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20 August 2018

Company Announcements

Australian Securities Exchange Limited
Level 40, Central Park,
152-158 St Georges Terrace
PERTH WA 6000

# Germanium Update

Ironbark Zinc Limited (**"Ironbark, the Company"**) (ASX: IBG) provides an update on the ongoing work to determine the presence of Germanium in the Citronen orebody.

## Scanning Electron Microscope (SEM) Results

Ironbark reports that it has received a report detailing the results from SEM test work. The SEM test work was commissioned to definitively answer the ongoing questions regarding the occurrence and nature of any potential germanium credits. Ironbark was unable to get a satisfactory explanation to explain the ongoing assay discrepancies and poor repeatability from several laboratories in Australia.

The full report, provided as an appendix to this ASX release, does not definitively prove the recoverability or payability of germanium. The report does however show that there is germanium present in the lead minerals and is likely to also report to the planned lead concentrate where it is likely to be concentrated. In the current flow sheet, Ironbark produces a pyrite pre-float which is currently planned to be sent to the tailings. The report indicates that germanium is associated with the pyrite and that the germanium grades might potentially be payable. Further testwork is being planned.

> *"Germanium is extracted mainly as a by-product of mining zinc sulphide-rich ores. It comes from sphalerite concentrates containing 50 to 3000 ppm Ge (Sinclair, 2014). Current production mostly comes from SHMS deposits in China (Huize, Jinding and Fankou), the United States (Red Dog SEDEX deposit, Alaska; and MVT deposits of the ElmwoodGordonsville district, Tennessee) and the Democratic Republic of the Congo (Kipushi deposit). The overall Ge grades in these deposits range from **10 to 300 ppm**, for total Ge resources of approximately 5400 tonnes.*
>
> *Global Ge resource and reserve data are inconsistent because Ge concentrations in many deposits are not properly reported".*[1]

## Germanium Market

*"The silicon germanium materials & devices market is projected to grow to $5,045.3 million by 2021, at a CAGR of 13.7% from 2016 to 2021.*

*This growth is highly attributed to the increasing requirement for huge data transfer, high applicability in wireless communication systems and rising demand from automotive sector for sophisticated sensors and radar systems. Moreover, the rapid penetration of IoT technology in the telecom, consumer electronics and auto industry, has led to an increased growth in the SiGe market. Apart from that, emerging opportunities in the 5G networking systems and autonomous driving electronics are expected to create huge impact on the SiGe market growth, during the forecast period."*[2]

1 ***Source:*** *Symposium on critical and strategic materials. British Columbia Geological Survey Paper 2015-3, Suzanne Paradis, Geological Survey of Canada, Pacifi c Division, Sidney, BC, V8L 4B2*
2 ***Source:*** *Research and Markets, Dublin, April 27, 2018 (GLOBE NEWSWIRE)*

**End.**

For further information please visit Ironbark's website www.ironbark.gl or contact us:

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## About Ironbark

Ironbark seeks to build shareholder value through the development of the wholly owned Citronen base metal project which currently hosts in excess of 13.1 Billion pounds of zinc (Zn) and lead (Pb). For full details refer to ASX announcement 25 November 2014 – Citronen Project Resource Update – JORC 2012 compliant resource. Ironbark is not aware of any new information or data that materially affects the information included in this ASX release, and Ironbark confirms that, to the best of its knowledge, all material assumptions and technical parameters underpinning the resource estimates in this release continue to apply and have not materially changed.

The current JORC 2012 compliant resource for Citronen:

**70.8 million tonnes at 5.7% Zn + Pb**

| Category | Mt | Zn% | Pb% | Zn+Pb% |
|---|---|---|---|---|
| Measured | 25.0 | 5.0 | 0.5 | 5.5 |
| Indicated | 26.5 | 5.5 | 0.5 | 6.0 |
| Inferred | 19.3 | 4.9 | 0.4 | 5.3 |

*Using Ordinary Kriging interpolation and reported at a 3.5% Zn cut-off*

Including a higher grade resource of:

**29.9 million tonnes at 7.1% Zn + Pb**

| Category | Mt | Zn% | Pb% | Zn+Pb% |
|---|---|---|---|---|
| Measured | 8.9 | 6.6 | 0.6 | 7.2 |
| Indicated | 13.7 | 6.8 | 0.5 | 7.3 |
| Inferred | 7.3 | 6.2 | 0.5 | 6.6 |

*Using Ordinary Kriging interpolation and reported at a 5.0% Zn cut-off*

***"Ironbark is an emerging leader amongst Australia's mineral resource companies, dedicated to the development of its major base metal mining operation in Greenland – the world class Citronen Project, and the acquisition of quality base metals projects."***

## Disclosure Statements and Important Information

### Forward Looking Statements

The following information is not intended to guide any investment decisions in Ironbark Zinc Limited. This material contains certain forecasts and forward-looking information, including possible or assumed future performance, costs, production levels or rates, reserves and resources, prices and valuations and industry growth and other trends. Such forecasts and information are not a guarantee of future performance and involve many risks and uncertainties, as well as other factors. Actual results and developments may differ materially from those implied or expressed by these statements and are dependent on a variety of factors. The Company believes that it has a reasonable basis for making the forward looking statements in the announcement, based on the information contained in this and previous ASX announcements.

The Citronen Zinc Project is considered to be at an early development stage and will require further regulatory approvals and securing of finance and there is no certainty that these will occur. Nothing in this material should be construed as either an offer to seek a solicitation or as an offer to buy or sell Ironbark securities. Consideration of the technical and financial factors requires skilled analysis and understanding of their context.

Ironbark is not aware of any new information or data that materially affects the information included in this ASX release, and Ironbark confirms that, to the best of its knowledge, all material assumptions and technical parameters underpinning the estimates in this release continue to apply and have not materially changed.

