

Integrated Spatial Analysis and Remote Sensing of Exploration Targets

08 - 17 January 2018

Presented by
Economic Geology Research Centre



Location
James Cook University
Townsville QLD

Course Leaders
A/Prof. Zhaoshan Chang (JCU), Dr Arianne Ford (KENEX), Dr Carsten Laukamp (CSIRO)

Course Fees

	Module 1	Module 2	Both Modules
EGRU member	\$1600.00	\$2375.00	\$3975.00
AIG member	\$1800.00	\$2675.00	\$4425.00
Non-EGRU member	\$2000.00	\$2875.00	\$4875.00

GST inclusive and Au\$

Registration
[Online Registration](#)

Subject Description

This course has two modules and participants can attend all or either module:

Date	Topic	Presenter
Module 1: Spectral Remote Sensing for Mineral Exploration		
Mon 08 Jan	SWIR (Short Wave Infra-Red) spectral analysis – 1	Zhaoshan Chang
Tue 09 Jan	SWIR (Short Wave Infra-Red) spectral analysis – 2	Zhaoshan Chang
Wed 10 Jan	Spectral remote sensing & image enhancement	Carsten Laukamp
Thu 11 Jan	Remote sensing image integration techniques	Carsten Laukamp
Module 2: Exploration Geochemistry and GIS-based prospectivity analysis		
Fri 12 Jan	Geochemistry in mineral exploration	Arianne Ford
Sat 13 Jan	Statistical analysis of geochemistry data	Arianne Ford
Sun 14 Jan	Basics of prospectivity analysis and fuzzy logic	Arianne Ford
Mon 15 Jan	Weights of Evidence prospectivity	Arianne Ford
Tues 16 Jan	In-class practical assignment	Arianne Ford
Wed 17 Jan	Review and Exam – optional for industry	Zhaoshan Chang

Enquiries:

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Course Content

Module 1 Spectral Remote Sensing for Mineral Exploration

The first part of this module aims for the participants to be able to take measurements using SWIR instruments including specTERRA and PIMA, interpret the spectra, and use the results in exploration. The second part of this module will cover applications of spaceborne multispectral and airborne radiometric images for recognition of indications of mineralised land.

1.1 SWIR (short wavelength Infra-Red) spectral techniques and applications

- Basic principles of the SWIR spectral techniques
- Taking measurements using a specTERRA or a PIMA instrument
- Interpret SWIR spectra manually
- Interpret SWIR spectra with the assistance of a software, TSG (The Spectral Geologist)
- Major spectral features of common minerals detectable by the technique
- Extract numerical features from SWIR spectra using TSG
- Applications of the SWIR spectral techniques in mineral exploration

1.2 Spectral remote sensing with spaceborne/airborne images

- The electromagnetic spectrum and remote sensing targets
- Hyper- and multispectral remote sensing technologies
- Radiometric sensors
- Methods of processing spectral and radiometric images
- Ground validation of remote sensing data and comparison with other geoscience data
- Regolith characterization
- Mapping mine-scale to regional mineral footprints

Module 2 Exploration Geochemistry and GIS-based Prospectivity Analysis

The first part of this module will cover principles of mineral exploration geochemistry as well as applications of statistical analyses to mapping of geochemical anomalies. The second part of this module will cover various methods for analysis and integration of various layers of spatial geo-exploration datasets for predictive mapping of mineral prospectivity.

Note: In Class Practical Assignment –

The assignment will be handed out on the first day of the module for participants to do some research and ask questions prior to completing the practical part of the work.

2.1 Geochemistry in Mineral Exploration

- Conceptual models of geochemical anomalies in the rock and weathering environment: geochemical dispersion
- Recognition of primary and secondary geochemical dispersion patterns
- Geochemical sampling and field methods for mineral exploration
- Element mobility, pathfinder elements, lithologic indicator elements
- Understanding analytical methods

2.2 Univariate analysis of exploration geochemical data

- Notions of background, threshold and anomaly
- Traditional methods of threshold selection to define/map anomalies
- Analysis of uni-element data distributions
- Analysis of uni-element threshold values and anomalies

2.3 Basics of Mineral Prospectivity Modelling

- Concept of spatial data analysis
- Mineral systems analysis
- Concept of mineral prospectivity modelling
- Tools for mineral prospectivity mapping, including GIS tools

2.4. Weights-of-evidence Modelling of Mineral Prospectivity

- Quantifying spatial association between mineral deposits and geological features
- Combining layers of spatial evidence in weights of evidence modelling to map prospective areas

