3.0 2.3 0.89 0.77 1.0 | Er 0.76 1.5 0.86 0.77 1.3 4.7 13 10 4.2 2.3 4.0 | Tm 0.11 0.26 0.18 0.23 0.91 2.2 1.9 0.79 0.42 0.71 | Yb 9.1 1.4 0.9 1.5 9.3 21.3 17 7.1 4.1 7.3 | Lu 0.07 0.33 0.21 0.14 0.31 1.5 3.4 2.8 1.0 0.69 1.0 | Σ REY 61 110 68 61 73 284 358 289 274 138 172 | Hf 0.05 <0.00 0.15 <0.04 0.05 <0.00 0.05 <0.00 0.06 <0.00 0.07 | Ta 0.01 <0.02 0.03 <0.01 <0.02 0.03 <0.01 <0.02 0.02 0.02 0.03 <0.00 <0.02 0.03 0.04 0.05 0.06 0.03 | W 0.34 0.44 0.24 0.38 0.04 0.35 0.42 0.09 1.5 0.39 | 2005 Pb 0.14 1.1 0.23 0.15 0.49 0.14 <0.02 0.18 0.93 3.0 0.70 | <pre>207Pb 1.0 0.61 0.51 0.05 0.22 0.18 <0.04 <0.03 0.86 1.44 0.61</pre> | <pre>208 Pb <0.028 0.53 0.62 0.04 0.61 0.06 0.18 0.02 0.30 1.75 0.46</pre> | Th 0.02 0.07 0.04 0.03 0.03 0.02 0.03 <0.01 0.04 0.21 0.05 | U 0.04 0.71 0.25 0.04 0.27 0.54 0.02 0.17 0.72 2.59 0.54 |
| 751002Flvein-1 751002Flvein-2 751002Flvein-3 751002Flvein-4 751002Flvein-5 751002Flvein-6 751002Flvein-7 751002Flvein-8 751002Flvein-9 751002Flvein-1 Mean (n=10) S.D. | Ba <0.00 7.0 <0.63 0.43 <0.00 0.86 <0.00 <0.00 <0.00 2.2 3.2 | La 2.0 19 2.8 3.6 2.4 24 9.2 9.0 38 9.6 12 12 | Ce 0.31 0.25 0.37 0.56 0.16 76 33 25 72 0.66 21 31 | Pr 1.3 4.4 1.8 1.7 1.3 5.3 3.4 2.6 9.7 3.7 3.7 3.5 2.6 | Nd 6.6 18 9.4 8.6 7.5 15 15 15 12 36 18 15 8.6 | Sm 1.6 2.7 2.3 2.2 2.3 2.5 3.2 2.9 4.4 4.1 2.8 0.88 | Eu 0.11 0.15 0.21 0.19 0.15 0.36 0.46 0.40 0.27 0.38 0.27 0.12 | Gd 1.9 2.9 2.0 1.2 2.8 3.5 5.8 4.1 4.1 4.9 3.3 1.4 | Tb 0.19 0.41 0.34 0.20 0.36 0.51 1.1 0.84 0.49 0.54 0.5 0.3 | Dy 1.4 2.2 1.3 1.2 1.9 4.9 11 8.3 3.5 3.9 3.9 3.9 3.3 | Ho 0.19 0.50 0.42 0.28 0.45 1.3 3.0 2.3 0.89 0.77 1.0 0.93 | Er 0.76 1.5 0.86 0.77 1.3 4.7 13 10 4.2 2.3 4.0 4.4 | Tm 0.11 0.26 0.18 0.23 0.91 2.2 1.9 0.79 0.42 0.71 0.75 | Yb 9.1 1.4 0.9 1.5 9.3 21.3 17 7.1 4.1 7.3 7.0 | Lu 0.07 0.33 0.21 0.14 0.31 1.5 3.4 2.8 1.0 0.69 1.0 1.2 | Σ REY 61 110 68 61 73 284 358 289 274 138 172 116 | Hf 0.05 <0.00 0.15 <0.04 0.05 <0.00 0.05 <0.00 0.06 <0.00 0.07 0.04 | Ta 0.01 <0.02 0.03 <0.01 <0.00 <0.00 <0.02 0.02 0.06 0.03 0.02 | W 0.34 0.44 0.24 0.14 0.38 0.04 0.35 0.42 0.09 1.5 0.39 0.40 | 2005 Pb 0.14 1.1 0.23 0.15 0.49 0.14 <0.02 0.18 0.93 3.0 0.70 0.92 | <pre>207Pb 1.0 0.61 0.51 0.05 0.22 0.18 <0.04 <0.03 0.86 1.44 0.61 0.48</pre> | 208 Pb 0.028 0.53 0.62 0.04 0.61 0.06 0.18 0.02 0.30 1.75 0.46 0.54 | Th 0.02 0.07 0.04 0.03 0.03 0.02 0.03 <0.01 0.04 0.21 0.05 0.06 | U 0.04 0.25 0.04 0.27 0.54 0.02 0.17 0.72 2.59 0.54 0.77 |
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FLUORITE

Two types of fluorite can also be distinguished in terms of REY chemistry. The first type of fluorite (Table 3), occurring as patches and co-existing with molybdenite, is shown to be a significant carrier of REY, with consistent concentrations of ~1000-2000 ppm (Σ REE + Y) in the 17 analytical spots (Table 3a). The chondrite-normalised REY-fractionation trend for fluorite (Figure 9c) is distinct, with a generally flat trend and pronounced negative Eu-anomaly and positive Y-anomaly, consistent with published REY data for fluorite (e.g. Gagnon *et al.* 2003). The second type of fluorite, restricted to the wider veins, is characterised by significantly lower Σ REY. Chondrite-normalised REY-fractionation trends are flat and similar to type I except for a marked negative Ce-anomaly typical for grains along the vein margin. In both types, the measured concentrations of other elements in fluorite are generally low. Minor although inconsistent concentrations of Mg, Fe and Si are noted - possibly attributable to µm-scale mineral inclusions. Based on these marked differences two generations of fluorite can be suggested, where the second type implies REDOX changes in the fluids.

U-Pb geochronology

ZIRCON U-PB

Zircon U-Pb geochronology was conducted on zircon *in-situ* from polished blocks of the samples 751002, 751002, and 845007. SEM images show that zircon grains from all three samples are heavily cracked with obvious visual evidence of crystal damage via metamictisation (Figure 4i and Figure 7j). The grains range in morphology from rounded to acicular. Laser ablation spots were placed on all identifiable zircon grains identified in the polished blocks, two zircon grains in 751002, four in 751003, and four

in 845007. Multiple spots were placed on each zircon grain in the hope of forming internal isochrons as poor data quality was predicted given the visual evidence of heavy alteration. Model 1 discordia lines were fit through data for each grain and are displayed in Figure 12. Most zircon display a very poor fit with high scatter and high common lead content (Appendix B1). As such upper intercept ages calculated are to be taken as reconnaissance only. Despite this it is apparent that many of the zircon grains targeted represent an inherited component to the granite samples, each giving different ages outside of error. Samples of Samphire Granite have been previously dated as Hiltaba in age with two interpreted ages of 1584 ± 4 and 1585 ± 6 (Jagodzinski & Reid in press).

Sample 751003

Four separate zircon grains were targeted from this sample. Common lead contents ranged from low to high from grain to grain, and within each grain (Appendix B1). Each grain displays a distinctly different discord albeit with large errors. Grain one gives an upper intercept of 1136 ± 360 Ma, grain two 1480 ± 97 Ma, grain three 2594 ± 91 Ma, and grain four 2391 ± 780 Ma. Little emphasis can be placed on the calculated absolute ages. Despite the very large errors on each discord it is apparent that each forms its own distinct discord line, suggesting differing ages for each grain, and/or different components of common lead addition.

Sample 751002

Two separate zircon grains were targeted from this sample. Common lead contents for all analyses were high (Appendix B1). High scatter of analyses are apparent once plotted on a conventional Concordia diagram (Figure 12). Analyses were separated by grain as per the previous sample. Grain one gives an upper intercept age of 2838 ± 330 Ma, and the three analyses of grain two give a similar upper intercept age of 2480 ± 110 Ma.

Sample 845007

Four separate zircon grains were analysed in this sample, with common lead components ranging from moderate to high. An internal discordia line was only calculated for grain 1 given the small number of analyses conducted on the remaining three grains (Appendix B1). The single grain gives an upper intercept age of 1902 ± 170 Ma, and a weighted average 207 Pb/ 206 Pb age of 1764 ± 80 Ma.



Figure 12 Zircon Concordia. (a) 751003 zircon concordia all spots; (b) 751002 zircon concordia all spots; (c) 845007 zircon concordia grain 1; (d) 751003 zircon concordia separated by grain; (e) 751002 zircon concordia separated by grain; (f) 845007 zircon concordia separated by grain. All ellipses are 68.3% confident

THORITE U-PB

Similar to the zircon analyses, thorite U-Pb analysis was conducted *in-situ* from polished blocks of samples 751002 and 751003. Reflected light images show variable amounts of cracks and changing reflectivity, possibly indicating zonation and variable alteration. Grains were large rounded to oblong in morphology. Multiple analytical spots were placed on two grains from each of the samples. Their large size and the reduced laser spot used allowed many analytical points to be placed on all grains. When plotted on a conventional concordia diagram analytical points from each of the two grains from each of the two grains from each of the two grains from sample 751003 displayed slightly different discord trends and thus were treated separate. Analytical points from the two grains of sample 751002 also displayed two separate trends, however analytical spots from each "age group" were present in each of the two grains, thus data for 751002 was separated based on their "age group". Most data displayed moderate to high common Pb contents, and as with zircon the ages display high scatter and are taken as reconnaissance only.

Sample 751003

Two separate thorite grains were targeted from this sample, with common Pb contents ranging from low to high from grain to grain and within each grain (Appendix B2). Grain one gives an upper intercept of 2265 ± 79 Ma with a weighted average 207 Pb/ 206 Pb age of 2314 ± 25 Ma. Grain two gives an upper intercept of 2452 ± 290 Ma with a weighted average 207 Pb/ 206 Pb age of 2645 ± 140 Ma.



Figure 13 Thorite Concordia. (a) 751003 thorite Concordia all spots; (b) 751002 thorite Concordia all spots; (c) 751003 thorite Concordia grain 1; (d) 751003 thorite Concordia grain 2; (e) 751002 thorite Concordia population 2. All ellipses are 68.3% confidence

Sample 751002

As with the previous sample, two separate thorite grains were targeted from this sample. Common Pb contents for analyses were low to high (Appendix B2). As mentioned above, these data were separated based on their apparent "age groups", with analyses from each age group present in each grain. High scatter of analyses are apparent once plotted on a conventional Concordia diagram (Figure 13). Population one gives an upper intercept age of 1607 ± 200 Ma with a weighted average 207 Pb/²⁰⁶Pb age of 1935 ± 85 Ma. Population two give an upper intercept age of 2478 ± 100 Ma and weighted average 207 Pb/²⁰⁶Pb age of 2446 ± 59 Ma, similar to that of sample 751003.

HEMATITE U-PB

Hematite U-Pb analysis was conducted *in-situ* from polished blocks of samples 751003 and 751008. As discussed above, an early and late phase of hematite was identified and targeted for U-Pb analysis in an effort to determine the age of each phase. Multiple analytical spots were placed on multiple grains from each of the samples. Their large size allowed a large spot size to be utilised on all grains. Due to the same textural relationships between the early and late phase iron oxide, data from both samples were combined. When pooled and plotted on a conventional concordia diagram, analytical display a very large amount of scatter (Figure 14). This is due to the very low level of uranium in the some of the late phase hematite, in addition to the moderate to large amounts of common lead in all analyses. Following the same methods as what was previously successfully employed to hematite dating (Ciobanu *et al.* 2013), data was filtered based on uranium and common lead content. Analyses that returned less than 1000 cps uranium, or a ²⁰⁴Pb/²⁰⁶Pb count ratio >0.1, were excluded from age calculations (Appendix B3). In addition grains that were highly reversely discordant

were excluded. The remaining data was almost solely from the late hematite phase, and as a result the single point from the early phase was pooled with the late. The resultant data displays a very poor discord line with an upper intercept of 3215 ± 130 , and a weighted average 207 Pb/ 206 Pb age of 3071 ± 90 Ma.



