



WAXI - West African Exploration Initiative

IXOA - L'Initiative d'Exploration Ouest Africaine



**PRACTICAL APPLIED GEOPHYSICS AND EXPLORATION
TARGETTING COURSES AND FIELD-CAMPS FOR GEOLOGISTS
WAXI Training Proposal – 9-25 May 2016
Ouagadougou, Burkina Faso**

**In association with INSTITUT TENG TUUMA GEOSCIENCES DE
OUAGADOUGOU (I.TTG.O) in conjunction with Towards a Better Future
Foundation (Australia)**

Registration Deadline 5th May, send attached registration form to
luc.siebenaller@asdm.lu (for WAXI sponsors and sponsors-in-kind)
ttgeoservices@gmail.com (for NON WAXI registrations)

The objectives of the course are

1. To impart a thorough knowledge of the relationship between geology and the more common useful geophysical techniques in gold, and more generally mineral exploration
2. To understand the various survey geometries, and survey parameters used for mineral exploration, in the ground and air.
3. To understand what geophysical techniques cannot do in geological mapping and devise strategies to counter the knowledge gap.
4. To understand what the geological significance of the resolution, signal to noise trade off commonly made in the different surveys
5. To understand the expressions of different styles of mineralisation in geophysical data sets.
6. To be able to complete a first pass qualitative interpretation of airborne magnetometer survey (preferable that participants bring along their own data sets to work on, but data sets will be provided as well).

The teaching pattern on each day of the course will typically involve classroom presentations, data acquisition activities in the TTG Office, computer analysis and modelling exercises, as well as some geophysical equipment demonstrations (IP, Resistivity, and magnetometer). Presentations will take the form of 60 minute

sessions, with 30 minutes presentation, 15 minutes discussion and 15 minutes of practical exercises

The Proposed Program

	Day	Date	Course Element
MODULE I: PRACTICAL GEOPHYSICS COURSES	Day 1 & Day 2	Monday 9 th & Tuesday 10 th May	Gravity and Magnetic Methods
	Day 3 & Day 4	Wednesday 11 th & Thursday 12 th May	Electrical methods Electromagnetic and Borehole Methods
	Day 5 & Day 6	Friday 13 th & Saturday 14 th May	Seismic Methods Airborne Magnetics In Focus
MODULE II: PRACTICAL GEOPHYSICS- FIELD CAMP	Day 1	Monday 16 th May	Setting Up Field Operations
	Day 2	Tuesday 17 th May	Magnetics
	Day 3	Wednesday 18 th May	Induced Polarisation Surveying; Gradient Array
	Day 4	Thursday 19 th May	Induced Polarisation Surveying; Gradient Array
	Day 5	Friday 20 th May	Induced Polarisation Surveying; Pole-Dipole Array
	Day 6	Saturday 21 th May	Gravity

MODULE III: PRACTICAL TARGETTING in EXPLORATION	Day 1	Monday 23 th May	Observed Controls On Gold Mineralisation
	Day 2	Tuesday 24 th May	Observing The Controls In Geophysics (Scale, Resolution)
	Day 3	Wednesday 25 th May	Mineral Occurrence Maps

Activities will commence at 8.30am each day and typically conclude at 5-5.30pm

Course Content: Lectures

PRACTICAL GEOPHYSICS-COURSES

Gravity and Magnetic Methods

- Basic gravity theory
- **Converting Gravity into Geology – Density what are they, mineralogy, rock types of Rocks,**
- Gravity survey methods, instrumentation and field procedures
- Surveying for geophysical surveys
- Gravity data processing
- Basic magnetic theory
- **Converting Magnetism into Geology – Rock magnetisations, what are they, mineralogy, rock types**
- Magnetic survey methods, instrumentation and field procedures
- Processing and enhancement of potential field data
- Qualitative interpretation of geophysical imagery
- Quantitative interpretation of potential field data –forward modelling and inversion