### Competent Persons Statement

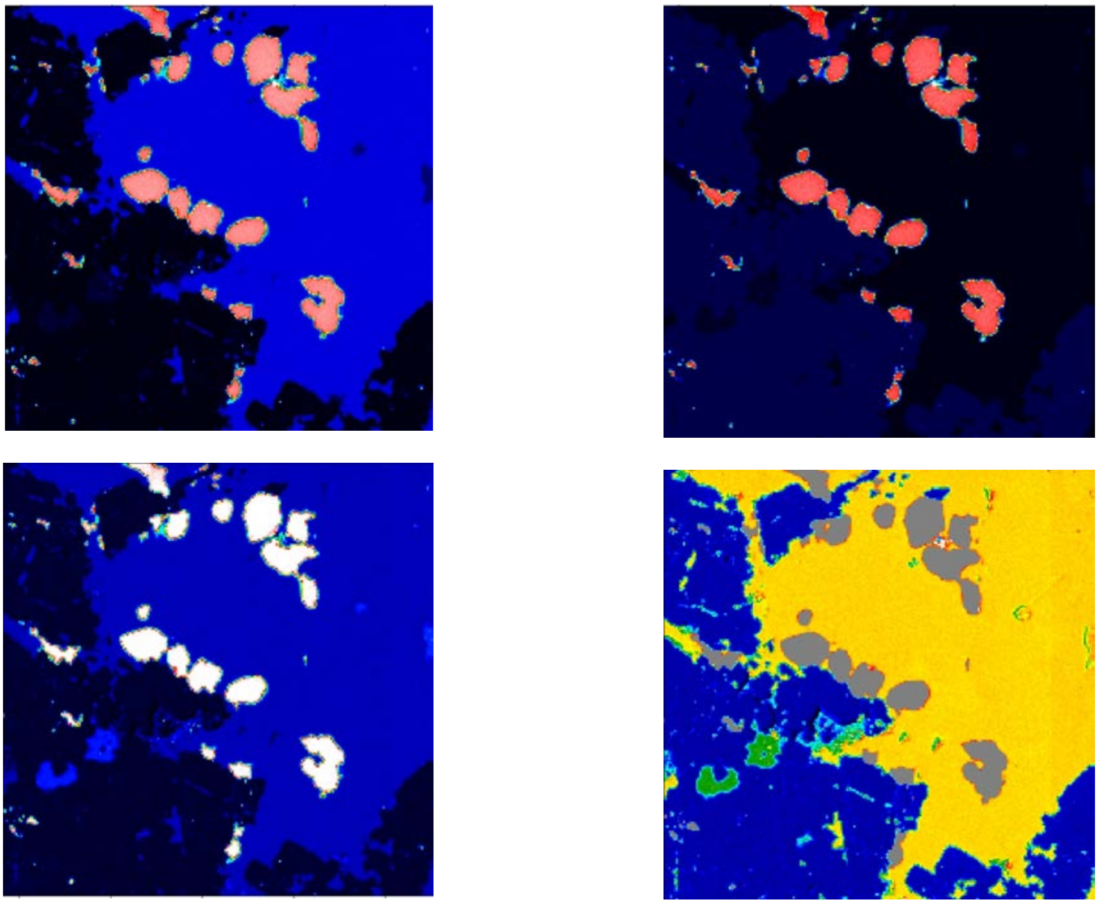
The information included in this report that relates to Exploration Results & Mineral Resources is based on information compiled by Ms Laursen (B. ESc Hons (Geol), GradDip App. Fin., MSEG, MAIG), an employee of Ironbark Zinc Limited. Ms Laursen has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity which they are undertaking to qualify as a Competent Person as defined in the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves. Ms Laursen consents to the inclusion in the report of the matters based on this information in the form and context in which it appears

### Competent Persons Disclosure

Ms Laursen is an employee of Ironbark Zinc Limited and currently holds securities in the company.

Centre for Microscopy, Characterisation and Analysis

# *Petrology and the composition of principal suphides minerals as hosts to Germanium mineralisation in four samples from the Citronen Zn-Pb project*



Dr Malcolm P Roberts *FAusImm MAIG FGSSA FMinSoc*

## 1. *Scope of work*

CMCA was approached by Ironbark with the specific task of determining the form and occurrence of the element Ge in core samples from their Citronen project in northern Greenland. Considering the importance of Ge in the semi-conductor industry as well as the need to add credit to the company asset on the back of its identification in certain intersections, it was agreed that determining where and how Ge occurs in these rocks was of significant interest. Following discussions with Ironbark on this matter, the following scopes were agreed on:

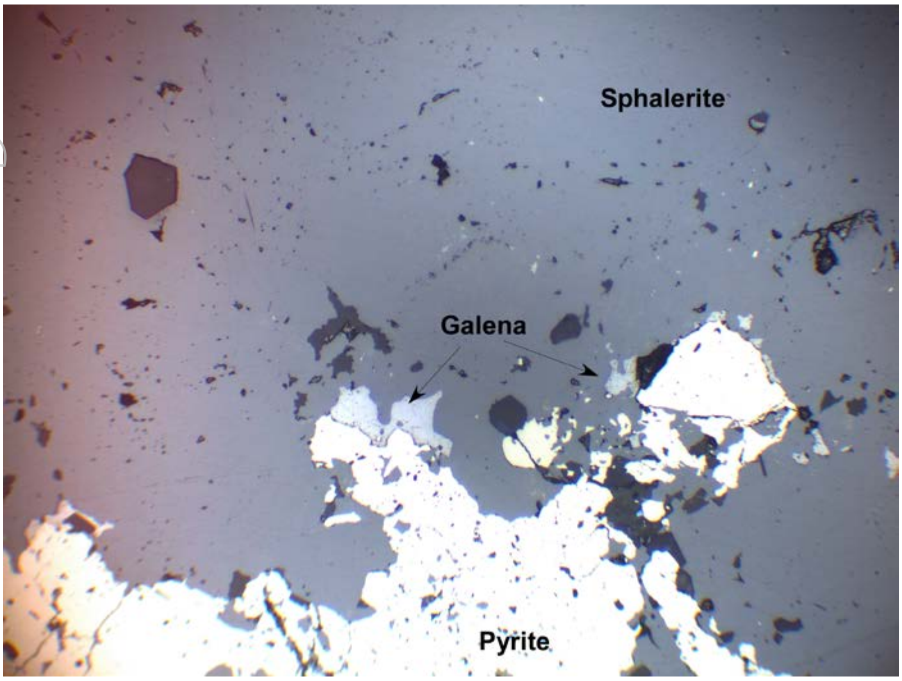
1) Basic petrographic investigation to identify primary phases and parageneses
2) Chemical analysis of these phases by electron microprobe analysis concentrating of the elements Fe, S, Ge, Pb, Zn, Co, Cd & Ag.
3) Reporting as pertinent.

This report presents and discusses the results of this study.