Figure 14 Hematite Concordia. a) 751003 and 751008 all data. Note some spots lie off displayed plot area; b) 751003 and 751008 data filtered as per relevant text. All ellipses are 68.3% confident.

DISCUSSION

A conceptual model for bedrock mineralization within the Samphire project area needs to consider all information, including geological, petrographic, mineralogical and geochronological data. Derivation of a genetic model is dependent on the critical evaluation of all available evidence.

The mineral assemblages observed in altered granite and within the crosscutting 'epithermal' fluorite veins hosted by the granite sampled here closely resemble those identified in IOCG-style mineralization throughout the eastern parts of the Gawler Craton (Conor *et al.* 2010; Hayward & Skirrow 2010). IOCG-style mineralization of Hiltaba-age is known on the Eyre Peninsula as far west as the Middleback Ranges, where it occurs at the Moola and Princess prospects within mining tenements held by Arrium (Feltus et al. in press). Other base and precious metal prospects discovered in the Central Eyre region in recent years (e.g. in the Paris and Menninnie Dam areas), even if not considered as IOCG systems, do show a spatial affinity with 1.6 - 1.575 Ga Hiltaba Suite Granites or Gawler Range Volcanics, and are thus cautiously interpreted as the products of the same metallogenic event.

Alongside fluorite, base metal sulphides (including molybdenite) and hematite, complex mineral associations containing rare earth elements, uranium and thorium, as well as HFSE and other granitophile elements (W, Sn, Mo) have been observed in this study (Figures 4-8). Based on these characteristics it is reasonable to interpret the bedrock mineralization as related to the host granite. However, despite the fact that the petrographic and mineral signatures are broadly comparable with those known from other IOCG deposits and prospects in the Olympic Province, the reconnaissance zircon, thorite and hematite geochronological data shows inherited ages that are older than the ~1.6 Ga age of the Hiltaba Suite.

Petrography and mineral geochemical signatures

The LA-ICP-MS trace element data presented here shows that there are two distinct generations of hematite expressed in both textural and compositional terms: (i) an early

generation which replaces accessory magnetite + ilmenite, and is characterised by enrichment in REY and U; and (ii) a clearly later (hydrothermal) generation of hematite (along veinlets, bladed appearance) that is enriched in other granitophile elements (W+Sn+Mo) relative to the first generation (Figure 10a). A known mechanism of alteration within IOCG-type mineralization is hematite replacing magnetite, which is associated with an early, deep to late, shallow trend (Mark *et al.* 2006; Bastrakov *et al.* 2007).

The early alteration of granite comprises mineralogical features (albite lamella in Kfeldspar), similar to those reported for Hiltaba granites from the Moonta area during albitization (Kontonikas-Charos *et al.* 2014). The geochemical signature of hematite replacing accessory magnetite in the Arthurton granite (Moonta area; Ciobanu 2013 DET CRC unpublished report) is also comparable to that within the Mullaquana granite here (Figure 10). Zonation patterns and enrichment in W, Sn, Mo in the second generation of hematite is comparable to U-bearing hematite from mineralised breccias at Olympic Dam (Ciobanu *et al.* 2013). The depletion in REY relative to first generation of hematite can be attributed to preferential partitioning into REY-minerals such as thorite, and also fluorite. The relative U-depletion can be attributed to partial remobilisation of this element (Figure 11).

Petrographic data and chondrite-normalised REE fractionation patterns for fluorite also point to the likelihood of two generations of fluorite. This raises the question of what each of these generations represent, and what is their relative timing. Moreover the pronounced negative Ce-anomaly in vein fluorite, as well as the lower REY budget,

indicates fluids which are distinct from those related to the earlier phase of alteration and molybdenite deposition.

Figure 15 proposes a sequence of hydrothermal alteration within the Samphire Granite. The presence of calcite and halite suggest some interesting possibilities for evolving fluid compositions and sources within the alteration sequence. IOCG ore fluids have been shown to be variable and contain high salinity with significant volatile (H₂O, CO₂ and F) contents (Kendrick *et al.* 2007; Reid *et al.* 2009; McPhie *et al.* 2011a; McPhie *et al.* 2011b). Fluid mixing models have been proposed (e.g. Haynes *et al.* 1995) between magmatic source fluids and meteoric/surficial brines.





Geochronological constraints

Direct evidence for the age of granites underlying the Samphire prospect is available in the form of U-Pb SHRIMP zircon data of samples from drillholes MRC005 and MRC009 (Jagodzinski and Reid, in press) intersecting the Mullaquana granite. These gave interpreted ages of magmatic crystallization of 1584 ± 4 Ma and 1585 ± 6 Ma, respectively. These two drillholes are ~1 and ~10 km SE of the area covered in the present study.

The reconnaissance geochronological data presented here is in poor agreement with the results of Jagodzinski & Reid (in press). The ages determined for thorite (Pb/Pb ages of 2.6-2.3 and 1.935 Ga) and hematite (Pb/Pb ages older than 3.0 Ga?) are all significantly older than expected, which could be interpreted as inherited uranium and thorium. The upper intercept zircon ages and average Pb-Pb ages display a broad range from Archean to later Proterozoic.

These results should be interpreted with caution for a number of reasons: (i) metamictization of the zircons; (ii) use of non-matrix-matched zircon standards for thorite and hematite; (iii) the relatively small number of grains analysed; and (iv) a high proportions of common lead in many of the analysed grains. They are nevertheless sufficiently different and internally consistent to warrant interest. It is also important to note there are no grounds to suspect instrumental problems, given that 'expected' ages were determined on other samples using identical methodology during the same LA-ICP-MS runs. Thorite has been shown to be a robust and accurate geochronometer well

suited to LA-ICP-MS U-Pb analysis, and without any evidence for isotopic inheritance (Cottle 2014).

One plausible interpretation is that the granite sampled and dated in this study is not the same as that analyzed by Jagodzinski & Reid (in press) and that the bedrock in the vicinity of Samphire (broadly considered as the Samphire batholith) is populated by granites of different ages despite similarity in appearance. The granite body strikes 35 km N-S and is clearly delineated by magnetic imagery. It has, until now, been considered to be a composite body but nevertheless to have a shared age. Interestingly, Uranium SA have shown that certain petrogenetic indicators differ from the Hiltaba average, notably concentrations of high field strength elements, high K/Rb and high Rb/Sr.

A second possibility is that the Samphire granite incorporates fragments or xenoliths of older granites or other felsic igneous rocks. Indirect support for this interpretation comes from the observation (Figure 3) of more porphyritic varieties within an otherwise homogeneous rock.

Further work is required to validate the ages obtained here as they potentially provide tantalising evidence for introduction of U-Th-bearing assemblages during Archean to Paleoproterozoic time into this portion of the Gawler Craton, well before the Hiltaba event at 1.6 Ma. Future work might also attempt to constrain the age of the fluorite veins relative to the host granite. The presence of abundant and relatively coarsegrained molybdenite within those veins opens up the possibility of using Re-Os geochronology to constrain the age of mineralization (Reid *et al.* 2013).

There exists a good precedent for pre-Hiltaba aged granites in the eastern part of the Eyre Peninsula. Fraser *et al.* (2010) have given U–Pb SHRIMP zircon ages and Sm–Nd isotopic evidence for early Mesoarchean (~3150 Ma) crust which covers an area of at least ~1500 km². The Cooyerdoo Granite sample analysed by Fraser *et al.* (2010) was collected ~50 km NW of the Samphire property.

Towards a genetic model

Several sub-styles of uranium mineralization occur on the Samphire property. The largest tonnage (the Blackbush deposit) occurs in the Eocene-Miocene cover sequence, particularly within Eocene Kanaka beds that lie immediately above the unconformable top of the granite (Figure 16). More recently, higher-grade mineralization has been recognised within the unconformity zone itself. A third type of uranium mineralisation (so-called 'bedrock mineralization') is restricted to decompression structures in clay-altered granite and saprolite, with the best grades in shallow-dipping structures within the granite.



Figure 16 Schematic cross-section showing location of uranium of uranium mineralization in the Samphire project area relative to bedrock (Uranium SA 2013)

In the currently held genetic model to explain all uranium mineralization on the Samphire property, the uranium in the cover sequence, at the granite-cover unconformity, and in clay-altered granite was originally sourced in the underlying granite and was driven into the cover at some time after sedimentation of the latter. According to Uranium SA presentations, and based on the work of Schofield (2010), the granite is considered to hold potential for larger reserves of disseminated magmaticrelated uranium. In this model, the fluorite veins are considered to have played a role as conduits for upwards migration of U-bearing fluids. The present study shows changes in the signatures of key alteration minerals (Fe-oxides, REY-minerals, fluorite) from the basement granite, supporting recycling of U, granitophile elements (W, Sn, Mo) and REY concurrent with the above idea that the granite is host and a potential source for U mineralisation, whether within clay-altered granite or in the cover. The low U content in fluorite relative to other coexisting minerals such as hematite in stage II indicates this is not necessarily the key pathfinder for U pathways. The observed trace element recycling is concurrent with a sequence of superimposed magmatic and tectonic events in this area.

Practical implications

The study suggests that the bedrock geology of the Samphire project area may be more complex than previously considered. This has implications for a conceptual genetic model and also for ongoing exploration of bedrock-hosted mineralization in the Samphire deposit, including the 2014 discovery of mylonite-hosted uranium mineralization (Dragon prospect), 4 km west of Blackbush and likely part of the regional, 1730–1690 Ma Kalinjala Mylonite Zone (Dutch *et al.* 2008).

Geochemical fingerprinting of Fe-oxides is increasingly used in ore geology, not only to discriminate between different deposit types (e.g. Dupuis & Beaudoin 2011) but also to recognise temporally-distinct generations of mineralization with metallogenically complex terranes (e.g. Ciobanu *et al.* 2013), or where mineralization events have been superimposed on one another. The data for hematite presented here represent a valuable contribution to ongoing work aimed at establishing a framework for distribution

patterns in Fe-oxides in South Australian IOCG deposits and in other types of ironbearing ore systems.

CONCLUSIONS

Mineralogy and textural relationships have been determined in altered granite and crosscutting fluorite veins. The assemblages, comprising fluorite, base metal sulphides and hematite, and minerals containing REE, U and Th are comparable with those found in IOCG mineralization across the eastern Gawler Province.

LA-ICP-MS trace element data for hematite and fluorite show geochemically and texturally distinct generations, raising the possibility of multiple mineralization events.

Reconnaissance U-Pb geochronology of zircon, hematite and thorite has given a range of Archean-Paleoproterozoic ages, all of which are significantly older than the anticipated ~1.6 Ga. This raises the possibility that there are older granites, or fragments thereof in the region, and that uranium could have been introduced early in the crustal history of the region.

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APPENDIX A: LA-ICP-MS METHODOLOGY

LA-ICP-MS trace element spot analysis

Sample material consists of 1-inch polished blocks. Samples were investigated using optical and scanning electron microscopes prior to LA-ICP-MS analysis.

Trace element compositions of hematite and fluorite were determined using a Resonetics M-50-LR 193-nm Excimer laser microprobe coupled to an Agilent 7700cx Quadrupole ICP-MS housed at Adelaide Microscopy. The M-50 utilises a two-volume small volume ablation cell designed by Laurin Technic Pty (e.g., Müller et al., 2009). Ablation was performed in an atmosphere of UHP He (0.7 l/min), and upon exiting the cell the aerosol cell is mixed with Ar (0.93 l/min) immediately after the ablation cell, after which the mix is passed through a pulse-homogenizing device or "squid" prior to direct introduction into the torch. The ICPMS was optimized daily to maximize sensitivity on isotopes of the mass range of interest, while keeping production of molecular oxide species (i.e., 232 Th¹⁶O/²³²Th) and doubly charged ion species (i.e., 140 Ce²⁺/¹⁴⁰Ce⁺) as low as possible, and usually <0.2%. Beam diameter was set at 30 µm, with a repetition rate of 10 Hz and energy set to produce a fluence at the sample of ~8 Jcm⁻². Ablation was conducted using identical tune conditions to those mentioned in the mapping section below.

