

Textural and LA-ICP-MS trace
element chemistry analysis of pyrite
from Telfer Au-Cu deposit, W.A.:
Implications for a multi-stage and/or
multi-source ore system

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TEXTURAL AND LA-ICP-MS TRACE ELEMENT CHEMISTRY ANALYSIS OF PYRITE FROM TELFER AU-CU DEPOSIT, W.A.: IMPLICATIONS FOR A MULTI-STAGE AND/OR MULTI-SOURCE ORE SYSTEM

PYRITE ANALYSIS FROM TELFER AU-CU DEPOSIT

ABSTRACT

Latest-generation microanalytical techniques, offering ppm-level precision coupled with micron-scale resolution, represent new methods to decipher the genetic history of an orebody. The 38.5 Moz world-class Au-Cu Telfer deposit is hosted within a sequence of Paleo- to Neoproterozoic marine sediments on the northwestern margin of the Paterson Orogeny, Western Australia. The deposit is characterised by two dome structures hosting a series of stratabound and vertically-stacked ore horizons ('reefs'). Pyrite, a typically refractory mineral, is a common component of Au-ores and is the dominant ore mineral at Telfer. Petrographic analysis and Scanning Electron Microscope back-scatter imaging established four morphologically discrete stages of pyrite and an abundance of associated minerals. Laser-Ablation Inductively Coupled Plasma Mass-Spectrometry spot analysis and element mapping on selected pyrite grains delineated trace element patterns that allow for development of a model of multi-stage ore genesis. Gold distribution in pyrite indicates deformation-induced remobilisation of initially lattice-bound Au. Gold expelled from the sulphide lattice during remobilisation is observed as grains of electrum and native gold within brittle fractures and fissures as well as micro-, and likely also nanoscale inclusions in pyrite. Silver, Bi, Te, Pb, Tl, Co, Sn and As were also seen reconcentrated into micro-fractures and at grain margins. Oscillatory pyrite growth, expressed by zonation of As, Co and Ni are prominent; the latter two suggesting a metal source of mafic origin. Enrichment of Sn, Bi, Cu \pm Zn, Te, Au, and associated presence of exsolved stannite, chalcopyrite and accessory bismuthinite, aikinite, calaverite, tetradymite and tsumoite suggest a granitic source for at least one generation of pyrite. The pyrite morphology, and recorded trace element chemistry distribution in pyrite are concordant with a hypothesis by which the Telfer deposit is the product of a protracted multi-stage ore forming system or single mineralising event with multiple sources of metals and/or sulphur.

KEYWORDS

Telfer, Au-Cu, Pyrite, Textures, Laser-Ablation Inductively Coupled Plasma Mass-Spectrometry, grain-scale mapping, multi-stage ore formation

TABLE OF CONTENTS

Pyrite analysis from Telfer Au-Cu deposit.....	1
Abstract.....	1
Keywords.....	1
List of Figures and Tables	3
Introduction	5
Geological Setting	6
Methods	18
Results	19
Discussion.....	41
Conclusions	47
Acknowledgments	48
References	49
Appendix A: Detailed Methods.....	52
Appendix B: Sample Locality and Description.....	55
Appendix C: LA-ICP-MS spot analyses for pyrite.....	Attached document

LIST OF FIGURES AND TABLES

Table 1 Lithology and mineralisation of the Telfer and Malu Formations. 10

Table 2 Summary of the tectonic evolution of the Paterson Orogen 13

Table 3 Summary table, sub-divided by ore zones, for minor and trace element concentration in pyrite..25

Figure 1 Geological map of the Patterson Province and locations of the Telfer and Nifty deposits and Kintyre prospects (A). Map adapted from Bagas (2004a); Local granites are proximal to Telfer , located in the outcropping Neoproterozoic Lamil Group within the Phanerozoic Canning Basin. Map adapted from Czarnota (2009) (B); Telfer mine geology and locations of Main and West Dome structures (Map adapted from Goellnicht et al. 1989) (C); and a schematic generalised section of the SW limb of West Dome deposit looking WNW (D). Refer to Figure 2(b) for lithology horizon depths and thickness.....7

Figure 2 Figure 1 Stratigraphic columns for (a) the Regional geology of Telfer; and (b) Telfer and Malu Formations which contain the reef ore zones mined in Main Dome and West Dome. Corresponding samples numbers from this study are identified in brackets next to their respective reef locations..... 11