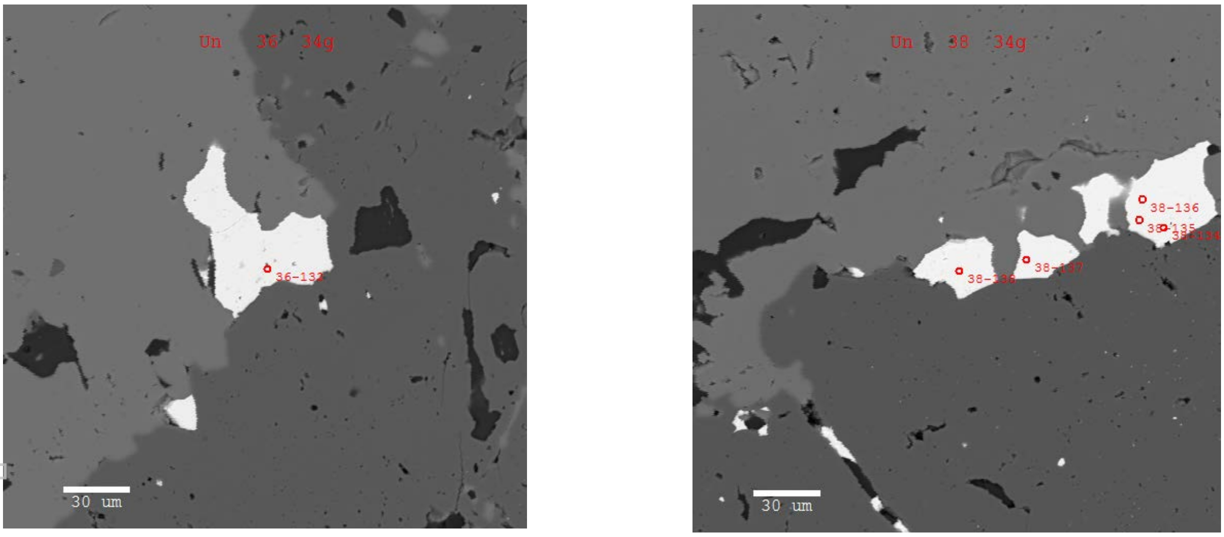
## 2. *Samples and preparation*

Four samples were provided to the CMCA by Elizabeth Laursen, Senior Geologist, Ironbark Zinc Ltd, Hay Street Perth. The samples were BQ diameter half core with polished flat surface for presentation and were marked out by the customer with those areas they requested the work to be carried out on. The samples were then cut to size and mounted with epoxy onto glass slides. Excess material was trimmed and the upper surfaces polished down to 1 mm diamond paste, then carbon coated for SEM and microanalysis.

1. 34 – compared to the other three samples, this sample has more massive pyrite and sphalerite. Some pyrite framboids remain. Galena is a minor phase and can mostly be found along the contact margins between pyrite and sphalerite. It is generally not enclosed in either and hence should not present a problem to liberate.



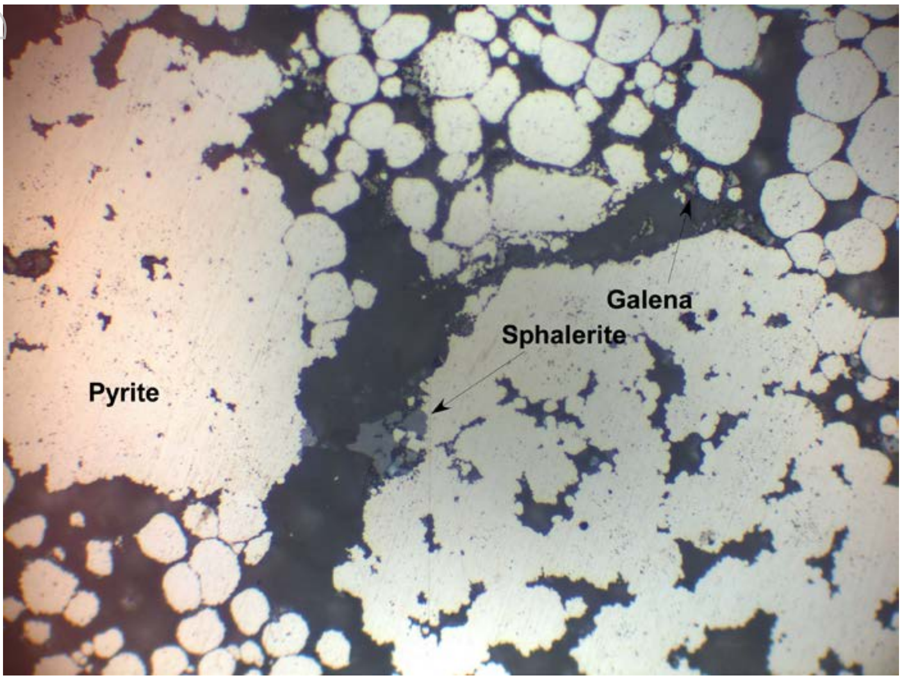

Width of image 1mm.




Two backscattered electron images showing galena analysis points in sample 34.

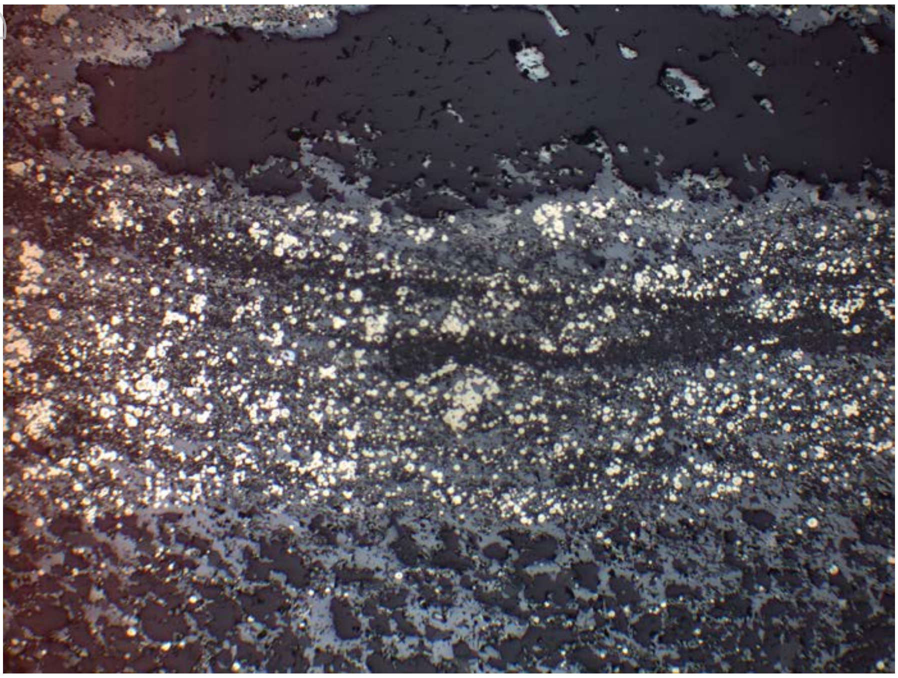
2. 75A – The sample has developed framboids to the point of appearing massive. In fact this rock is dominated by pyrite. Defocussing the microscope enables one to get a good perspective of the

fine particle sizes involved in the framboids themselves. See photomicrograph below which shows that galena and sphalerite are minor and small.