2.5. Alternative Methods of Modelling Mineral Prospectivity

- GIS-based conceptual fuzzy logic
- GIS-based data-driven neural networks
- GIS-based evidential belief functions

Presenters



Arianne Ford is a Senior GIS Analyst at Kenex Ltd. based in Wellington, New Zealand. Her expertise is in the application of spatial statistics and computational techniques to mineral exploration targeting and resource classification. She obtained her PhD from James Cook University in 2008 on the application of fractal and multifractal methods to copper exploration in the Mt Isa Inlier. Before taking up a position at Kenex, Arianne held postdoctoral research positions at the Centre for Exploration Targeting at the University of Western Australia in Perth, and the Economic Geology Research Centre at James Cook University in Townsville. In her current position, Arianne is working on multiple GIS-based prospectivity analysis projects for industry and government clients.



Zhaoshan Chang is an Associate Professor and the director of EGRU at JCU. He has worked extensively on skarns, epithermal, porphyry, IOCG, Sn-W and sediment-hosted Au deposits, plus SWIR (Short Wavelength Infra-Red) and LA-ICP-MS U-Pb dating / mineral trace element analysis methodologies. He works closely with the mineral industry on exploration-oriented research projects, looking for indicators, discriminators and zoning patterns in mineralogy, texture and geochemistry that can be directly used in exploration. His research mainly involves the investigation of the spatial and temporal distribution of alteration and mineralization, and understanding the genesis of ore systems.



Carsten Laukamp is a senior research geoscientist at CSIRO Mineral Resources, based in Perth, Australia. Carsten obtained his Doctorate of Science (Dr. rer. Nat.) from the Ruprecht Karls University in Heidelberg, Germany, based on his study of the structural and fluid system evolution in the Otavi Mountain Land (Namibia) and its significance for the genesis of sulphide and nonsulphide mineralisation. Before joining CSIRO, Carsten was a postdoctoral research fellow at James Cook University in Townsville, where he worked in the pmd*²CRC on the evaluation of hyperspectral remote sensing data for mapping hydrothermal alteration footprints in the Mount Isa Inlier. In his current role with CSIRO, as leader of the Mineral Footprints Team and the National Virtual Core Library Project, Carsten explores the potential for combined use of lab, field and remote visible and infrared reflectance spectroscopy, geochemistry and geophysics for tracing hydrothermal alteration signatures through cover.

Location

James Cook University
Townsville QLD 4811

08 - 09 Jan	034.127 (teaching room)
10 - 11 Jan	142.021 (computer lab)
12 - 16 Jan	142.021 (computer lab)
17 Jan	034.127

[Map](#)

NOTE: Please arrive at 08.15 on January 8th.

Daily Routine

Each day will be divided into four sessions:

Session 1	08.30 – 10.00
Session 2	10.30 – 12.30
Session 3	13.30 – 15.00
Session 4 1	15.30 – 17.00

Additional work outside course hours will be required. Participants should not be planning significant extracurricular activities or large quantities of other work while doing the course.

Course Notes, Computers and Software

Course notes will be provided in the form of pdfs of the PowerPoint slides, which will be posted on Learnjcu. Some additional papers will be provided.

Access to LearnJCU (link is on the JCU Homepage)

Students once enrolled in the subject: automatically have access to LearnJCU using jc# and password

Industry: Before the course commences you will receive an email detailing how to access LearnJCU

Participants will require laptop computers with Microsoft Excel for practical exercises. Participants will need to download ILWIS version 3.08 from <http://www.52north.org/> and familiarize themselves with this software from the manuals (http://www.ilwis.org/user_friendly_gis_teach_yourself.htm). Please note that if participants wish to use their personal version of ArcGIS on their laptops for practical exercises, they should contact Arianne Ford (arianne@kenex.co.nz) prior to starting the course to discuss the ArcGIS licenses and version required. The software packages will also be available on desktop computers in a JCU computer lab.

Catering

Morning and afternoon tea – fully catered

Lunch – Industry - fully catered for industry participants only

Note: no food is allowed in the labs

Transport and Parking

[Sunbus](#) – Route 201 - one stop on the University near building 134 – follow pathway in front of the Library to 034

Parking – free parking is available beside the ring road opposite buildings 017/034 – parking tickets for the permit areas are available at the bookshop

Accommodation Options

Cedar Lodge – www.cedarlodge.com.au

JCU Short Stays - <https://www.jcu.edu.au/jcu-halls/short-stays>

General Townsville Accommodation -

http://www.queenslandholidays.com.au/destinations/townsville/accommodation/accommodation_home.cfm