CASE STUDIES

Using Magnetism for Gold Exploration in West Africa – Regional examples

Using Gravity for Gold Exploration in West Africa – Regional examples

Using Magnetism for Gold Exploration in West Africa – Prospect Scale examples
Using Gravity for Gold Exploration in West Africa – Prospect Scale examples

Use of Magnetism and Gravity in Geological mapping in Archean and Proterozoic Terrains around the world

Use of Magnetism and Gravity in Mineral Exploration in Archean and Proterozoic Terrains around the world, for different commodities and ore types, including Porphyry Copper, VMS, IOCG. A close inspection of the relative information of high resolution ground magnetism versus high resolution airborne magnetism in lateritic terrains

PRACTICAL EXERCISES

Processing airborne magnetic and gravity data in Burkina Faso to target gold camps.
Interpreting airborne magnetic and gravity data in Burkina Faso to target gold camps.

Electrical Methods

The electrical properties of rocks

Galvanic methods – Resistivity and IP theory, field Procedures and logistics
Resistivity and IP data processing and interpretation

CASE STUDIES

Using Resistivity for Gold Exploration in West Africa – Regional examples

Using Resistivity for Gold Exploration in West Africa – Prospect Scale examples
Using IP for Gold Exploration in West Africa – Prospect Scale examples

Use of Resistivity and IP in Geological mapping in Archean and Proterozoic Terrains around the world
Use of Resistivity and IP in Mineral Exploration in Archean and Proterozoic Terrains around the world, for different commodities and ore types, including Porphyry Copper, VMS, IOCG.

A close inspection of the relative information of high resolution ground surveys, and understanding of survey design parameters

PRACTICAL EXERCISES

Processing of Resistivity and IP data in Burkina Faso to target gold mineralisation. Interpreting Resistivity and IP data in Burkina Faso to target gold mineralisation.

Electromagnetic and Borehole Methods

The EM method – basic EM theory, FEM, TEM, AEM, field procedures and logistics

Magnetometric resistivity (Fast sampling)

Magnetotelluric Surveying and Interpretation

Downhole electrical methods DHEM, DHMMR

EM data processing, display and interpretation

Ground penetrating radar

Borehole logging methods – basic theory – selection of tools etc.

Airborne Electromagnetics, Helicopter systems versus Fixed Wing Systems

CASE STUDIES

Magnetotelluric traverses across West Africa – what do they tell us, and what not. Using Electromagnetics for Gold Exploration in West Africa – Regional examples

Using Electromagnetics Exploration in West Africa – Prospect Scale examples Using Gravity for Gold Exploration in West Africa – Prospect Scale examples

Use of Electromagnetics in Geological mapping in Archean and Proterozoic Terrains around the world Use of Electromagnetics in Mineral Exploration in Archean and Proterozoic Terrains around the world, for different commodities and ore types, including Porphyry Copper, VMS, IOCG.

A close inspection of the relative information of high resolution ground Electromagnetics versus high resolution airborne Electromagnetics in lateritic terrains

PRACTICAL EXERCISES

Processing airborne and ground Electromagnetics data in Burkina Faso to target gold camps.

AEM design for bedrock conductor mapping in West Africa

Interpreting airborne Electromagnetics data in Burkina Faso to target gold camps.

Seismic Methods

- Seismic wave propagation, wave types, elastic properties and seismic velocity
- Seismic sources and detectors
- Seismic refraction – theory and field procedures, data interpretation
- Seismic reflection – theory and field procedures
- Seismic reflection – data processing
- Seismic reflection – data interpretation

CASE STUDIES

Using Seismic for Gold Exploration in West Africa – Regional examples

Using Seismic for Exploration in Archean and Proterozoic Terrains around the world, for different commodities and ore types, including Porphyry Copper, VMS, IOCG.

Training staff

The following personnel will be involved in the delivery of the courses

Mr Peter WILLIAMS

Mr Peter Williams is co-founder of TTG. He has over a decade of invaluable experience in working in the mining sector in West Africa and in excess of 30 years in the international mining and exploration business. During his career he has held management and executive positions with a number of major resources groups including WMC Resources, Resolute Mining and the Independence Group. In WMC he held the positions of Chief Geophysicist and Manager of Geosciences Technology. He also has co-founded and played significant roles in the growth of several highly successful Exploration and Mining Companies.