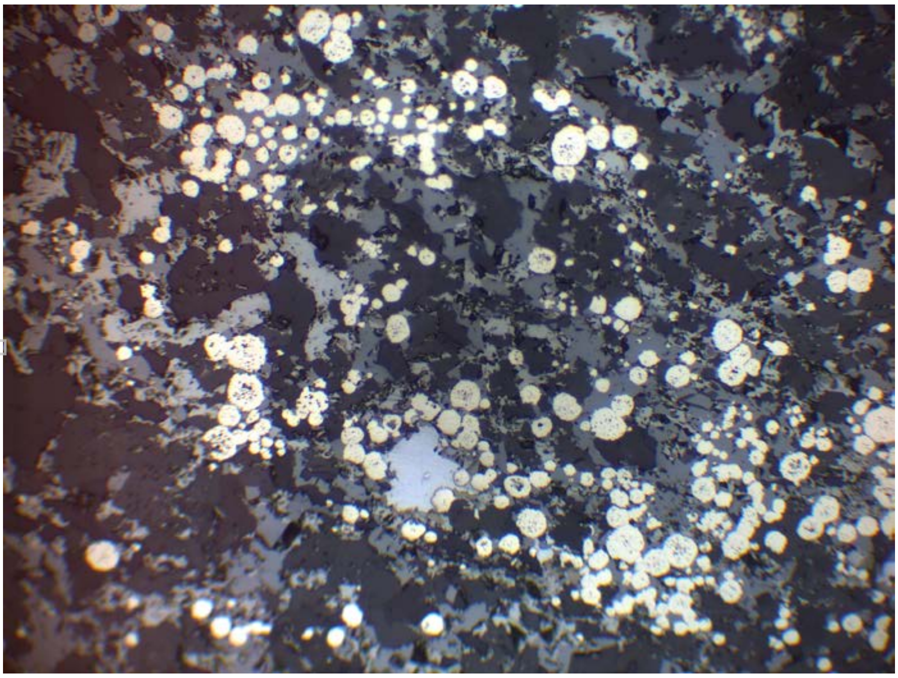



Width of image 0.5 mm.

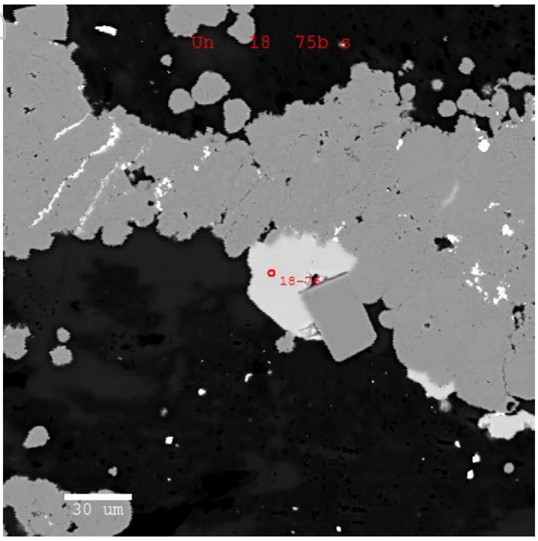
3. 75B - This sample shows distinct layering of quartz and carbonate alternating with pyrite framboids and interstitial sphalerite. Galena is a minor phase and appears late crystallising.

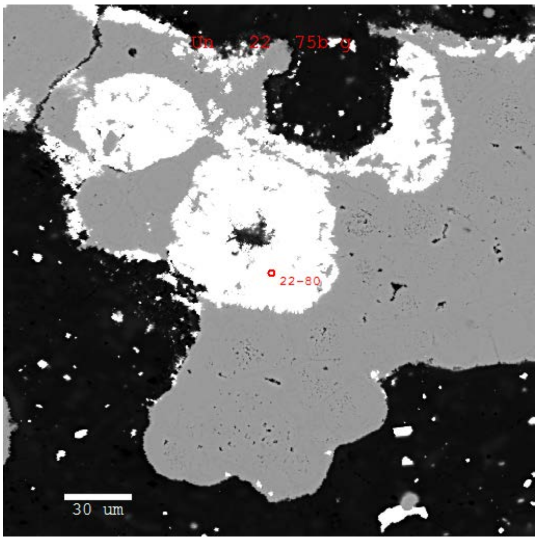


Gangue/sphalerite/framboid layering in 75B. Width of image 2 mm.



Interstitial galena. Note how the galena mantles the pyrite framboids indicating stability. Width of image 1 mm.




Backscattered electron images showing sphalerite and galena relationships with pyrite framoids in sample 75B.

4. 79 – ca 20 micron diameter, on average, pyrite framboids occur distributed in layers enclosed in sphalerite. High magnification imaging shows the framboids as being made up of ca 2 micron particles. Galena is rare and late compared to the other phases it occurs around the framboids and even as a framboid in-filling. Gangue is quartz and carbonate