Data were collected using time-resolved data acquisition in fast peak-jumping mode, and calculations were carried out using the data reduction software GLITTER (Van Achterbergh et al., 2001). Total acquisition time per analysis was 80 seconds (s), with 30s background measurement followed by 50s of sample ablation. Calibration was performed against the NIST-601 and BHVO-2G standard glasses using the coefficients of Pearce et al. (1997). Batches of ten analyses were bracketed by repeat analyses of the

external standard BHVO-2G, allowing monitoring of, and correction for, instrumental drift. A linear drift correction based on the analysis sequence and on the bracketing analyses of BHVO-2G, was applied to the count rate for each sample. ⁵⁷Fe and ⁴³Ca were used as the internal standards for hematite and fluorite, respectively, assuming end-member composition. Nadoll and Koenig (2011) reported that silicate glass standards can produce accurate results for trace element LA-ICP-MS analyses of Fe-oxides.

The following basic set of isotopes were monitored: ²⁴Mg, ²⁷Al, ²⁹Si, ³¹P, ⁴³Ca, ⁴⁵Sc, ⁴⁹Ti, ⁵¹V, ⁵³Cr, ⁵⁵Mn, ⁵⁷Fe, ⁵⁸Fe, ⁵⁹Co, ⁶⁰Ni, ⁶⁵Cu, ⁶⁶Zn, ⁶⁹Ga, ⁷⁵As, ⁸⁹Y, ⁹⁰Zr, ⁹³Nb, ⁹⁵Mo, ¹¹⁸Sn, ¹²¹Sb, ¹³⁷Ba¹³⁹La, ¹⁴⁰Ce, ¹⁴¹Pr, ¹⁴⁶Nd, ¹⁴⁷Sm, ¹⁵³Eu, ¹⁵⁷Gd, ¹⁵⁹Tb, ¹⁶³Dy, ¹⁶⁵Ho, ¹⁶⁶Er, ¹⁶⁹Tm, ¹⁷²Yb, ¹⁷⁵Lu, ¹⁸¹Ta, ¹⁸²W, ²⁰⁶Pb, ²⁰⁷Pb, ²⁰⁸Pb, ²³²Th and ²³⁸U.

LA-ICP-MS element mapping

LA-ICP-MS mapping of hematite was conducted using the same LA-ICP-MS system. Imaging was performed by ablating sets of parallel line rasters in a grid across the sample. A beam size of 24 μ m and a scan speed of 15 μ m/s were chosen which resulted in the desired sensitivity of elements of interest, and adequate spatial resolution for the study. The spacing between the lines was kept at a constant 24 μ m to match the size of the laser beam used. The effect of redeposition during mapping was minimized by preablating each line prior to its main data collection run. A laser repetition of 10 Hz was selected at a constant energy output of 100 mJ, resulting in an energy density of ~6 J/cm2 at the target. Using these beam conditions depth of ablation during mapping was around 5-10 μ m. A set of 21 elements were analyzed with dwell time for all masses set to 0.003 s, resulting in a total sweep time of ~0.03 s. A 20 second background

acquisition was acquired at the start of every raster, and to allow for cell wash-out, gas stabilization, and computing processing, a delay of 20 s was used after each line. Identical rasters were done on reference glasses NIST-610 and BHVO-2G at the start and end of a mapping run.

Images were compiled and processed using the program Iolite developed by the Melbourne Isotope Group at Melbourne University (e.g., Woodhead et al., 2007). Iolite is an open source software package for processing ICP-MS data, and is an add-in for the data analysis program Igor developed by WaveMetrics. A typical mapping run was analyzed over a 6-7-hour session, in which significant instrument drift could occur. To correct for this, standards were analyzed immediately before and after the run to assess drift and if present, was corrected for by applying a linear fit between the two sets of standards. Following this, for each raster and every element, the average background was subtracted from its corresponding raster, and the rasters were compiled into a 2-D image displaying combined background/drift corrected intensity for each element.

U-Pb dating methodology

In situ U-Pb hematite, zircon, and thorite geochronology was undertaken via Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS). U-Pb analyses were carried out on a Resonetics M-50 193nm Excimer laser attached to an Agilent 7700cs ICP-MS. Ablation was conducted in a helium atmosphere after which argon gas added immediately after the cell to aid transport of material. Iron oxide analysis was conducted with a spot size of 33 micron, zircon a spot size of 17 micron, and thorite at a reduced spot size of 10 micron and transmission of 25%, in order to limit the sensitivity of thorium at the mass spectrometer. A laser frequency of 10 Hz

was used resulting in a fluence range of 5-8 J/cm² at the ablation site for iron oxide, zircon, and thorite. A single analytical spot consisted of a 30s gas blank followed by 30s of data acquisition with the laser firing. Measured isotopes were ²⁰⁴Pb, ²⁰⁶Pb, ²⁰⁷Pb, ²⁰⁸Pb, ²³²Th, and ²³⁸U with dwell times of 10, 30, 60, 20, 20, and 30 ms respectively for both iron oxide and zircon analysis, and 10, 15, 30, 10, 10, and 15ms for thorite analysis. Mass ²⁰⁴Pb was measured as a monitor of common lead content, and due to the unresolvable isobaric interference of ²⁰⁴Hg on ²⁰⁴Pb common lead corrections were not conducted.

Age calculations and corrections for down-hole element fractionation for all three phases dated were corrected in the GLITTER software via the use of the external primary zircon standard GJ-1 (TIMS normalisation data 207 Pb/ 206 Pb = 608.3 Ma, 206 Pb/ 238 U = 600.7 Ma and 207 Pb/ 235 U = 602.2 Ma^{S5}). An overestimated uncertainty of 1% was assigned to the TIMS derived normalisation age for GJ-1. Instrument drift was also corrected for in GLITTER via standard bracketing every 15-20 unknowns and application of a linear correction. Accuracy was verified by repeat analysis of the inhouse Sri Lankan zircon standard (BJWP-1, ID-TIMS 206 Pb/ 238 U = 720.4 Ma). The compiled weighted average 206 Pb/ 238 U age for BJWP-1 were 717 ± 10 for (95% confidence; n=13).

Due to the unresolvable ²⁰⁴Hg on ²⁰⁴Pb interference, isotope ratios are presented uncorrected for common lead, with concordia plots generated using Isoplot/Ex 3.71 (Ludwig 2008).

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APPENDIX B1: U-PB DATING OF ZIRCON

| Analysis_# | C | 207 | | Isotope Ratios | | 207 | | 208 /232 | | Ages (Ma) | |
|--------------------------|----------|--------|--------|-------------------|--------|--------|--------|----------|--------|------------|----------|
| Carrie 1- 754.00 | Grain | Pb/Pb | 1σ | Pb/U | 1σ | Pb/U | 15 | Pb/Th | 1σ | Pb/Pb | 1σ |
| Sample 75100 | 13 | | | | | | | | | | |
| 01 751003 - | 1 | 0.0829 | 0.0011 | 0.0765 | 0.0008 | 0.8739 | 0.0115 | 0.0076 | 0.0003 | ### | 26 |
| 02 751003 - | 1 | 0.0895 | 0.0019 | 0.0609 | 0.0006 | 0.7517 | 0.0142 | 0.0101 | 0.0007 | ### | 39 |
| 03 751003 - | 1 | 0.0833 | 0.0013 | 0.0520 | 0.0005 | 0.5972 | 0.0089 | 0.0060 | 0.0003 | ### | 31 |
| 04 751003 - | 1 | 0.0871 | 0.0015 | 0.0605 | 0.0008 | 0.7256 | 0.0127 | 0.0036 | 0.0002 | ### | 33 |
| 05 751003 - | 1 | 0.0912 | 0.0014 | 0.0456 | 0.0006 | 0.5729 | 0.0092 | 0.0059 | 0.0003 | ### | 30 |
| 06 751003 - | 2 | 0.0925 | 0.0035 | 0.0672 | 0.0012 | 0.8574 | 0.0304 | 0.0087 | 0.0006 | ### | 70 |
| 07 751003 - | 2 | 0.0913 | 0.0022 | 0.0940 | 0.0013 | 1.1822 | 0.0277 | 0.0059 | 0.0005 | ### | 45 |
| 08 751003 - | 2 | 0.0914 | 0.0030 | 0.0359 | 0.0006 | 0.4479 | 0.0140 | 0.0058 | 0.0005 | ### | 61 |
| 09 751003 - 10 | 2 | 0.0874 | 0.0025 | 0.0412 | 0.0007 | 0.4934 | 0.0137 | 0.0022 | 0.0001 | ### ### | 54 40 |
| 751003 - 11 | 3 | 0.1745 | 0.0033 | 0.0533 | 0.0007 | 1.2787 | 0.0248 | 0.0018 | 0.0001 | ### | 31 |
| 751003 - 12 | 3 | 0.1708 | 0.0037 | 0.0864 | 0.0013 | 2.0321 | 0.0444 | 0.0052 | 0.0004 | ### | 36 |
| 751003 - 13 | 3 | 0.1685 | 0.0038 | 0.0587 | 0.0009 | 1.3598 | 0.0309 | 0.0023 | 0.0002 | ### | 37 |
| 751003 - 14 | 4 | 0.1038 | 0.0028 | 0.0201 | 0.0003 | 0.2874 | 0.0075 | 0.0015 | 0.0001 | ### | 48 |
| 751003 - 15 751002 | 4 | 0.1279 | 0.0037 | 0.0221 | 0.0004 | 0.3897 | 0.0110 | 0.0041 | 0.0004 | ### | 50 |
| 16 751003 - | 4 | 0.1039 | 0.0034 | 0.0142 | 0.0003 | 0.2030 | 0.0064 | 0.0010 | 0.0001 | ### | 59 |
| 17 751003 - | 4 | 0.1093 | 0.0030 | 0.0161 | 0.0003 | 0.2429 | 0.0065 | 0.0014 | 0.0001 | ### | 49 |
| 18 751003 - | 4 | 0.1108 | 0.0034 | 0.0144 | 0.0002 | 0.2198 | 0.0066 | 0.0034 | 0.0004 | ### | 55 |
| 19 | 4 | 0.1027 | 0.0032 | 0.0172 | 0.0003 | 0.2433 | 0.0074 | 0.0026 | 0.0002 | ### | 56 |
| Sample 75100 |)2 | | | | | | | | | | |
| 751002 - 01 751002 | 1 | 0.1572 | 0.0025 | 0.0222 | 0.0003 | 0.4810 | 0.0077 | 0.0021 | 0.0001 | ### | 27 |
| 02 751002 - | 1 | 0.1478 | 0.0031 | 0.0202 | 0.0003 | 0.4107 | 0.0086 | 0.0021 | 0.0001 | ### | 35 |
| 03 751002 - | 1 | 0.1858 | 0.0031 | 0.0667 | 0.0008 | 1.7076 | 0.0278 | 0.0097 | 0.0005 | ### | 27 |
| 04 751002 - | 1 | 0.1998 | 0.0031 | 0.1275 | 0.0015 | 3.5108 | 0.0543 | 0.0207 | 0.0009 | ### | 25 |
| 05 751002 - | 1 | 0.2235 | 0.0032 | 0.2382 | 0.0026 | 7.3414 | 0.1003 | 0.0842 | 0.0031 | ### | 22 |
| 06 751002 - | 1 | 0.1644 | 0.0036 | 0.0438 | 0.0007 | 0.9917 | 0.0218 | 0.0041 | 0.0003 | ### | 36 |
| 07 | 1 | 0.1442 | 0.0028 | 0.0370 | 0.0005 | 0.7354 | 0.0142 | 0.0046 | 0.0003 | ### | 33 |