Peter is a highly experienced geologist and geophysicist having graduated with First Class Honours from the University of South Australia and MSc in Geophysical Engineering from the Colorado School of Mines. He has been directly involved in the discovery of one gold mine in Western Australia, two copper gold mines in South Australia, a nickel sulphide mine in Western Australia and most recently two new gold provinces in southern Burkina Faso, now held by Gryphon Minerals and Centamin (formerly Ampella).

As importantly he has been involved in the development of successful new strategies and technologies for gold and base metal exploration. Peter was a prime strategist in the development of one of Australia's most successful junior mining companies in recent years, Independence Group NL, where his roles included Chief Geophysicist and Executive Director of Exploration for Lightning Nickel (a wholly owned subsidiary of Independence Group). He was the co-founder of Sanemabore Sarl, which was responsible for identifying the Banfora Project which is under active exploration by Gryphon Minerals, and introducing that company into Burkina Faso. He is a co-founder of the highly successful Gold Exploration Company, Ampella which is focused on discovering Gold in West Africa, and which has discovered a new gold province in southern Burkina Faso.

He is also a co-founder of HiSeis, which is a company focused on providing high definition 3d seismic surveying for the Mining, Energy, Engineering and Hydro-geological Industries, and which is a finalist in the West Australian Innovator of the Year Award in 2010. Peter was an invited Speaker at the Technical Sessions of International 10 yearly Exploration 1997 and 2007 Conferences, as well as at the

Prospectors and Developers Association of Canada meetings in 2005 and 2010. He is a member of the Australian Society of Geophysicists Research Group, the Australian Institute of Geoscientists and the Australian Institute of Company Directors. He also holds the position of Adjunct Senior Research Fellow at the West Australian School of Mines and Adjunct Associate Professor at the Centre for Exploration Targeting, university of Western Australia.

Dr Morou Francois OUEDRAOGO

Holds a PhD in Metallogeny and structural Geology from university of Orleans (France); He is an exploration geologist with 25 years' experience in the Birimian (Early Proterozoic) greenstone of West Africa.. Dr Ouedraogo was the team leader of the United Nations Development Programme Project which was focused on the search for volcanogenic massive sulphide (VMS) mineralization in southern and central Burkina Faso. He is the co-author of "West African Gold Deposits in their Proterozoic Litho-structural Setting" and the "West African Mineral Map".

He was also in charge of preparation of the Burkina Faso country wide geology mapping and airborne magnetic and radiometry coverage project funded by European Union SYSMIN facilities and He has been involved in four gold discoveries in Burkina Faso Dr Ouedraogo has visited the majority of significant. He has held numerous senior and executive roles with BUMIGEB (Bureau des Mines et de la Géologie du Burkina), United Nations Development Programme (Exploration Projects), WMC (Africa) Ltd, Resolute (West Africa) Ltd, Goldbelt Resources (West Africa) Sarl as well as in Ampella Mining as Vice President of Exploration and more recently Senior Vice President Corporate Africa. He is a co-founder of ASX listed Ampella Mining, as well as co-founder of Sanembaore Sarl which has attracted several foreign investment in West Africa the last 5 years totalling over \$250m Dollars for exploration. The most important being

- Gryphon Minerals (Greenfields Discovery 3.6 M oz @2.1 g/t)
- Ampella Mining (Greenfields Discovery 3.2 M oz @2 g/t)

Most interestingly, Dr Ouedraogo put together the team at Inata and implemented with Peter Williams techniques which took the project from 600,000 oz of resources to 1,400,000 oz in 18 months and completed pre-faisibility and feasibility study with Goldbelt resources. Dr Ouedraogo put also the team which discovered Batie West Konkera deposit of Ampella Mining Ltd.