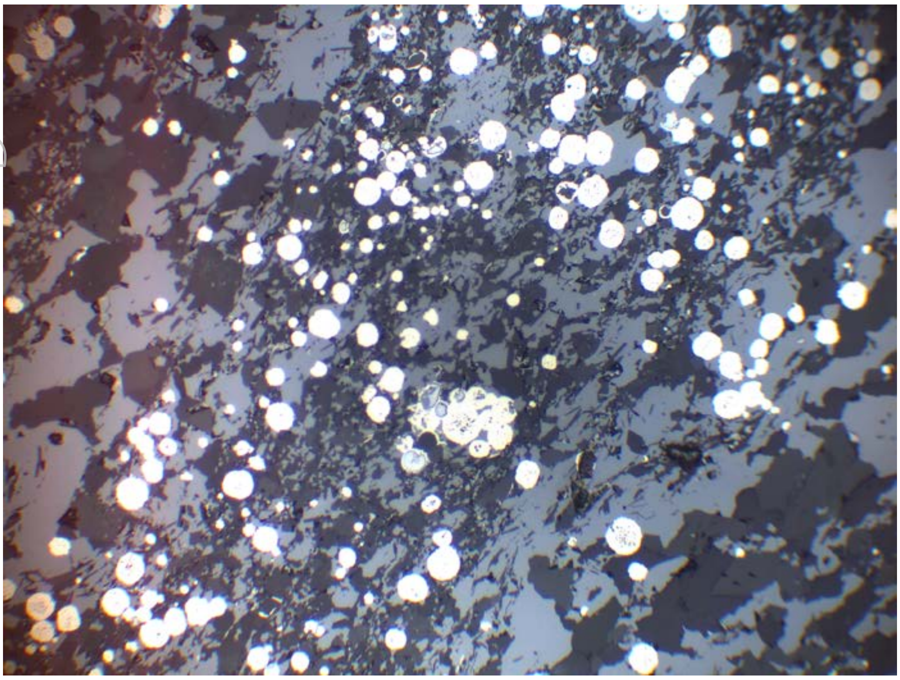
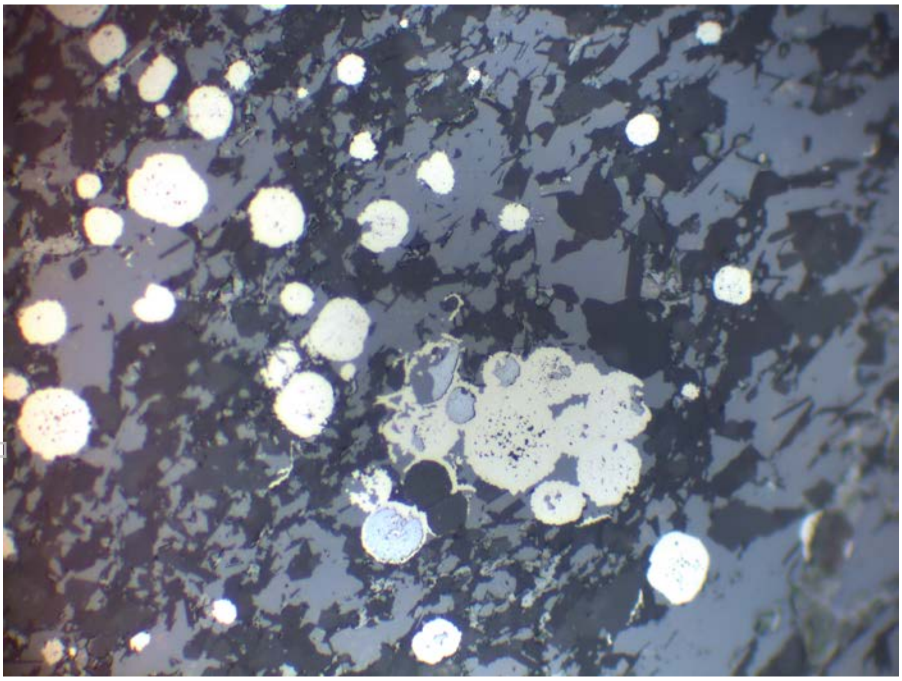


Image shows cluster of pyrite gored with galena. Middle grey-coloured mineral is sphalerite with the darkest being gangue. Width of image is 1 mm.



Close up of previous showing relationship of the framboids with galena and sphalerite. Width of image 0.5 mm.

Imaging and analyses were carried out using a JEOL JXA8530F field emission electron microprobe fitted with Secondary and backscattered electron detectors. X-ray microanalysis capability was provided by energy dispersive spectrometry for basic point and shoot qualitative mineral identification, with wavelength dispersive spectrometry used for more precise quantitative mineral analyses. Analysis conditions for quantitative analysis were a 40 degree take off angle, 25 kV accelerating voltage with a fully focussed electron beam and 80 nA beam current. These conditions were chosen to give the optimal lower limits of detection for the technique. The analytical X-ray lines selected were Ag l$\alpha$, Cd l$\alpha$, S k$\alpha$, Pb m$\alpha$, Ge k$\alpha$, Cu k$\alpha$, Zn k$\alpha$, Fe k$\alpha$, Mn k$\alpha$, and Co k$\alpha$. Mean atomic background correction was used throughout. Standards employed were a suite of proprietary and commercial metals and sulphides.

## *3. Results*

The results are presented pictorially for the most part. Where there is a need for more description, I have provided this in the figure captions and expanded as necessary in the conclusions.

Figure 1*a* provides the Ge budget as a function of mineral in the samples from Ironbark Zinc. The points to note are that the bulk of the Ge is associated with galena. The least is associated with sphalerite. A significant proportion of the pyrite samples host Ge at levels above the detection limit. The reason for this is not clear but I have tried to test for the presence of galena nanoparticles in the pyrite framboids by looking for an element relationship between Pb and Ge. This can be seen in Figure 1b, a plot of wt % Pb vs wt % Ge. The data dispersion shows no clear trend and it remains equally likely that the Ge is an intrinsic part of the pyrite.