Figure 3 Back-scatter electron images of identified textural phases in West Dome pyrite. (a) Inclusions of quartz and carbonate in a euhedral grain of pyrite. In addition an arsenic rim absent of inclusions can be identified; (b) Remnant pyrite containing gangue inclusions (circled in white) within larger grains of subhedral pyrites. Fractures cross cut both remnant and overgrowth pyrite; (c) Euhedral grain of pyrite with internal arsenic zonation; (d) Three euhedral pyrite grains joined by an overgrowth of oscillatory zonation; (e) Secondary arsenic zonation attributed to fracturing in which a large grain of xenotime (Xe) has crystallised; and (f) fine grained exsolution blebs in massive fractured pyrite.....23

Figure 4 LA-ICP-MS element maps of pyrite grains in sample MF6, with BSE image of the same grain (top left). The grain shows three distinct texturally-defined zones; inclusion-rich cores; an inclusion-free growth zone; and a zone of brittle fracturing. The scale for As, Co and Ni in counts-per-second (CPS) is logarithmic. Iron, Ga, Ag, Bi and W are shown calculated as ppm values..... 28

Figure 5 LA-ICP-MS element maps of pyrite grains in MF8, with BSE image of the same grain (top). The grains show complex internal As-growth zonation. The scale for Fe, As, Co, Bi and Ni in CPS is logarithmic. Silver, Au, Te and Cu are shown calculated as ppm values. 29

Figure 6 LA-ICP-MS element maps of pyrite grain in sample MF40. The grain shows anhedral grain habit with fractures containing chalcopyrite and bornite. The scale for Co (top right), Bi and Pb in CPS is logarithmic. Iron, Co (top centre), As, Ni, Zn, Cu, Sn, Ag and Tl are shown calculated as ppm values. 30

Figure 7 LA-ICP-MS element maps of pyrite grains in sample MF7, with BSE image of the same grain (top). The grain, surrounded by chalcopyrite, shows anhedral grain habit with micro fractures, inclusions and pores. The scale for As, Bi, Pb and Cu scale in CPS is logarithmic. Cobalt, Ni, Sn, Te, Au, Ag, Ga and Sb are shown calculated as ppm values. 31

Figure 8 Back-scatter electron images of Cu-Sn-Bi-Te mineralogy. (a) Grains of exsolved chalcopyrite (Ccp) and stannite (St) in massive pyrite (Py); (b) Grains of stannite with typical exsolution textures in pyrite; (c) A composite grain of chalcopyrite and stannite in pyrite; (d) a composite grain of stannite and tsumoite (Tsu) in pyrite; (e) An elongated composite grain of chalcopyrite and stannite and a solitary grain of stannite in pyrite; and (f) A larger grain of chalcopyrite with associated microfractures containing chalcopyrite and bismuthinite (Bi) The latter appears restricted to microscopic grains at pyrite - chalcopyrite grain boundaries..... 34

Figure 9 Reflected light (a) and back-scatter electron images (b – f) of selected associated minerals in pyrite. (a) A fractured pyrite (Py) grain surrounded by chalcopyrite (Ccp). Galena (Ga) and chalcopyrite can be seen in the pyrite fractures; (b) Chalcopyrite amongst several grains of pyrite. Grains of arsenopyrite (Asp) and galena can be seen within the chalcopyrite at the pyrite boundary. A zircon (Zr) is also in the chalcopyrite and electrum (El) is observed within a fissure in the pyrite; (c) Chalcopyrite and bornite (Bo) at the boundary of a pyrite grain; (d) Covellite (Co) grain with typical ‘boxwork’

replacement texture; (e) Composite grain of chalcocite (Cc) and wittichenite (Wi) within a microfissure in pyrite; and (f) an inclusion of coffinite (Cof). 35

Figure 10 Back-scatter electron (a,c-f) and reflected-light (b) images of Au-Ag minerals. (a) and (b) Grains of native gold (Au) within a microfracture in pyrite (Py); (c) Grain of electrum within a fracture in pyrite; (d) Au telluride (possibly calaverite?) adjacent to a grain of stannite (St) within a composite inclusion in pyrite;(e) Native silver (Ag) halo surrounding a grain of chloroargyrite (AgCl) and electrum (El). An additional grain of electrum is seen in the top left and galena (Ga) is found within pyrite fracture; and (f) Grain of native silver with an interconnected lattice texture 37

Figure 11 Trace element binary plots from M10 and M20 reefs (a-c), LLU (d) and E-reefs (e and f). Showing strong correlation amongst multiple samples and reefs between Te and Bi and Co and Ni (a and e); single sample variability in the correlation between Cu and Au in an otherwise correlating reef sample suit (b); independent sample clusters between Co and Ni concentrations from the LLU (d); and, circled sample(s) clustering (e) outside of the strong correlation between Co and Ni observed from E-reef sample concentrations (f). 39

Figure 12 Plots showing the consistent strong correlations between Sn and Cu, Cu and Bi, Au and Cu, Te and Cu, Sn and Au and Bi and Au in sample MF21(total of 80 spot analyses) 40