| 751002 - | | | | | | | | | | | |
|---------------------------|---|-----------|--------|-----------|--------|--------|---------|--------|--------|-----|----|
| 08 | 1 | 0.1316 | 0.0026 | 0.0387 | 0.0005 | 0.7021 | 0.0141 | 0.0033 | 0.0002 | ### | 34 |
| 751002 - | | | | | | | | | | | |
| 09 | 1 | 0.1178 | 0.0027 | 0.0481 | 0.0007 | 0.7796 | 0.0180 | 0.0030 | 0.0002 | ### | 41 |
| 751002 - | | | | | | | | | | | |
| 10 | 1 | 0.1264 | 0.0038 | 0.0302 | 0.0005 | 0.5265 | 0.0156 | 0.0094 | 0.0009 | ### | 52 |
| 751002 - | | 0 4 4 5 0 | 0.000- | 0.0400 | 0 0000 | 0.000 | 0.04.00 | 0.0000 | 0.000- | | |
| 11 | 1 | 0.1159 | 0.0027 | 0.0432 | 0.0006 | 0.6905 | 0.0160 | 0.0063 | 0.0005 | ### | 41 |
| 751002 - | 2 | 0 1 2 2 2 | 0 0020 | 0.0202 | 0 0002 | 0 2700 | 0.0070 | 0.0011 | 0.0001 | шиц | 27 |
| 12 751002 - | Z | 0.1522 | 0.0028 | 0.0205 | 0.0005 | 0.5706 | 0.0079 | 0.0011 | 0.0001 | ### | 57 |
| 13 | 2 | 0 1553 | 0 0048 | 0 0737 | 0 0013 | 1 5780 | 0 0480 | 0 0054 | 0.0005 | ### | 52 |
| 751002 - | 2 | 0.1555 | 0.0040 | 0.0757 | 0.0015 | 1.5700 | 0.0400 | 0.0004 | 0.0005 | | 52 |
| 14 | 2 | 0.1416 | 0.0047 | 0.0208 | 0.0004 | 0.4059 | 0.0131 | 0.0019 | 0.0002 | ### | 56 |
| Sample 845007 845007 - | | | | | | | | | | | |
| 01 | 1 | 0.1046 | 0.0020 | 0.1215 | 0.0015 | 1.7517 | 0.0339 | 0.0102 | 0.0006 | ### | 35 |
| 845007 - | | | | | | | | | | | |
| 02 | 1 | 0.1080 | 0.0029 | 0.0994 | 0.0015 | 1.4788 | 0.0394 | 0.0090 | 0.0008 | ### | 49 |
| 845007 - | | | | | | | | | | | |
| 03 | 1 | 0.1157 | 0.0026 | 0.2311 | 0.0028 | 3.6868 | 0.0778 | 0.0217 | 0.0016 | ### | 39 |
| 845007 - | | | | | | | | | | | |
| 04 | 1 | 0.1085 | 0.0028 | 0.1034 | 0.0016 | 1.5453 | 0.0399 | 0.0078 | 0.0006 | ### | 46 |
| 845007 - | | | | | | | | | | | |
| 05 | 1 | 0.1058 | 0.0025 | 0.1078 | 0.0016 | 1.5/11 | 0.0374 | 0.0093 | 0.0007 | ### | 43 |
| 845007 - | 1 | 0 1025 | 0.0024 | 0 1 0 0 2 | 0.0010 | 1 5570 | 0.0500 | 0.0000 | 0.0000 | ццц | 60 |
| 00 845007 | T | 0.1035 | 0.0034 | 0.1092 | 0.0019 | 1.5572 | 0.0506 | 0.0030 | 0.0003 | ### | 60 |
| 07 | 2 | 0 1299 | 0 0037 | 0 0768 | 0 0012 | 1 37// | 0 0380 | 0.0040 | 0.0004 | ### | 40 |
| 845007 - | 2 | 0.1255 | 0.0057 | 0.0700 | 0.0012 | 1.5744 | 0.0505 | 0.0040 | 0.0004 | | 45 |
| 08 | 2 | 0.1309 | 0.0041 | 0.0605 | 0.0010 | 1.0921 | 0.0333 | 0.0051 | 0.0005 | ### | 53 |
| 845007 - | _ | | | | | | | | | | |
| 09 | 3 | 0.1110 | 0.0030 | 0.0638 | 0.0010 | 0.9757 | 0.0264 | 0.0056 | 0.0005 | ### | 48 |
| 845007 - | | | | | | | | | | | |
| 10 | 3 | 0.1062 | 0.0028 | 0.0445 | 0.0006 | 0.6511 | 0.0167 | 0.0049 | 0.0004 | ### | 48 |
| 845007 - | | | | | | | | | | | |
| 11 | 3 | 0.0871 | 0.0025 | 0.1307 | 0.0021 | 1.5705 | 0.0455 | 0.0107 | 0.0010 | ### | 55 |
| 845007 - | | | | | | | | | | | |
| 12 | 4 | 0.1123 | 0.0034 | 0.0822 | 0.0013 | 1.2726 | 0.0382 | 0.0076 | 0.0008 | ### | 54 |
| | | | | | | | | | | | |

Appendix B2: U-Pb dating of thorite

| | | | Isotope Ratios | | | | | | Ages (Ma) | |
|-------|---|--|--|---|---|---|---|--|---|---|
| Grain | ²⁰⁷ Pb/ ²⁰⁶ Pb | 1σ | ²⁰⁶ Pb/ ²³⁸ U | 1σ | ²⁰⁷ Pb/ ²³⁵ U | 1σ | ²⁰⁸ Pb/ ²³² Th | 1σ | ²⁰⁷ Pb/ ²⁰⁶ Pb | 1σ |
| 3 | | | | | | | | | | |
| 1 | 0.1527 | 0.0029 | 0.0621 | 0.0009 | 1.3067 | 0.0247 | 0.0023 | 0.0001 | 2376 | 32 |
| 1 | 0.1440 | 0.0029 | 0.1139 | 0.0015 | 2.2637 | 0.0452 | 0.0047 | 0.0003 | 2276 | 34 |
| 1 | 0.1496 | 0.0026 | 0.0619 | 0.0009 | 1.2769 | 0.0232 | 0.0024 | 0.0001 | 2342 | 30 |
| 1 | 0.1507 | 0.0031 | 0.0537 | 0.0008 | 1.1157 | 0.0233 | 0.0018 | 0.0001 | 2354 | 35 |
| 1 | 0.1456 | 0.0031 | 0.0509 | 0.0007 | 1.0213 | 0.0218 | 0.0016 | 0.0001 | 2295 | 36 |
| 1 | 0.1438 | 0.0039 | 0.0486 | 0.0008 | 0.9630 | 0.0250 | 0.0014 | 0.0001 | 2273 | 46 |
| 1 | 0.1361 | 0.0041 | 0.0567 | 0.0009 | 1.0639 | 0.0307 | 0.0013 | 0.0001 | 2178 | 52 |
| 1 | 0.1409 | 0.0038 | 0.0592 | 0.0009 | 1.1510 | 0.0298 | 0.0018 | 0.0001 | 2238 | 46 |
| 1 | 0.1404 | 0.0036 | 0.0667 | 0.0010 | 1.2915 | 0.0317 | 0.0018 | 0.0001 | 2232 | 44 |
| 1 | 0.1524 | 0.0030 | 0.0491 | 0.0007 | 1.0311 | 0.0206 | 0.0015 | 0.0001 | 2373 | 33 |
| 1 | 0.1504 | 0.0028 | 0.0562 | 0.0008 | 1.1649 | 0.0223 | 0.0018 | 0.0001 | 2350 | 32 |
| 1 | 0.1483 | 0.0027 | 0.0730 | 0.0010 | 1.4918 | 0.0283 | 0.0027 | 0.0001 | 2327 | 31 |
| | Grain 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | Grain ²⁰⁷ Pb/ ²⁰⁶ Pb 3 1 0.1527 1 0.1440 1 1 0.1496 1 1 0.14507 1 1 0.1456 1 1 0.1456 1 1 0.1438 1 1 0.1404 1 1 0.1404 1 1 0.1404 1 1 0.1524 1 1 0.1504 1 1 0.1483 1 | Grain207 Pb/206 Pb1σ310.15270.002910.14400.002610.14960.002610.15070.003110.14560.003110.14380.003910.13610.004110.14090.003810.15240.003010.15040.002810.14830.0027 | Isotope Ratios Grain ²⁰⁷ Pb/ ²⁰⁶ Pb 1c ²⁰⁶ Pb/ ²³⁸ U 3 1 0.1527 0.0029 0.0621 1 0.1440 0.0029 0.1139 1 0.1496 0.0026 0.0619 1 0.1507 0.0031 0.0537 1 0.1456 0.0031 0.0509 1 0.1438 0.0039 0.0486 1 0.1361 0.0041 0.0567 1 0.1409 0.0038 0.0592 1 0.1404 0.0036 0.0667 1 0.1524 0.0030 0.0491 1 0.1504 0.0028 0.0562 1 0.1483 0.0027 0.0730 | Isotope Ratios Grain ²⁰⁷ Pb/ ²⁰⁶ Pb 1σ ²⁰⁶ Pb/ ²³⁸ U 1σ 3 1 0.1527 0.0029 0.0621 0.0009 1 0.1440 0.0029 0.1139 0.0015 1 0.1496 0.0026 0.0619 0.0009 1 0.1496 0.0026 0.0619 0.0009 1 0.14507 0.0031 0.0537 0.0008 1 0.1456 0.0031 0.0509 0.0007 1 0.1438 0.0039 0.0486 0.0008 1 0.1361 0.0041 0.0567 0.0009 1 0.1409 0.0038 0.0592 0.0009 1 0.1404 0.0036 0.0667 0.0010 1 0.1524 0.0030 0.0491 0.0007 1 0.1504 0.0028 0.0562 0.0008 1 0.1483 0.0027 0.0730 0.0010 | Isotope Ratios Grain ²⁰⁷ Pb/ ²⁰⁶ Pb 1σ ²⁰⁶ Pb/ ²³⁸ U 1σ ²⁰⁷ Pb/ ²³⁵ U 3 1 0.1527 0.0029 0.0621 0.0009 1.3067 1 0.1527 0.0029 0.1139 0.0015 2.2637 1 0.1440 0.0026 0.0619 0.0009 1.2769 1 0.1507 0.0031 0.0537 0.0008 1.1157 1 0.1456 0.0031 0.0509 0.0007 1.0213 1 0.1438 0.0039 0.0486 0.0088 0.9630 1 0.1361 0.0041 0.0567 0.0009 1.510 1 0.1409 0.038 0.0592 0.0009 1.1510 1 0.1404 0.0036 0.0667 0.0010 1.2915 1 0.1524 0.0030 0.0491 0.0007 1.0311 1 0.1504 0.0028 0.0562 0.0008 1.1649 1 0.1483< | Isotope Ratios Grain 207Pb/206Pb 10 207Pb/235U 10 1 0.1527 0.0029 0.0621 0.0009 1.3067 0.0247 1 0.1440 0.0029 0.1139 0.0015 2.2637 0.0452 1 0.1496 0.0026 0.0619 0.0009 1.2769 0.0232 1 0.1507 0.0031 0.0537 0.0008 1.1157 0.0233 1 0.1456 0.0031 0.0509 0.0007 1.0213 0.0218 1 0.1438 0.0039 0.0486 0.0008 0.9630 0.0250 1 0.1361 0.0041 0.0567 0.0009 1.1510 0.0298 1 0.1409 0.0038 0.0592 0.0009 1.1510 0.0298 1 0.1404 0.0036 0.0667 0.0010 1.2915 0.0317 1 0.1504 0.0028 0.0562 0.0008 1.1649 </td <td>Isotope Ratios Grain 207Pb/206Pb 10 206Pb/238U 10 208Pb/235U 10 208Pb/232Th 3 1 0.1527 0.0029 0.0113 207Pb/235U 10 208Pb/232Th 1 0.1527 0.0029 0.1139 0.0015 2.2637 0.0247 0.0023 1 0.1440 0.0026 0.0019 1.2769 0.0232 0.0024 1 0.1436 0.0031 0.0537 0.008 1.1157 0.0233 0.0018 1 0.1438 0.0039 0.0007 1.0143 0.0036 0.0007 1.0141 0.1361 0.0123 0.0131 1 0.1443 <th< td=""><td>Isotope Ratios Grain ²⁰⁷Pb/²⁰⁶Pb 16 ²⁰⁶Pb/²³⁸U 10 2⁰⁶Pb/²³⁸U 10 2⁰⁶Pb/²³⁸U 10 2⁰⁶Pb/²³⁸U 10 2⁰⁶Pb/²³⁸U 10 2⁰⁶Pb/²³⁶U 10 1 0.1527 0.0029 0.0019 1.2637 0.0447 0.0003 1 0.1436 0.0026 0.0011 1 0.1438 0.0039 0.0028 0.0031 0.007 1 0.1438 0.0038 0.0238 0.0014 0</td><td>Isotope Ratios Ages (Ma) Grain ²⁰⁷Pb/²⁰⁶Pb 1s ²⁰⁶Pb/²³⁸U 1s ²⁰⁷Pb/²³⁵U 1s ²⁰⁸Pb/²³²Th 1s ²⁰⁷Pb/²⁰⁶Pb 3 1 0.1527 0.0029 0.0621 0.0009 1.3067 0.0247 0.0023 0.0001 2376 1 0.1527 0.0029 0.1139 0.0015 2.2637 0.0452 0.0047 0.0003 2276 1 0.1440 0.0026 0.0619 0.009 1.2769 0.0232 0.0024 0.0001 2342 1 0.1507 0.0031 0.0537 0.008 1.1157 0.0233 0.0016 0.0001 2354 1 0.1456 0.0031 0.0599 0.007 1.0213 0.0218 0.0016 0.0011 2273 1 0.1438 0.0039 0.0486 0.0639 0.0307 0.0013 0.0011 2273 1 0.1409 0.0038 0.0592 0.0009 1.1510</td></th<></td> | Isotope Ratios Grain 207Pb/206Pb 10 206Pb/238U 10 208Pb/235U 10 208Pb/232Th 3 1 0.1527 0.0029 0.0113 207Pb/235U 10 208Pb/232Th 1 0.1527 0.0029 0.1139 0.0015 2.2637 0.0247 0.0023 1 0.1440 0.0026 0.0019 1.2769 0.0232 0.0024 1 0.1436 0.0031 0.0537 0.008 1.1157 0.0233 0.0018 1 0.1438 0.0039 0.0007 1.0143 0.0036 0.0007 1.0141 0.1361 0.0123 0.0131 1 0.1443 <th< td=""><td>Isotope Ratios Grain ²⁰⁷Pb/²⁰⁶Pb 16 ²⁰⁶Pb/²³⁸U 10 2⁰⁶Pb/²³⁸U 10 2⁰⁶Pb/²³⁸U 10 2⁰⁶Pb/²³⁸U 10 2⁰⁶Pb/²³⁸U 10 2⁰⁶Pb/²³⁶U 10 1 0.1527 0.0029 0.0019 1.2637 0.0447 0.0003 1 0.1436 0.0026 0.0011 1 0.1438 0.0039 0.0028 0.0031 0.007 1 0.1438 0.0038 0.0238 0.0014 0</td><td>Isotope Ratios Ages (Ma) Grain ²⁰⁷Pb/²⁰⁶Pb 1s ²⁰⁶Pb/²³⁸U 1s ²⁰⁷Pb/²³⁵U 1s ²⁰⁸Pb/²³²Th 1s ²⁰⁷Pb/²⁰⁶Pb 3 1 0.1527 0.0029 0.0621 0.0009 1.3067 0.0247 0.0023 0.0001 2376 1 0.1527 0.0029 0.1139 0.0015 2.2637 0.0452 0.0047 0.0003 2276 1 0.1440 0.0026 0.0619 0.009 1.2769 0.0232 0.0024 0.0001 2342 1 0.1507 0.0031 0.0537 0.008 1.1157 0.0233 0.0016 0.0001 2354 1 0.1456 0.0031 0.0599 0.007 1.0213 0.0218 0.0016 0.0011 2273 1 0.1438 0.0039 0.0486 0.0639 0.0307 0.0013 0.0011 2273 1 0.1409 0.0038 0.0592 0.0009 1.1510</td></th<> | Isotope Ratios Grain ²⁰⁷ Pb/ ²⁰⁶ Pb 16 ²⁰⁶ Pb/ ²³⁸ U 10 2 ⁰⁶ Pb/ ²³⁶ U 10 1 0.1527 0.0029 0.0019 1.2637 0.0447 0.0003 1 0.1436 0.0026 0.0011 1 0.1438 0.0039 0.0028 0.0031 0.007 1 0.1438 0.0038 0.0238 0.0014 0 | Isotope Ratios Ages (Ma) Grain ²⁰⁷ Pb/ ²⁰⁶ Pb 1s ²⁰⁶ Pb/ ²³⁸ U 1s ²⁰⁷ Pb/ ²³⁵ U 1s ²⁰⁸ Pb/ ²³² Th 1s ²⁰⁷ Pb/ ²⁰⁶ Pb 3 1 0.1527 0.0029 0.0621 0.0009 1.3067 0.0247 0.0023 0.0001 2376 1 0.1527 0.0029 0.1139 0.0015 2.2637 0.0452 0.0047 0.0003 2276 1 0.1440 0.0026 0.0619 0.009 1.2769 0.0232 0.0024 0.0001 2342 1 0.1507 0.0031 0.0537 0.008 1.1157 0.0233 0.0016 0.0001 2354 1 0.1456 0.0031 0.0599 0.007 1.0213 0.0218 0.0016 0.0011 2273 1 0.1438 0.0039 0.0486 0.0639 0.0307 0.0013 0.0011 2273 1 0.1409 0.0038 0.0592 0.0009 1.1510 |