Mr Tibo YANOGO

Chief Geophysicist of TTG, Polytech of Montreal, 30 Years' experience airborne & ground geophysical surveys including (Mag, EM, IP, Radiometry,...for Water and minerals. BUMIGEB, UNDP, various major and junior companies (BHP, Anglo, Randgold, Resolute, High River Gold, Orezone, Ampella, Volta Resources, Semafo) across countries of West Africa. French & very good English

Education

- French BAC, C (mathematics, Physics and Chemistry option) mention fairly well;
- French DUES in Mathematics and Physics;
- French Degree in Mathematics
- North American BAC in Geophysics engineering

Field Experience:

Mr Yanogo has undertaken lot of surveys for minerals exploration projects as well as for ground water drilling both in sedimentary (West and North of Burkina Faso) and crystalline bedrock .

From September 1998 to February 2000 is was enrolled by AURENSA a Spanish geophysical survey company, as Technical Assistant assuming the daily quality (QC) of airborne magnetic and radiometric survey performed by GEOTERREX on all west part of Burkina Faso.

From July 1989 to February 1998, Mr Yanogo was engaged in a United Nations (UNDP) project for Data interpretation acquire by an airborne magnetic and electromagnetic survey on the Boromo Greenstone Belt. Ground follow up of conductive EM anomalies for base metal exploration.

Mr Yanogo has long experience in exploration through the Bureau of Mines and Geology of Burkina for numerous exploration companies is a key asset to TTG for servicing companies in geophysics and geology.

Course Venue and Facilities

All classroom activities will be conducted at TTG in Ouagadougou.

Data processing and interpretation exercises will be undertaken in TTG's computer laboratories that are equipped with an extensive collection of commercial and publically available geophysical software.

Students are encouraged to bring their own laptops and will be provided with a USB/DVD containing public domain geophysical data analysis and display software, some of which will be used during the course.

TTG has a comprehensive range of geophysical equipment, and by arrangement with BUMIGEB, that will be utilised by participants for data acquisition exercises and for equipment demonstrations:

- Overhauser magnetometers
- Resistivity and induced polarisation systems

REGISTRATION FEE (*prices are given first for WAXI-sponsors and second for Non WAXI-sponsors*)

US \$ 1500/1800 MODULE I : PRACTICAL GEOPHYSICS-COURSES (9th – 14th May)

US \$ 1500/1800 MODULE II : PRACTICAL GEOPHYSICS- FIELD CAMP (16th – 21st May)

US \$ 750/900 MODULE III : PRACTICAL TARGETTING in EXPLORATION (23rd – 25th May)

US \$ 3000/3600 for ALL OF THE THREE MODULES (15 days course: 9th – 25th May)

The fee includes catering and one course dinner.

Participants are required to make their own travel and accommodation arrangements.

Please keep a copy of this form for your records and email the original to:

- Dr Luc Siebenaller (in case of WAXI-sponsor or sponsor-in-kind registration)
Email: luc.siebenaller@asdm.lu
Phone: +352 621 561 261
- Dr Morou Francois Ouedraogo (in case of non-WAXI registrations)
Email: mfo.ttgeoservices@gmail.com
Phone: +226 76 92 08 00

PAYMENTS

Full payment must be received prior to 7th May 2016. Participants will receive an invoice as soon as they have registered.



PRACTICAL APPLIED GEOPHYSICS FOR GEOLOGISTS

REGISTRATION FORM

Please note there is a limit of 20 participants for this course, so please return the form as soon as possible.

Registrations close May 05, 2016.

- Registration for:**
- Module I**
 - Module II**
 - Module III**
 - All 3 modules**

PERSONAL DETAILS

Title – Please circle (Prof / Dr / Mr / Mrs / Ms / Miss).....

First Name Last Name (surname/family name)
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Preferred Name (for name tag)
.....

Position
Company/University.....
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Address.....
.....

City State
Postcode.....
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Country.....
..... Email

Mobile.....
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Phone (home) Phone (work)

Fax.....
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Dietary
requirements/allergies.....
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