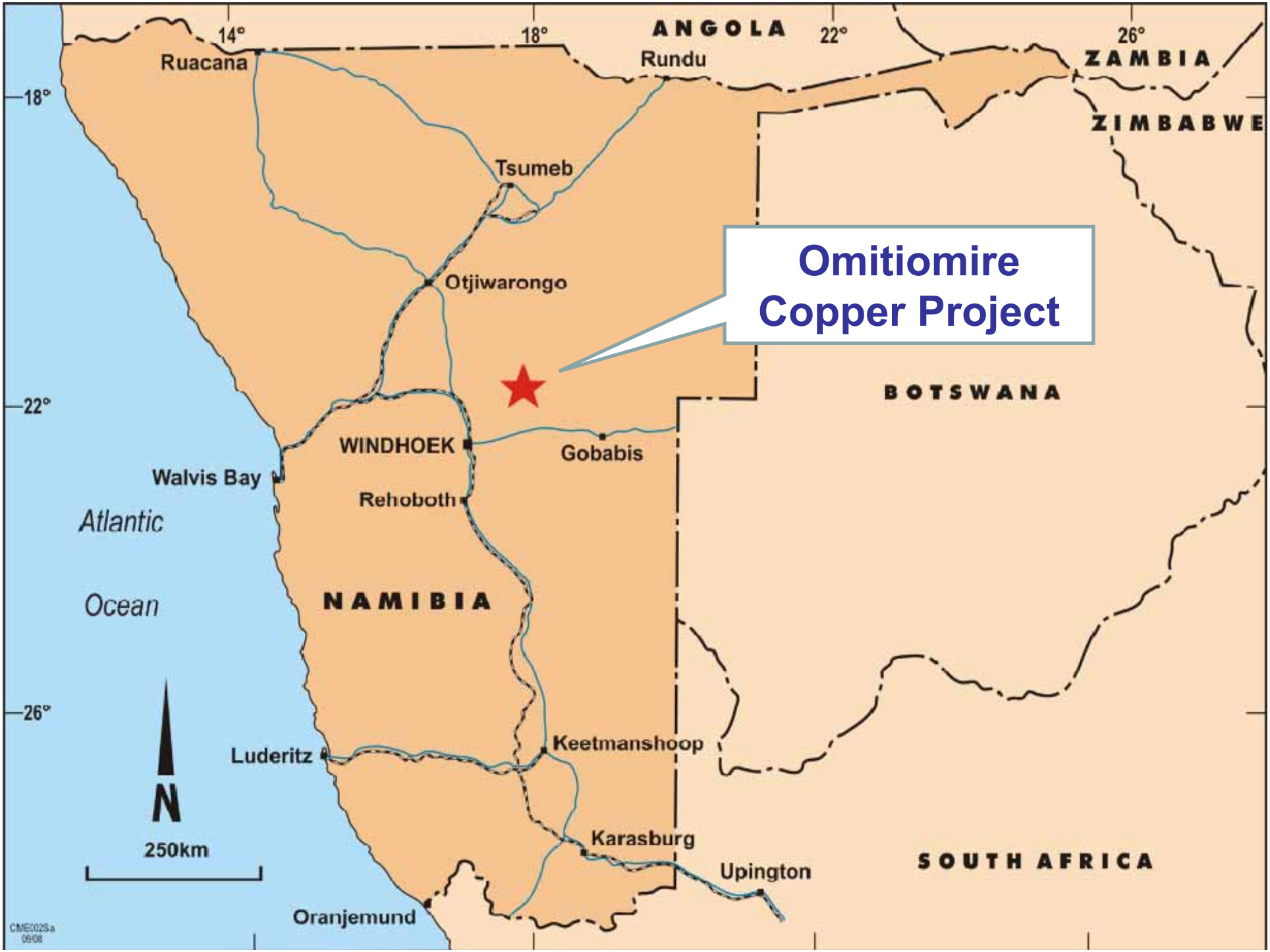
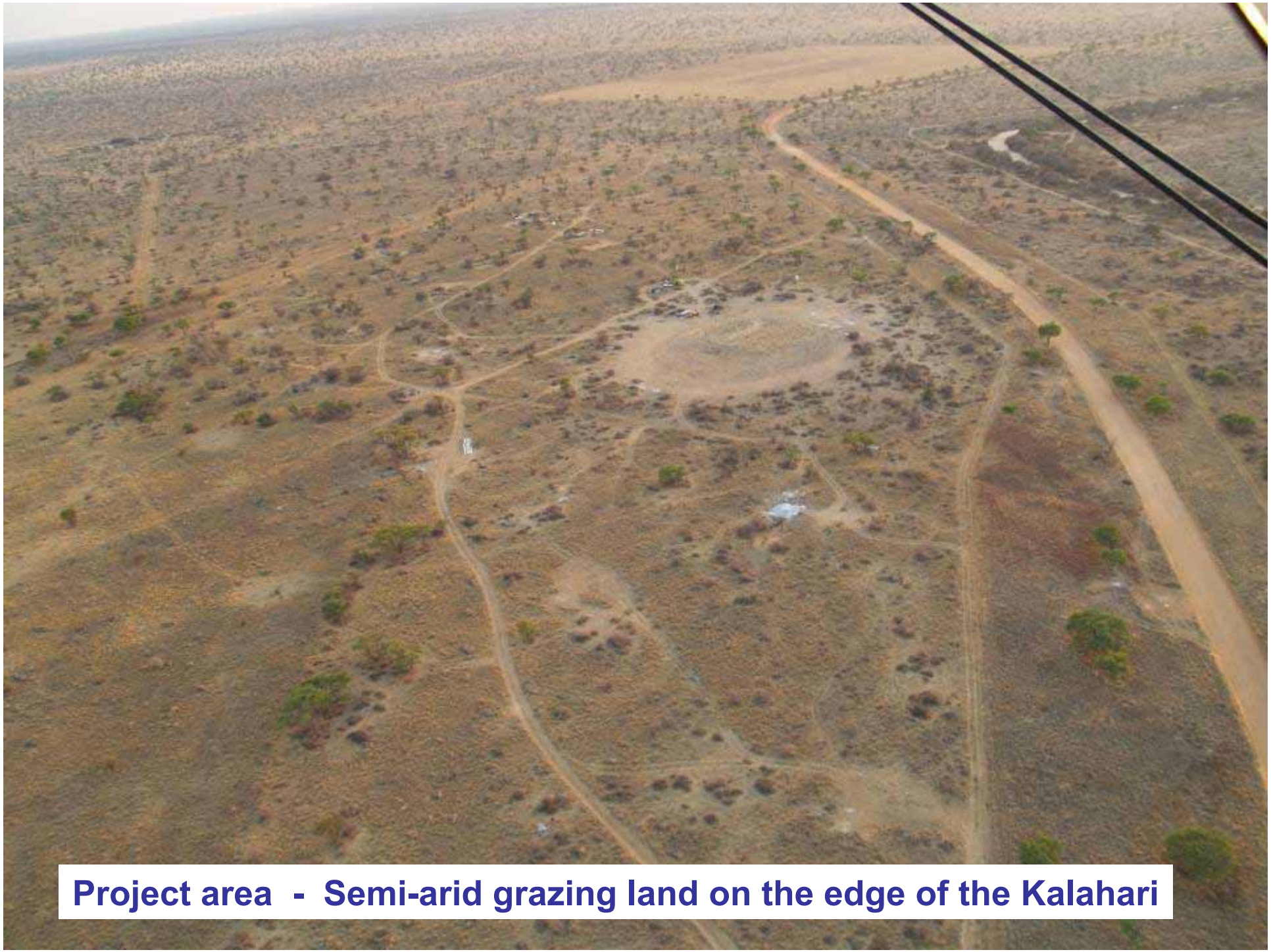
Portable XRF in Soil Geochemical Surveys - the Omitiomire Copper Project, Namibia

Karl Hartmann, Craton Mining & Exploration P/L