| 751003 - 13 | 1 | 0.1456 | 0.0027 | 0.0739 | 0.0010 | 1.4829 | 0.0281 | 0.0025 | 0.0001 | 2295 | 31 |
|---------------|--------|--------|--------|--------|---------|--------|--------|--------|--------|------|----------|
| 751003 - 14 | 1 | 0.1528 | 0.0030 | 0.0596 | 0.0008 | 1.2559 | 0.0246 | 0.0021 | 0.0001 | 2377 | 33 |
| 751003 - 15 | 1 | 0.1485 | 0.0032 | 0.0742 | 0.0011 | 1.5193 | 0.0327 | 0.0025 | 0.0002 | 2329 | 36 |
| 751003 - 16 | 1 | 0.1502 | 0.0032 | 0.1438 | 0.0022 | 2.9777 | 0.0652 | 0.0009 | 0.0001 | 2348 | 36 |
| 751003 - 17 | 1 | 0.1406 | 0.0030 | 0.1052 | 0.0015 | 2.0402 | 0.0430 | 0.0009 | 0.0001 | 2235 | 36 |
| 751003 - 18 | 1 | 0.1438 | 0.0032 | 0.0851 | 0.0013 | 1.6863 | 0.0367 | 0.0007 | 0.0000 | 2273 | 37 |
| 751003 - 19 | 1 | 0.1450 | 0.0032 | 0.1468 | 0.0022 | 2.9345 | 0.0645 | 0.0012 | 0.0001 | 2288 | 37 |
| 751003 - 20 | 2 | 0.1829 | 0.0079 | 0.0206 | 0.0005 | 0.5188 | 0.0204 | 0.0003 | 0.0000 | 2679 | 69 |
| 751003 - 21 | 2 | 0.2189 | 0.0088 | 0.0170 | 0.0004 | 0.5120 | 0.0190 | 0.0007 | 0.0001 | 2973 | 64 |
| 751003 - 22 | 2 | 0.1858 | 0.0050 | 0.2318 | 0.0038 | 5.9370 | 0.1576 | 0.0078 | 0.0007 | 2705 | 44 |
| 751003 - 23 | 2 | 0.1867 | 0.0067 | 0.0356 | 0.0007 | 0.9157 | 0.0308 | 0.0016 | 0.0002 | 2713 | 58 |
| 751003 - 24 | 2 | 0.1794 | 0.0056 | 0.0232 | 0.0004 | 0.5741 | 0.0168 | 0.0007 | 0.0001 | 2648 | 51 |
| 751003 - 25 | 2 | 0.1725 | 0.0052 | 0.0315 | 0.0006 | 0.7497 | 0.0214 | 0.0008 | 0.0001 | 2582 | 49 |
| 751003 - 26 | 2 | 0.1626 | 0.0073 | 0.0256 | 0.0006 | 0.5734 | 0.0236 | 0.0001 | 0.0000 | 2483 | 74 |
| 751003 - 27 | 2 | 0.1675 | 0.0047 | 0.1037 | 0.0017 | 2.3943 | 0.0662 | 0.0025 | 0.0002 | 2533 | 46 |
| Sample 751002 | ? | | | | | | | | | | |
| 751002 - 01 | 1 | 0.1551 | 0.0055 | 0.0138 | 0.0003 | 0.2950 | 0.0099 | 0.0006 | 0.0000 | 2403 | 59 |
| 751002 - 02 | 1 | 0.1749 | 0.0047 | 0.2075 | 0.0037 | 5.0025 | 0.1323 | 0.0083 | 0.0005 | 2605 | 44 |
| 751002 - 03 | 1 | 0.1729 | 0.0052 | 0.0422 | 0.0008 | 1.0055 | 0.0290 | 0.0011 | 0.0001 | 2586 | 49 |
| 751002 - 04 | 1 | 0.1036 | 0.0030 | 0.0456 | 0.0008 | 0.6514 | 0.0186 | 0.0005 | 0.0000 | 1690 | 53 |
| 751002 - 05 | 1 | 0.1606 | 0.0032 | 0.0827 | 0.0011 | 1.8300 | 0.0361 | 0.0014 | 0.0001 | 2462 | 33 |
| 751002 - 06 | 1 | 0.1244 | 0.0035 | 0.0258 | 0.0004 | 0.4426 | 0.0120 | 0.0004 | 0.0000 | 2020 | 49 |
| 751002 - 07 | 1 | 0.1297 | 0.0029 | 0.0302 | 0.0005 | 0.5394 | 0.0118 | 0.0007 | 0.0000 | 2094 | 38 |
| 751002 - 08 | 1 | 0.1303 | 0.0026 | 0.0368 | 0.0005 | 0.6611 | 0.0132 | 0.0006 | 0.0000 | 2102 | 34 |
| 751002 - 09 | 1 | 0.1001 | 0.0022 | 0.0462 | 0.0007 | 0.6373 | 0.0139 | 0.0006 | 0.0000 | 1626 | 40 |
| 751002 - 10 | 1 | 0 1814 | 0.0049 | 0.0887 | 0.0015 | 2 2176 | 0.0567 | 0.0043 | 0.0003 | 2666 | 44 |
| 751002 - 11 | 1 | 0 1412 | 0.0032 | 0.0416 | 0.00015 | 0.8109 | 0.0185 | 0.0008 | 0.0001 | 2242 | 39 |
| 751002 - 12 | 1 | 0 1228 | 0.0027 | 0.0404 | 0.0006 | 0.6843 | 0.0147 | 0.0008 | 0.0000 | 1997 | 38 |
| 751002 - 13 | 1 | 0 1136 | 0.0023 | 0.0419 | 0.0007 | 0.6569 | 0.0185 | 0.0006 | 0.0001 | 1858 | 51 |
| 751002 - 14 | 1 | 0 1137 | 0.0030 | 0.0361 | 0.0006 | 0.5657 | 0.0148 | 0.0007 | 0.0001 | 1860 | 47 |
| 751002 - 15 | 1 | 0.1197 | 0.0030 | 0.0301 | 0.0000 | 0.3037 | 0.0140 | 0.0007 | 0.0001 | 1945 | 45 |
| 751002 - 16 | 1 | 0.1152 | 0.0051 | 0.0207 | 0.0005 | 0.4710 | 0.0120 | 0.0000 | 0.0000 | 2404 | 57 |
| 751002 10 | 1 | 0.1592 | 0.0035 | 0.0331 | 0.0007 | 0.7501 | 0.0245 | 0.0005 | 0.0000 | 2404 | /7 |
| 751002 17 | 1 | 0.1300 | 0.0043 | 0.0107 | 0.0005 | 0.4005 | 0.0111 | 0.0005 | 0.0000 | 2430 | 51 |
| 751002 10 | 1 | 0.1000 | 0.0030 | 0.0507 | 0.0007 | 0.0550 | 0.0100 | 0.0000 | 0.0000 | 1646 | 18 |
| 751002 15 | 1 | 0.1012 | 0.0020 | 0.0022 | 0.0010 | 0.0070 | 0.0225 | 0.0005 | 0.0001 | 1867 | 12 |
| 751002 - 20 | 1 | 0.1133 | 0.0028 | 0.0479 | 0.0008 | 0.7310 | 0.0185 | 0.0000 | 0.0000 | 1663 | 58 |
| 751002 - 21 | 1 | 0.1021 | 0.0033 | 0.0493 | 0.0003 | 0.0944 | 0.0218 | 0.0005 | 0.0000 | 2171 | 10 |
| 751002 - 22 | 1 | 0.1333 | 0.0038 | 0.0133 | 0.0003 | 0.2800 | 0.0073 | 0.0003 | 0.0000 | 2171 | 49 E6 |
| 751002 - 25 | 1 2 | 0.1447 | 0.0048 | 0.0133 | 0.0005 | 0.2040 | 0.0085 | 0.0002 | 0.0000 | 2204 | 47 |
| 751002 - 24 | 2 | 0.1383 | 0.0043 | 0.0275 | 0.0003 | 0.3930 | 0.0103 | 0.0008 | 0.0001 | 2430 | 47 |
| 751002 - 25 | 2 | 0.1302 | 0.0040 | 0.0105 | 0.0005 | 0.2900 | 0.0104 | 0.0002 | 0.0000 | 2101 | 64 |
| 751002 - 20 | 2 | 0.1207 | 0.0046 | 0.0150 | 0.0005 | 0.2700 | 0.0099 | 0.0005 | 0.0000 | 2055 | 50 |
| 751002 - 27 | 2 | 0.1345 | 0.0044 | 0.0239 | 0.0004 | 0.4430 | 0.0139 | 0.0005 | 0.0000 | 2157 | 50 |
| 751002 - 28 | 2 | 0.1421 | 0.0050 | 0.01/1 | 0.0003 | 0.3354 | 0.0111 | 0.0003 | 0.0000 | 2254 | 59 |
| 751002 - 29 | 2 | 0.1582 | 0.0067 | 0.0105 | 0.0002 | 0.2290 | 0.0090 | 0.0002 | 0.0000 | 2437 | 70 |
| 751002 - 30 | 2 | 0.1506 | 0.0062 | 0.0135 | 0.0003 | 0.2810 | 0.0108 | 0.0002 | 0.0000 | 2352 | 68 |
| 751002 - 31 | 2 | 0.1250 | 0.0041 | 0.0229 | 0.0004 | 0.3951 | 0.0124 | 0.0003 | 0.0000 | 2029 | 57 |
| 751002 - 32 | 2 | 0.1064 | 0.0031 | 0.0341 | 0.0006 | 0.5005 | 0.0141 | 0.0007 | 0.0001 | 1739 | 52 |
| 751002 - 33 | 2 | 0.1742 | 0.0066 | 0.0078 | 0.0002 | 0.1883 | 0.0067 | 0.0004 | 0.0000 | 2598 | 62 |
| 751002 - 34 | 2 | 0.1530 | 0.0049 | 0.0091 | 0.0002 | 0.1914 | 0.0059 | 0.0003 | 0.0000 | 2380 | 54 |
| 751002 - 35 | 2 | 0.16/1 | 0.0080 | 0.0124 | 0.0003 | 0.2853 | 0.0126 | 0.0004 | 0.0000 | 2529 | /9 |
| 751002 - 36 | 2 | 0.1/18 | 0.0057 | 0.0076 | 0.0002 | 0.1/8/ | 0.0055 | 0.0003 | 0.0000 | 25/5 | 54 |
| 751002 - 37 | 2 | 0.1553 | 0.0051 | 0.0127 | 0.0002 | 0.2/12 | 0.0084 | 0.0005 | 0.0000 | 2405 | 54 |
| 751002 - 38 | 2 | 0.1403 | 0.0052 | 0.0108 | 0.0002 | 0.2091 | 0.0074 | 0.0003 | 0.0000 | 2231 | 63 |
| /51002 - 39 | 2 | 0.1204 | 0.0048 | 0.0225 | 0.0005 | 0.3744 | 0.0143 | 0.0004 | 0.0000 | 1963 | 70 |
| /51002 - 40 | 2 | 0.1615 | 0.0064 | 0.0138 | 0.0003 | 0.3061 | 0.0113 | 0.0003 | 0.0000 | 2471 | 65 |
| /51002 - 41 | 2 | 0.1696 | 0.0074 | 0.0294 | 0.0007 | 0.6880 | 0.0280 | 0.0015 | 0.0002 | 2554 | 71 |
| /51002 - 42 | 2 | 0.1949 | 0.0067 | 0.0466 | 0.0009 | 1.2512 | 0.0405 | 0.0017 | 0.0002 | 2784 | 55 |