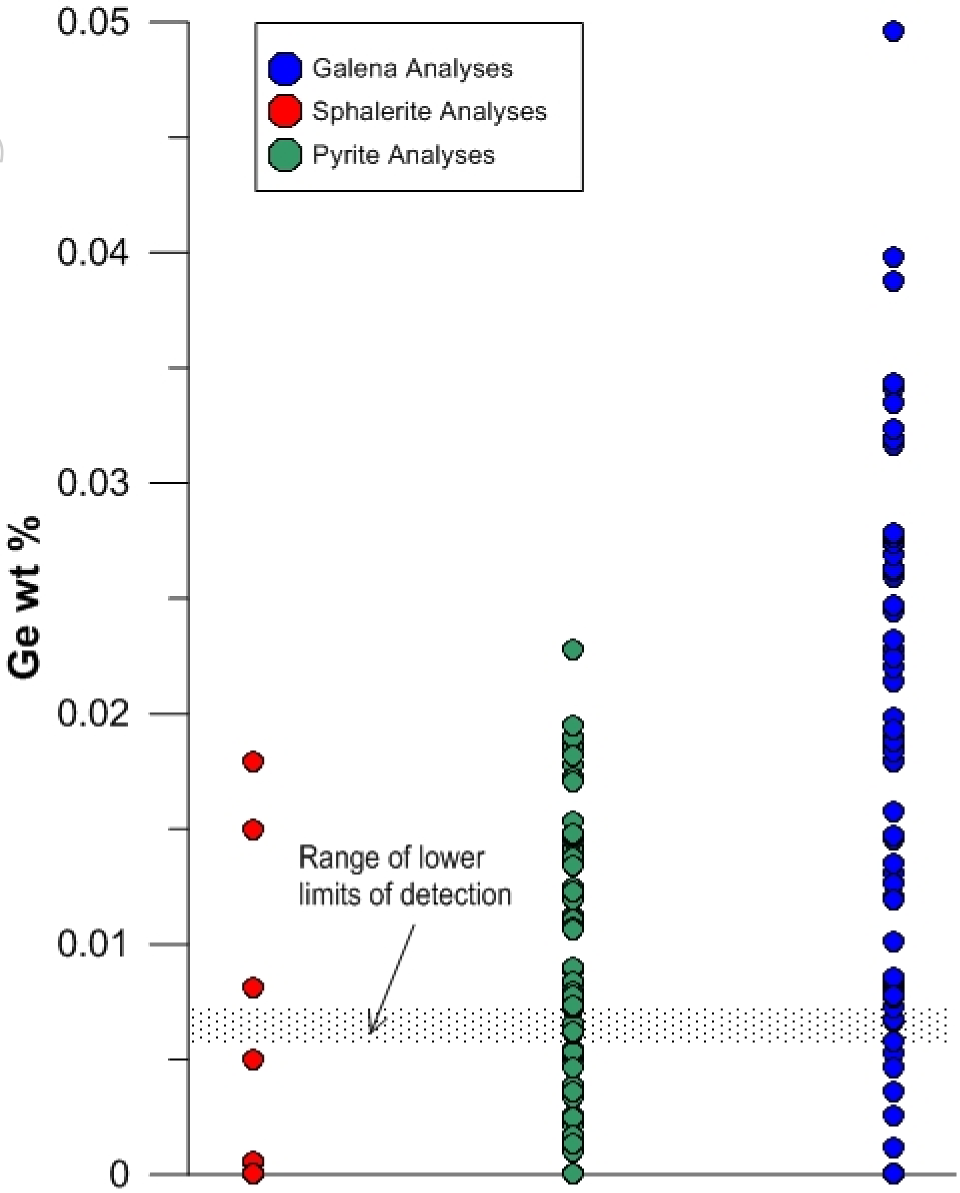



Fig 1*a* Plot of *wt %* Ge *vs* mineral type in all samples. The hatched area marks the range of lower limits of detection for Ge.

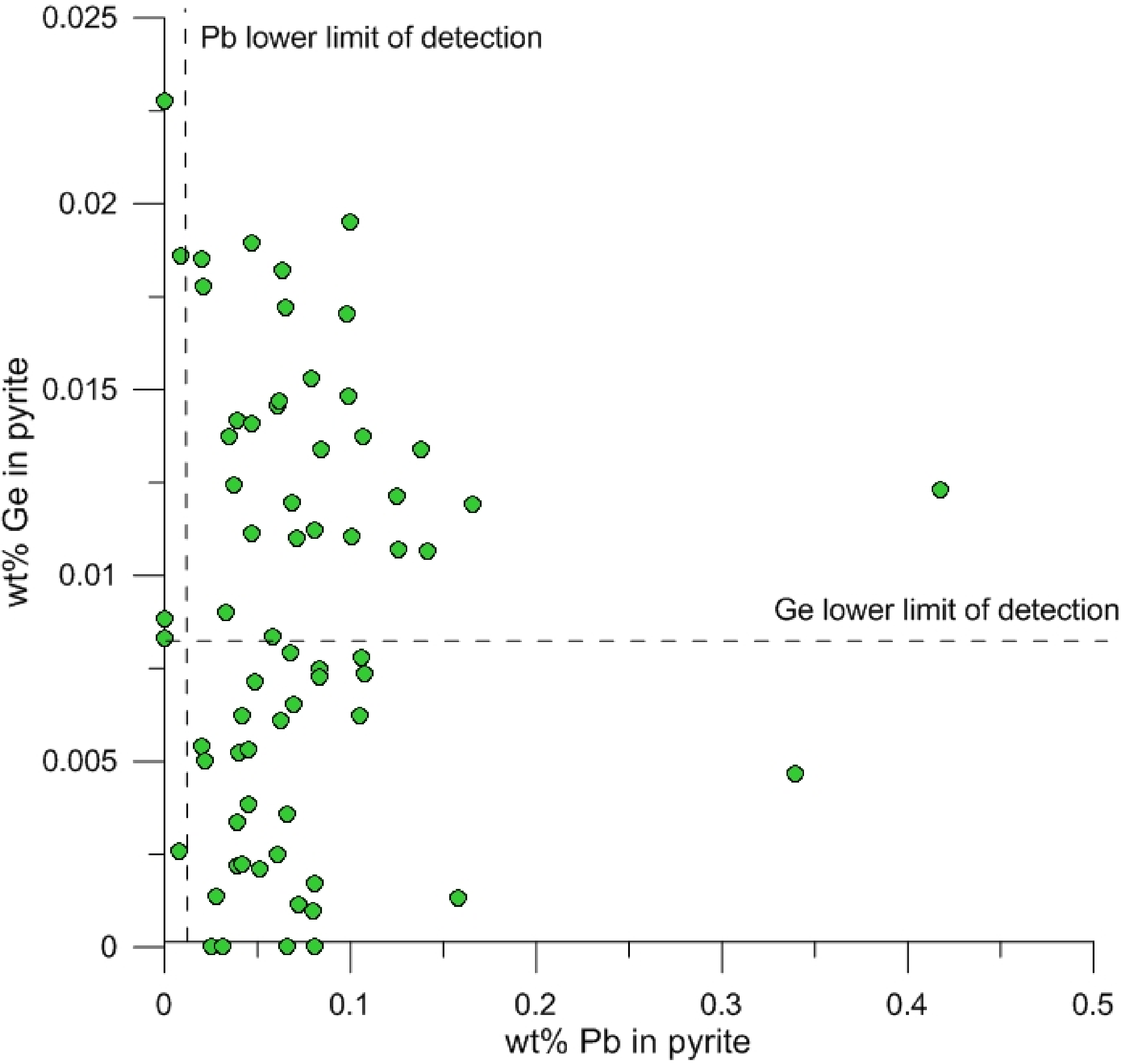



Fig 1*b* Plot of *wt* % Ge *vs* wt % Pb in pyrite from all the rock samples. The hatched lines mark the range of lower limits of detection for Ge and Pb. To the left and below these lines mean that these specific elements cannot be detected with analytical certainty. This plot shows that there is no relationship between Pb content and Ge content in pyrites in the samples.