| Analysis_# | Ages (Ma) | | | | Ages (Ma) | | | | Background subtracted CPS | | | |
|--------------------------|-------------------------------------|----|-------------------------------------|----|--------------------------------------|----|-------------------|-------------------|---------------------------------|-------------------|-------------------|------------------|
| | ²⁰⁶ Pb/ ²³⁸ U | 1σ | ²⁰⁷ Pb/ ²³⁵ U | 1σ | ²⁰⁸ Pb/ ²³² Th | 1σ | ²⁰⁴ Pb | ²⁰⁶ Pb | ²⁰⁷ Pb | ²⁰⁸ Pb | ²³² Th | ²³⁸ U |
| Sample 7510 751003 - | 003 | | | | | | | | | | | |
| 01 751003 - | 388 | 5 | 849 | 11 | 45 | 2 | 172 | 28608 | 4319 | 98724 | 4.1E+07 | 556226 |
| 02 751003 - | 696 | 9 | 1201 | 14 | 95 | 5 | 173 | 44190 | 6255 | 2E+05 | 3.2E+07 | 447919 |
| 03 751003 - | 387 | 5 | 836 | 10 | 48 | 2 | 140 | 31483 | 4701 | 1E+05 | 4.4E+07 | 630566 |
| 04 751003 - | 337 | 5 | 761 | 11 | 36 | 2 | 133 | 28315 | 4251 | 97519 | 5.2E+07 | 664183 |
| 05 751003 - | 320 | 5 | 715 | 11 | 31 | 2 | 102 | 22852 | 3304 | 84441 | 5.1E+07 | 549788 |
| 06 751003 - | 306 | 5 | 685 | 13 | 28 | 2 | 56 | 16297 | 2289 | 63874 | 4.1E+07 | 380483 |
| 07 751003 - | 355 | 6 | 736 | 15 | 26 | 2 | 62 | 18819 | 2517 | 67527 | 4.6E+07 | 384132 |
| 08 751003 - | 371 | 6 | 778 | 14 | 37 | 3 | 81 | 18843 | 2596 | 64267 | 3.2E+07 | 359721 |
| 09 751003 - | 416 | 6 | 842 | 14 | 37 | 3 | 103 | 22960 | 3159 | 77157 | 3.7E+07 | 391393 |
| 10 751003 - | 309 | 4 | 720 | 10 | 29 | 1 | 122 | 22910 | 3487 | 77695 | 4.8E+07 | 584696 |
| 11 751003 - | 352 | 5 | 784 | 10 | 36 | 2 | 137 | 26348 | 3951 | 88023 | 4.4E+07 | 581013 |
| 751003 - 12 751002 | 454 | 6 | 927 | 12 | 53 | 3 | 179 | 34345 | 5087 | 1E+05 | 4.2E+07 | 585884 |
| 13 | 459 | 6 | 923 | 12 | 50 | 3 | 166 | 33497 | 4863 | 1E+05 | 4.3E+07 | 561910 |
| 751003 - 14 751002 | 373 | 5 | 826 | 11 | 43 | 2 | 146 | 27543 | 4175 | 93050 | 4.2E+07 | 567699 |
| 751003 - 15 751002 | 461 | 7 | 938 | 13 | 51 | 3 | 182 | 35450 | 5277 | 1E+05 | 4.6E+07 | 616241 |
| 751003 - 16 | 866 | 12 | 1402 | 17 | 17 | 1 | 220 | 35410 | 5328 | 84092 | 8.9E+07 | 318743 |
| 751003 - 17 751002 | 645 | 9 | 1129 | 14 | 18 | 1 | 98 | 20761 | 2901 | 68547 | 7.4E+07 | 238781 |
| 751003 - 18 754002 | 526 | 7 | 1003 | 14 | 14 | 1 | 73 | 14802 | 2121 | 53583 | 7.4E+07 | 215531 |
| 751003 - 19 | 883 | 12 | 1391 | 17 | 24 | 1 | 176 | 31952 | 4628 | 96941 | 7.4E+07 | 278444 |
| 751003 - 20 | 131 | 3 | 424 | 14 | 5 | 0 | 85 | 11008 | 2227 | 31902 | 5.2E+07 | 764339 |
| 751003 - 21 | 109 | 2 | 420 | 13 | 15 | 1 | 97 | 11503 | 2540 | 35736 | 4.5E+07 | 938515 |
| 751003 - 22 | 1344 | 20 | 1967 | 23 | 157 | 14 | 247 | 33805 | 6268 | 66643 | 8695793 | 187577 |
| 751003 - 23 | 225 | 4 | 660 | 16 | 33 | 3 | 58 | 10973 | 2045 | 31368 | 2E+07 | 393168 |
| 751003 - 24 | 148 | 3 | 461 | 11 | 14 | 1 | 69 | 9833 | 1754 | 24121 | 3.6E+07 | 532353 |
| 751003 - 25 | 200 | 3 | 568 | 12 | 16 | 1 | 86 | 12286 | 2104 | 27261 | 3.5E+07 | 487920 |
| 751003 - 26 | 163 | 4 | 460 | 15 | 3 | 0 | 147 | 14752 | 2859 | 25744 | 5.2E+07 | 831804 |
| 751003 - 27 | 636 | 10 | 1241 | 20 | 51 | 5 | 236 | 51378 | 8530 | 81753 | 3.1E+07 | 658238 |
| Sample 7510 | 002 | | | | | | | | | | | |

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| 751002 - | | | | | | | | | | | | |
|----------------------------|-----------|--------|------------|--------|--------|--------|----------|----------------|--------------|----------------|--------------------|-------------------|
| 01 | 88 | 2 | 263 | 8 | 12 | 1 | 89 | 12813 | 1981 | 27591 | 4.9E+07 | 1251457 |
| 751002 - 02 751002 - | 1216 | 20 | 1820 | 22 | 168 | 11 | 136 | 20254 | 3536 | 40726 | 4435263 | 131622 |
| 03 751002 - | 266 | 5 | 707 | 15 | 23 | 2 | 123 | 20170 | 3463 | 38743 | 3.6E+07 | 631970 |
| 04 751002 - | 288 | 5 | 509 | 11 | 11 | 1 | 64 | 20213 | 2080 | 34437 | 6.5E+07 | 580718 |
| 05 751002 - | 512 | 7 | 1056 | 13 | 29 | 2 | 196 | 39064 | 6218 | 61174 | 4.1E+07 | 568823 |
| 06 751002 - | 164 | 3 | 372 | 8 | 9 | 1 | 48 | 12889 | 1593 | 24319 | 5.3E+07 | 604796 |
| 07 751002 - | 192 | 3 | 438 | 8 | 14 | 1 | 72 | 19496 | 2520 | 39431 | 5.6E+07 | 807473 |
| 08 751002 - | 233 | 3 | 515 | 8 | 13 | 1 | 81 | 20328 | 2651 | 38571 | 5.6E+07 | 692867 |
| 09 751002 - | 291 | 4 | 501 | 9 | 12 | 1 | 38 | 23114 | 2316 | 39896 | 6.2E+07 | 636971 |
| 10 751002 - | 548 | 9 | 1187 | 18 | 87 | 6 | 58 | 12026 | 2179 | 24739 | 5765036 | 168412 |
| 11 751002 - | 263 | 4 | 603 | 10 | 16 | 1 | 147 | 27510 | 3869 | 49218 | 6.4E+07 | 855775 |
| 12 751002 - | 256 | 4 | 529 | 9 | 15 | 1 | /2 | 18490 | 2264 | 35234 | 4.6E+07 | 549088 |
| 13 751002 - | 205 | 4 | 513 | 11 | 13 | 1 | 87 | 25100 | 2838 | 40000 | 7.3E+07 | 801515 |
| 751002 - 15 | 187 | 4 | 392 | 20 | 11 | 1 | 71 | 18681 | 2030 | 37330 | 6.8E+07 | 846219 |
| 751002 - 16 | 222 | 4 | 568 | 14 | 9 | 1 | 108 | 11834 | 1867 | 20814 | 3.9E+07 | 461433 |
| 751002 - 17 | 120 | 2 | 348 | 8 | 10 | 1 | 49 | 9135 | 1457 | 17239 | 3.2E+07 | 641749 |
| 751002 - 18 | 245 | 4 | 535 | 12 | 11 | 1 | 114 | 24861 | 3303 | 49600 | 7.4E+07 | 880665 |
| 751002 - 19 | 389 | 6 | 634 | 12 | 18 | 1 | 75 | 31382 | 3178 | 59170 | 6.7E+07 | 656977 |
| 751002 - 20 | 301 | 5 | 569 | 11 | 11 | 1 | 79 | 25737 | 2952 | 41740 | 7.1E+07 | 710388 |
| 751002 - 21 | 310 | 6 | 536 | 13 | 7 | 0 | 97 | 28354 | 3129 | 52807 | 7.5E+07 | 811251 |
| 751002 - 22 | 98 | 2 | 256 | 6 | 10 | 1 | 84 | 15769 | 2155 | 33644 | 6.2E+07 | 1374480 |
| 751002 - 23 751002 | 85 | 2 | 238 | 7 | 4 | 0 | 47 | 8602 | 1255 | 12224 | 6.8E+07 | 859387 |
| 751002 - 24 751002 | 174 | 3 | 474 | 10 | 16 | 1 | 86 | 16029 | 2541 | 25924 | 3.4E+07 | 736632 |
| 25 751002 - | 106 | 2 | 264 | 8 | 4 | 0 | 42 | 8958 | 1169 | 16026 | 7.5E+07 | 721382 |
| 26 751002 - | 101 | 2 | 248 | 8 | 6 | 0 | 25 | 7801 | 989 | 14664 | 5.6E+07 | 617404 |
| 27 751002 - | 152 | 3 | 372 | 10 | 9 | 1 | 51 | 13943 | 1878 | 27854 | 6.5E+07 | 762953 |
| 28 751002 - | 109 | 2 | 294 | 8 | 6 | 0 | 39 | 9410 | 1344 | 17587 | 6.4E+07 | 725728 |
| 29 751002 - | 68 | 2 | 210 | 7 | 4 | 0 | 17 | 6906 | 1095 | 10295 | 5.1E+07 | 875591 |
| 30 751002 - | 87 146 | 2 3 | 251 338 | 9 9 | 4 7 | 0 1 | 51 56 | 11814 11677 | 1873 1476 | 20732 21634 | 6.4E+07 6.4E+07 | 1223052 672965 |

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| 31 | | | | | | | | | | | | |
|----------|-----|---|-----|----|----|---|----|-------|------|-------|---------|---------|
| 751002 - | | | | | | | | | | | | |
| 32 | 216 | 3 | 412 | 10 | 14 | 1 | 63 | 18457 | 1966 | 35701 | 5.3E+07 | 673546 |
| 751002 - | | | | | | | | | | | | |
| 33 | 50 | 1 | 175 | 6 | 8 | 1 | 79 | 10525 | 1891 | 24265 | 5.5E+07 | 1849133 |
| 751002 - | | | | | | | | | | | | |
| 34 | 58 | 1 | 178 | 5 | 6 | 0 | 40 | 8827 | 1373 | 19390 | 5.7E+07 | 1296190 |
| 751002 - | | | | | | | | | | | | |
| 35 | 79 | 2 | 255 | 10 | 7 | 1 | 54 | 5692 | 981 | 10920 | 2.7E+07 | 634160 |
| 751002 - | | | | | | | | | | | | |
| 36 | 49 | 1 | 167 | 5 | 6 | 1 | 53 | 7031 | 1224 | 13424 | 4.3E+07 | 1215835 |
| 751002 - | | | | | | | | | | | | |
| 37 | 81 | 2 | 244 | 7 | 9 | 1 | 80 | 10412 | 1635 | 22883 | 5E+07 | 1081543 |
| 751002 - | | | | - | - | | | | | | | |
| 38 | 69 | 1 | 193 | 6 | 6 | 1 | 43 | 8543 | 1215 | 15294 | 4.9E+07 | 1056299 |
| /51002 - | | | | | | | | | | | ~ ~ ~ | |
| 39 | 144 | 3 | 323 | 11 | 8 | 1 | 52 | 16207 | 2055 | 32989 | 6E+07 | 1002522 |
| 751002 - | 00 | 2 | 274 | 0 | - | 0 | 20 | 7000 | 4000 | 44260 | 45.07 | 700004 |
| 40 | 88 | Z | 271 | 9 | 5 | 0 | 30 | 7880 | 1322 | 14260 | 4E+07 | 789931 |
| /51002 - | 107 | 4 | F22 | 17 | 20 | 2 | 62 | 0669 | 1600 | 20206 | 1 25,07 | 440536 |
| 41 | 187 | 4 | 532 | 17 | 30 | 3 | 63 | 9668 | 1688 | 20306 | 1.3E+07 | 448526 |
| 121002 - | 202 | c | 074 | 10 | 22 | 2 | 96 | 0660 | 1010 | 20652 | 1 15,07 | 201007 |
| 42 | 293 | O | 824 | 10 | 33 | 3 | 00 | 9009 | 1910 | 20053 | 1.10+07 | 281007 |

APPENDIX B3: U-PB DATING OF HEMATITE

| Analysis_# | | | lso | otope Rati | os | | | | | | l l | Ages (Ma) |
|----------------------|--------------------------------------|--------|-------------------------------------|------------|-------------------------------------|---------|--------------------------------------|---------|--------------------------------------|-----|-------------------------------------|-----------------|
| | ²⁰⁷ Pb/ ²⁰⁶ Pb | 1σ | ²⁰⁶ Pb/ ²³⁸ U | 1σ | ²⁰⁷ Pb/ ²³⁵ U | 1σ | ²⁰⁸ Pb/ ²³² Th | 1σ | ²⁰⁷ Pb/ ²⁰⁶ Pb | 1σ | ²⁰⁶ Pb/ ²³⁸ U | 1σ ² |
| Sample 751003 and 7. | 51008 | | | | | | | | | | | |
| 751003 Early -01 | 0.2606 | 0.0055 | 0.6677 | 0.0102 | 23.9828 | 0.4742 | 1.1821 | 0.0503 | 3250 | 33 | 3297 | 40 |
| 751003 Early -02 | 0.1489 | 0.0023 | 1.8855 | 0.0233 | 38.7180 | 0.6003 | 5.6875 | 0.2143 | 2334 | 26 | 6831 | 52 |
| 751003 Early -03 | 0.3665 | 0.0104 | 0.7371 | 0.0164 | 37.2468 | 0.9369 | 3.7498 | 0.2086 | 3777 | 42 | 3560 | 61 |
| 751003 Early -04 | 0.3977 | 0.0128 | 0.9912 | 0.0262 | 54.3422 | 1.5747 | 22.2175 | 3.6475 | 3900 | 48 | 4440 | 85 |
| 751003 Early -05 | 0.5065 | 0.0065 | 1.7401 | 0.0198 | 121.5090 | 1.5572 | 16.2836 | 0.5122 | 4260 | 19 | 6498 | 47 |
| 751003 Early -06 | 0.1970 | 0.0063 | 1.2641 | 0.0275 | 34.3424 | 1.0541 | 17.8220 | 2.0551 | 2801 | 51 | 5268 | 78 |
| 751003 Early -07 | 0.1818 | 0.0025 | 5.0322 | 0.0652 | 126.1456 | 1.8892 | 59.2621 | 3.1831 | 2670 | 23 | - | 70 |
| 751003 Late - 01 | 0.2313 | 0.0062 | 0.3609 | 0.0067 | 11.5081 | 0.2854 | 0.1947 | 0.0086 | 3061 | 43 | 1986 | 32 |
| 751003 Late - 02 | 0.2221 | 0.0042 | 0.3795 | 0.0056 | 11.6206 | 0.2124 | 0.2286 | 0.0074 | 2996 | 30 | 2074 | 26 |
| 751003 Late - 03 | 0.2136 | 0.0033 | 0.4026 | 0.0049 | 11.8543 | 0.1734 | 0.2791 | 0.0063 | 2933 | 25 | 2181 | 23 |
| 751003 Late - 04 | 0.2495 | 0.0044 | 0.4950 | 0.0065 | 17.0296 | 0.2742 | 0.3290 | 0.0091 | 3182 | 27 | 2592 | 28 |
| 751003 Late - 05 | 0.2296 | 0.0044 | 0.4376 | 0.0064 | 13.8539 | 0.2501 | 0.2107 | 0.0058 | 3050 | 30 | 2340 | 29 |
| 751003 Late - 06 | 0.2437 | 0.0049 | 0.5119 | 0.0075 | 11 1275 | 0.3157 | 0.4272 | 0.0129 | 3144 | 32 | 2005 | 32 |
| 751003 Late - 07 | 0.2511 | 0.0042 | 0.5217 | 0.0042 | 11.1575 | 0.1755 | 0.2012 | 0.0004 | 2206 | 20 | 1/90 | 20 |
| 751003 Late - 06 | 0.2600 | 0.0000 | 0.2316 | 0.0056 | 9.9505 | 0.1020 | 0.2075 | 0.0077 | 2220 | 52 | 12440 | 20 |
| 751003 Late - 09 | 0.2703 | 0.0083 | 0.2313 | 0.0048 | 17 7900 | 0.2340 | 0.3278 | 0.0132 | 7881 | 4/ | 7310 | 23 |
| 751003 Late - 10 | 0.2008 | 0.0056 | 0.4310 | 0.0032 | 16 1170 | 0.1734 | 0.1075 | 0.0058 | 3773 | 23 | 2310 | 23 |
| 751003 Late - 17 | 0.2676 | 0.0050 | 0.6094 | 0.0070 | 22 4908 | 0.5250 | 0.6330 | 0.0133 | 3273 | 55 | 3068 | 73 |
| 751003 Late - 13 | 0.2070 | 0.0110 | 0.0004 | 0.0102 | 10 7525 | 0.0307 | 0.0000 | 0.0007 | 2902 | 21 | 2039 | 20 |
| 751003 Late - 14 | 0.2030 | 0.0027 | 0.3721 | 0.0042 | 12 6859 | 0.1374 | 0.3006 | 0.0045 | 2932 | 28 | 2000 | 26 |
| 751003 Late - 15 | 0.2448 | 0.0031 | 0.2875 | 0.0033 | 9,7031 | 0.1273 | 0.2960 | 0.0082 | 3151 | 20 | 1629 | 16 |
| 751008 Early - 01 | 0.4078 | 0.0058 | 2.2256 | 0.0309 | 125.1315 | 1.8330 | 0.2582 | 0.0055 | 3938 | 21 | 7550 | 62 |
| 751008 Early - 02 | 0.3398 | 0.0121 | 0.9062 | 0.0245 | 42.4470 | 1.3635 | 0.1066 | 0.0060 | 3662 | 53 | 4159 | 83 |
| 751008 Early - 03 | 0.3465 | 0.0103 | 0.6292 | 0.0138 | 30.0619 | 0.8445 | 0.1861 | 0.0107 | 3692 | 45 | 3147 | 54 |
| 751008 Early - 04 | 0.3456 | 0.0083 | 0.7623 | 0.0141 | 36.3204 | 0.7809 | 0.1228 | 0.0045 | 3688 | 36 | 3653 | 52 |
| 751008 Early - 05 | 0.2975 | 0.0041 | 0.5707 | 0.0071 | 23.4066 | 0.3346 | 0.3316 | 0.0097 | 3457 | 21 | 2911 | 29 |
| 751008 Early - 06 | 0.3618 | 0.0122 | 1.1050 | 0.0295 | 55.1177 | 1.7244 | 2.1809 | 0.1533 | 3757 | 50 | 4798 | 90 |
| 751008 Early - 07 | 0.4518 | 0.0054 | 0.9922 | 0.0112 | 61.8126 | 0.7429 | 0.9193 | 0.0198 | 4091 | 18 | 4443 | 36 |
| 751008 Late - 01 | 0.5829 | 0.0338 | 0.4109 | 0.0193 | 33.0264 | 1.4462 | 0.5682 | 0.0333 | 4466 | 82 | 2219 | 88 |
| 751008 Late - 02 | 0.6269 | 0.0627 | 0.5880 | 0.0491 | 50.8366 | 3.9312 | 0.7461 | 0.0574 | 4572 | 138 | 2981 | 199 |
| 751008 Late - 03 | 0.5940 | 0.1465 | 1.5830 | 0.3599 | 129.6558 | 30.8760 | 2.8210 | 1.0970 | 4494 | 318 | 6117 | 898 |
| 751008 Late - 04 | 0.5620 | 0.0371 | 1.2704 | 0.0757 | 98.4554 | 5.6899 | 0.8661 | 0.0694 | 4413 | 93 | 5286 | 215 |
| 751008 Late - 05 | 0.3056 | 0.0397 | 0.4930 | 0.0397 | 20.7703 | 2.3379 | 0.3435 | 0.0417 | 3499 | 187 | 2584 | 171 |
| 751008 Late - 06 | 0.3312 | 0.0123 | 1.3543 | 0.0401 | 61.8500 | 2.1537 | 1.1528 | 0.0670 | 3623 | 56 | 5520 | 110 |
| 751008 Late - 07 | 0.4031 | 0.0109 | 0.9458 | 0.0208 | 52.5762 | 1.3035 | 1.0332 | 0.0497 | 3921 | 40 | 4291 | 69 |
| 751008 Late - 08 | 1.1018 | 0.2821 | 1.3814 | 0.3755 | 209.8560 | 47.6182 | 10.4197 | 12.1575 | 5373 | 317 | 5594 | 1016 |
| 751008 Late - 09 | 0.3721 | 0.0246 | 0.6835 | 0.0337 | 35.0711 | 1.9719 | 0.7209 | 0.0569 | 3800 | 96 | 3358 | 129 |
| 751008 Late - 10 | 0.3118 | 0.0080 | 0.7824 | 0.0154 | 33.6348 | 0.7884 | 0.7439 | 0.0303 | 3530 | 39 | 3726 | 56 |
| 751008 Late - 11 | 0.3472 | 0.0259 | 0.7062 | 0.0382 | 33.8162 | 2.1619 | 0.7017 | 0.0610 | 3695 | 109 | 3444 | 144 |
| 751008 Late - 12 | 0.3843 | 0.0169 | 2.1329 | 0.0841 | 113.0419 | 4.9046 | 1.4091 | 0.1036 | 3849 | 65 | 7362 | 173 |
| 751008 Late - 13 | 0.3325 | 0.0078 | 0.8077 | 0.0150 | 37.0328 | 0.7924 | 0.7581 | 0.0262 | 3629 | 36 | 3817 | 53 |
| /51008 Late - 14 | 0.5964 | 0.1475 | 0.4994 | 0.0942 | 41.0644 | 7.6486 | 226.5373 | - | 4499 | 319 | 2611 | 405 |
| 751008 Late - 15 | 0.2551 | 0.0161 | 0.9762 | 0.0418 | 34.3276 | 1.9709 | 0.2968 | 0.0185 | 3216 | 96 | 4391 | 136 |