Ag is lower than the detection limit in sphalerite, lesser amounts in pyrite than galena can be found. Galena grades an average of 600-800 ppm in galena could well be expected.

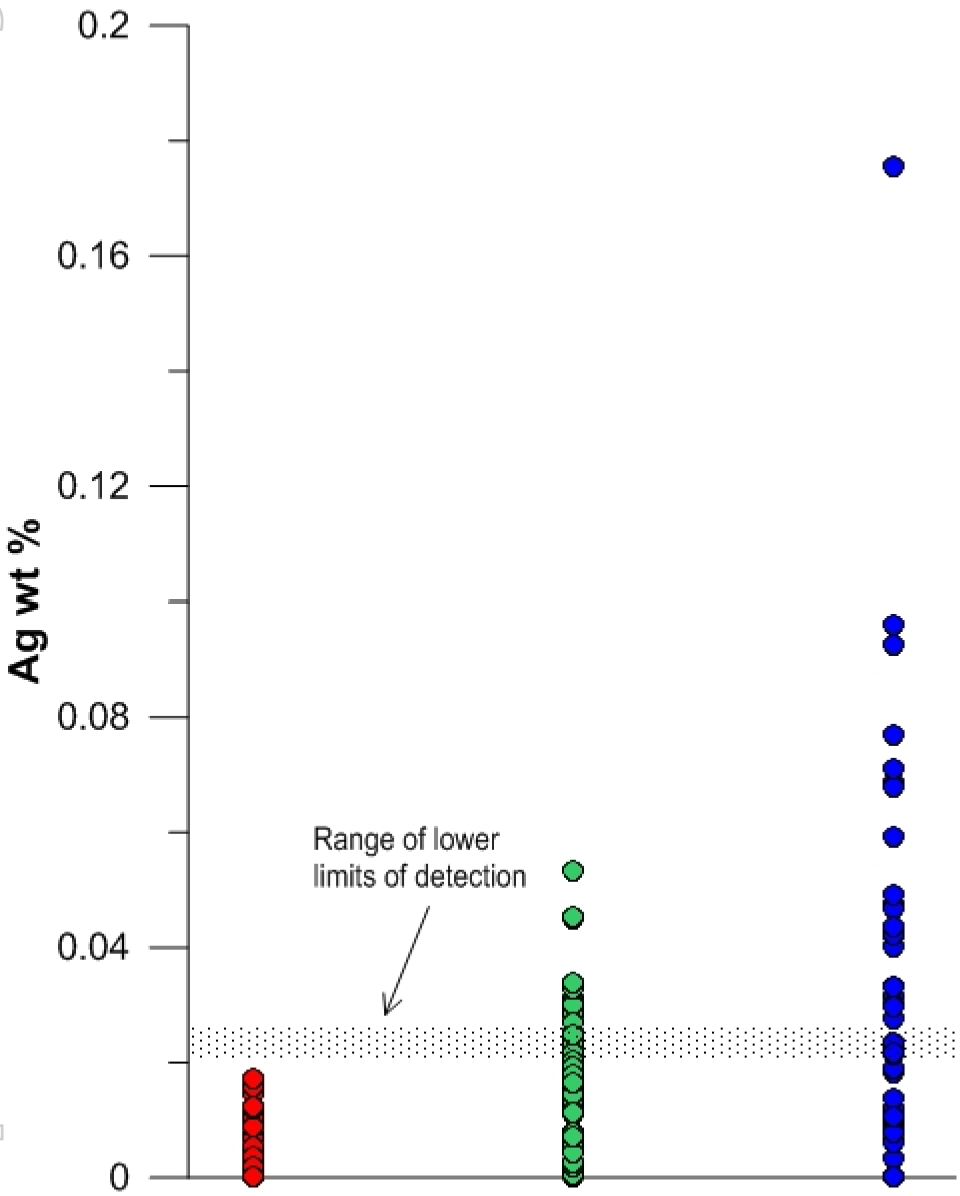



Fig 2*a* Plot of *wt* % Ag *vs* mineral type in all samples. The hatched area marks the range of lower limits of detection for Ag.