Samuel Goldsmith The Samphire Project: A distal IOCG

| Analysis_# | Ages (Ma) | | | Backgrou | und subtra | acted CPS | | | | |
|-------------------|--------------------------------------|------|-------------------|-------------------|-------------------|-------------------|-------------------|------------------|---------|------------------|
| | ²⁰⁸ Pb/ ²³² Th | 1σ | ²⁰⁴ Pb | ²⁰⁶ Pb | ²⁰⁷ Pb | ²⁰⁸ Pb | ²³² Th | ²³⁸ U | 204/206 | Notes |
| Sample 751003 and | 751008 | | | | | | | | | |
| 751003 Early -01 | - | 466 | 77 | 9484 | 2473 | 12761 | 7926 | 14756 | 0.01 | Included for age |
| 751003 Early -02 | - | 648 | 113 | 64925 | 9762 | 52207 | 6738 | 38085 | 0.00 | Very reversely d |
| 751003 Early -03 | - | 888 | 31 | 969 | 355 | 1055 | 207 | 1385 | 0.03 | High comm Pb |
| 751003 Early -04 | - | 3175 | 33 | 1056 | 422 | 1030 | 33 | 1170 | 0.03 | High comm Pb |
| 751003 Early -05 | - | 599 | 860 | 30691 | 15532 | 42695 | 1919 | 18208 | 0.03 | High comm Pb |
| 751003 Early -06 | - | 2207 | 7 | 7728 | 1533 | 6032 | 246 | 7082 | 0.00 | Very reversely d |
| 751003 Early -07 | - | 1068 | 90 | 17948 | 3271 | 15893 | 197 | 3799 | 0.01 | Missed grain |
| 751003 Late - 01 | 3596 | 146 | 120 | 10505 | 2483 | 9148 | 34233 | 34699 | 0.01 | Included for age |
| 751003 Late - 02 | 4161 | 121 | 173 | 15702 | 3547 | 12962 | 40660 | 48691 | 0.01 | Included for age |
| 751003 Late - 03 | 4975 | 99 | 110 | 8916 | 1903 | 7301 | 19090 | 22779 | 0.01 | Included for age |
| 751003 Late - 04 | 5749 | 138 | 106 | 7678 | 1905 | 6958 | 15498 | 15483 | 0.01 | Included for age |
| 751003 Late - 05 | 3964 | 96 | 69 | 6135 | 1424 | 5526 | 18438 | 15470 | 0.01 | Included for age |
| 751003 Late - 06 | 7190 | 183 | 65 | 5104 | 1236 | 4589 | 7867 | 9945 | 0.01 | Included for age |
| 751003 Late - 07 | 4691 | 102 | 99 | 5878 | 1475 | 4851 | 13606 | 18847 | 0.02 | High comm Pb |
| 751003 Late - 08 | 4791 | 122 | 42 | 3082 | 880 | 2541 | 6977 | 12464 | 0.01 | Included for age |
| 751003 Late - 09 | 5731 | 205 | 31 | 2445 | 681 | 1953 | 4313 | 11329 | 0.01 | Included for age |
| 751003 Late - 10 | 3131 | 65 | 121 | 10859 | 2251 | 9566 | 41760 | 26501 | 0.01 | Included for age |
| 751003 Late - 11 | 5579 | 234 | 332 | 23925 | 6450 | 19348 | 45247 | 65903 | 0.01 | Included for age |
| 751003 Late - 12 | 9913 | 417 | 12 | 1250 | 339 | 1159 | 1340 | 2284 | 0.01 | Included for age |
| 751003 Late - 13 | 3844 | 81 | 269 | 26523 | 5570 | 21313 | 74694 | 74941 | 0.01 | Included for age |
| 751003 Late - 14 | 5312 | 120 | 42 | 5075 | 1086 | 4050 | 9901 | 12432 | 0.01 | Included for age |
| 751003 Late - 15 | 5241 | 128 | 940 | 74388 | 18324 | 53942 | 132404 | 281575 | 0.01 | Included for age |
| 751008 Early - 01 | 4642 | 88 | 163 | 6763 | 2774 | 7429 | 23557 | 3160 | 0.02 | High comm Pb |
| 751008 Early - 02 | 2047 | 110 | 123 | 5732 | 1990 | 6080 | 47739 | 7481 | 0.02 | High comm Pb |
| 751008 Early - 03 | 3450 | 183 | 535 | 31700 | 12257 | 31305 | 78271 | 74059 | 0.02 | High comm Pb |
| 751008 Early - 04 | 2341 | 80 | 115 | 4102 | 1428 | 4314 | 27215 | 5239 | 0.03 | High comm Pb |
| 751008 Early - 05 | 5788 | 148 | 690 | 40077 | 11965 | 45240 | 115392 | 80142 | 0.02 | High comm Pb |
| 751008 Early - 06 | - | 974 | 118 | 7145 | 2672 | 6118 | 1981 | 8697 | 0.02 | High comm Pb |
| 751008 Early - 07 | - | 209 | 617 | 26793 | 12181 | 29991 | 26522 | 28298 | 0.02 | High comm Pb |
| 751008 Late - 01 | 9094 | 429 | 7 | 210 | 123 | 305 | 431 | 518 | 0.03 | Low Uranium |
| 751008 Late - 02 | - | 665 | 64 | 254 | 160 | 928 | 1061 | 483 | 0.25 | Low Uranium |
| 751008 Late - 03 | - | 5803 | 13 | 16 | 9 | 31 | 9 | 11 | 0.81 | Low Uranium |
| 751008 Late - 04 | - | 751 | 20 | 369 | 211 | 496 | 443 | 351 | 0.05 | Low Uranium |
| 751008 Late - 05 | 5968 | 628 | 29 | 65 | 20 | 51 | 121 | 139 | 0.45 | Low Uranium |
| 751008 Late - 06 | - | 629 | 65 | 2597 | 854 | 2947 | 2178 | 2058 | 0.03 | High comm Pb |
| 751008 Late - 07 | - | 494 | 106 | 3972 | 1616 | 4410 | 3622 | 4935 | 0.03 | High comm Pb |
| 751008 Late - 08 | - | - | 10 | 12 | 13 | 25 | 1 | 9 | 0.83 | Low Uranium |
| 751008 Late - 09 | - | 668 | 10 | 363 | 135 | 363 | 414 | 577 | 0.03 | Low Uranium |
| 751008 Late - 10 | - | 351 | 69 | 2696 | 844 | 2462 | 2692 | 3706 | 0.03 | High comm Pb |
| 751008 Late - 11 | - | 725 | 13 | 360 | 126 | 353 | 432 | 585 | 0.04 | Low Uranium |
| 751008 Late - 12 | - | 869 | 54 | 1674 | 653 | 1720 | 1047 | 954 | 0.03 | Low Uranium |
| 751008 Late - 13 | - | 301 | 42 | 1645 | 550 | 1586 | 1676 | 2157 | 0.03 | High comm Pb |
| 751008 Late - 14 | - | - | 0 | 17 | 10 | 16 | 0 | 36 | 0.00 | Low Uranium |
| 751008 Late - 15 | 5253 | 288 | 14 | 244 | 62 | 191 | 516 | 265 | 0.06 | Low Uranium |