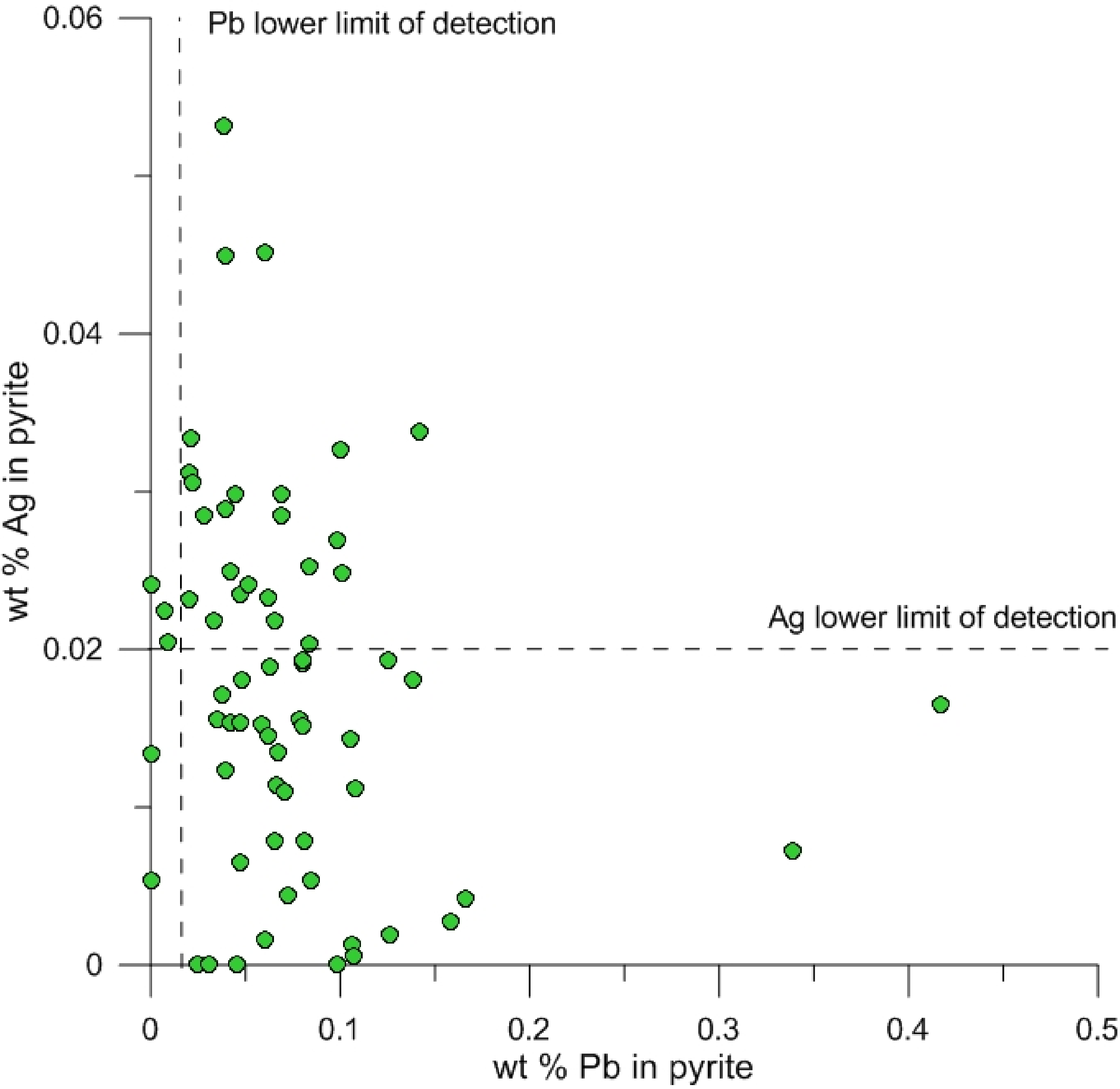



Fig 2*b* Plot of *wt* % Ag *vs* wt % Pb in pyrite from all the rock samples. The hatched lines mark the range of lower limits of detection for Ag and Pb. To the left and below these lines mean that these specific elements cannot be detected with analytical certainty. This plot shows that there is a loose relationship between Ag content and Pb content in pyrites in the samples. The extent to which this may be due to nanoparticles of galena is speculative.

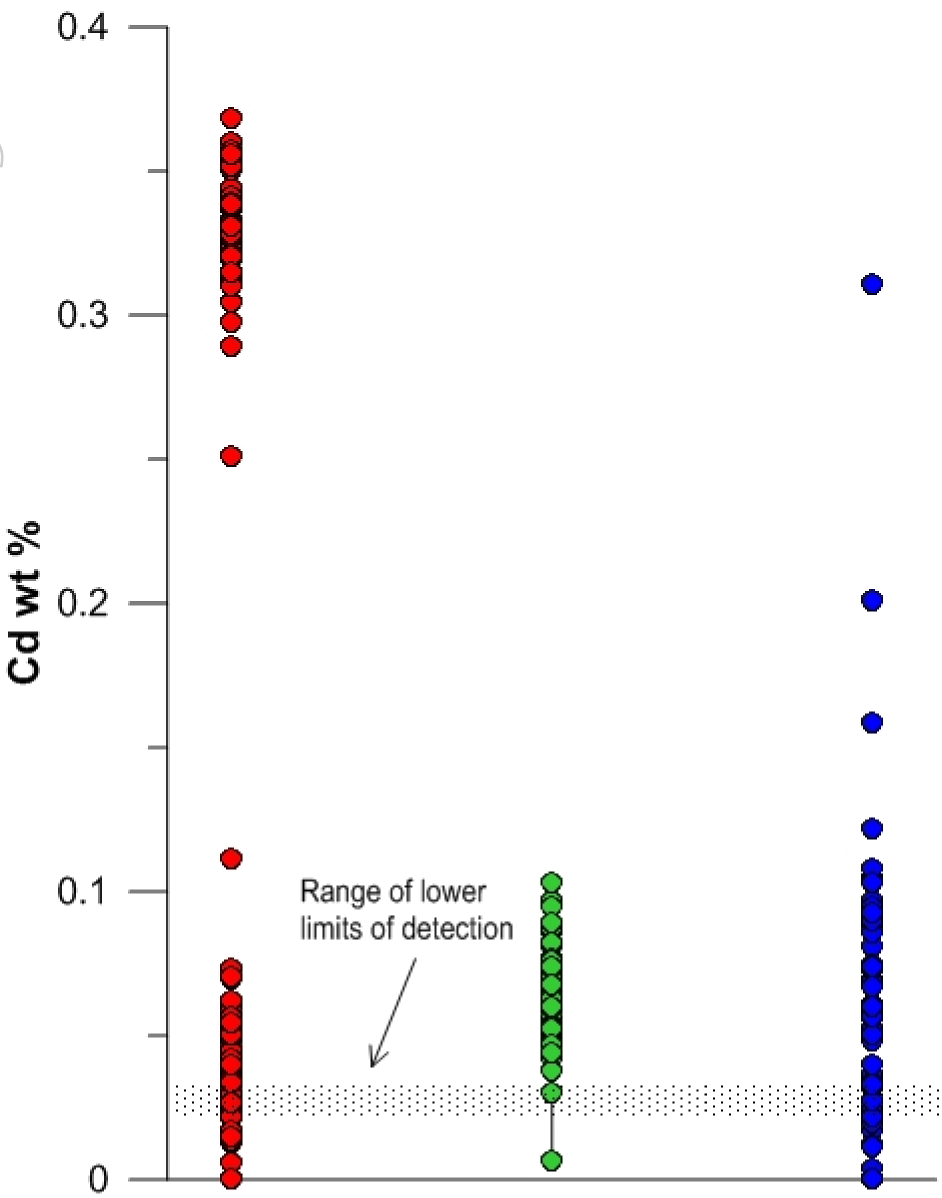



Fig 3 Plot of *wt* % Cd *vs* mineral type in all samples. The hatched area marks the range of lower limits of detection for Cd. Note the very obvious bimodal distribution of Cd between the sphalerite bearing samples.

THE UNIVERSITY OF WESTERN AUSTRALIA



### *4. Conclusions*

Bulk of the Ge will be recovered in the pyrite and galena fractions. Most will be associated with galena and will generate a concentrate with an average grade of ca 200 ppm Ge and 400 ppm Ag. Against this must be considered the Cd content of the ore. This will on average lie around 500 – 1000 ppm in the pyrite and galena fractions, up to ca 2000 to 3000 ppm in the sphalerite concentrate. There are two obvious rock types – low and high Cd bearing. These can be easy identified in hand specimen and may be useful for grade-control purposes. In the sample set given here, all high Cd analyses are from sample 34 hosting more massive sphalerite and textures indicative of soft-sediment deformation. How these relate to other elements is not worth discussing here as the Ge and Ag contents in the sphalerite samples is below detection limit for the most part.