Colin Brodie, Craton Mining & Exploration P/L
Ken Maiden, International Base Metals Limited

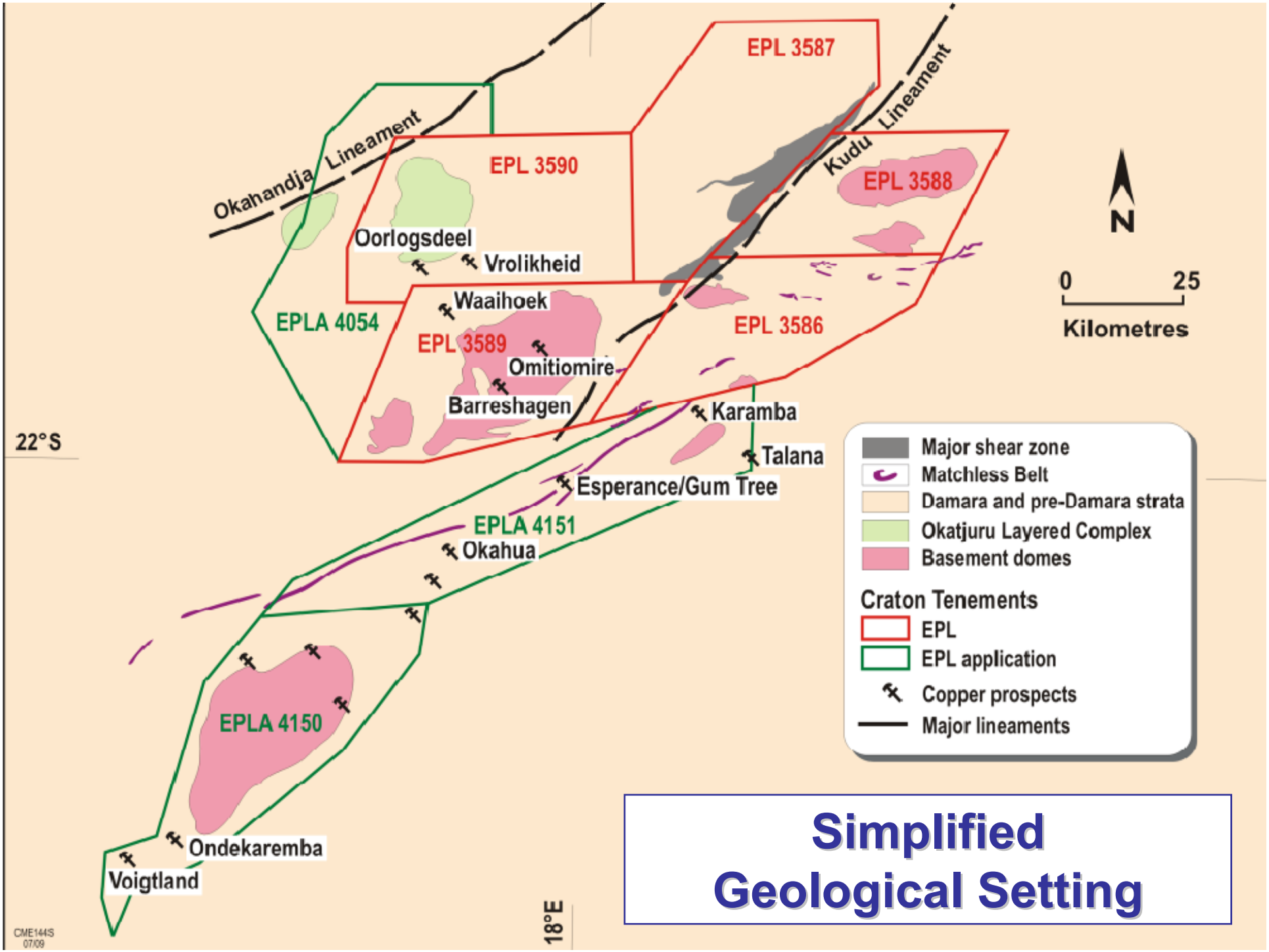

Omitiomire
Copper Project
ANGOLA
ZAMBIA
ZIMBABWE
BOTSWANA
SOUTH AFRICA
NAMIBIA
Ruacana
Rundu
Tsumeb
Otjiwarongo
WINDHOEK
Gobabis
Walvis Bay
Rehoboth
Atlantic
Ocean
Luderitz
Keetmanshoop
Karasburg
Upington
Oranjemund
14°
18°
22°
26°
N
250km



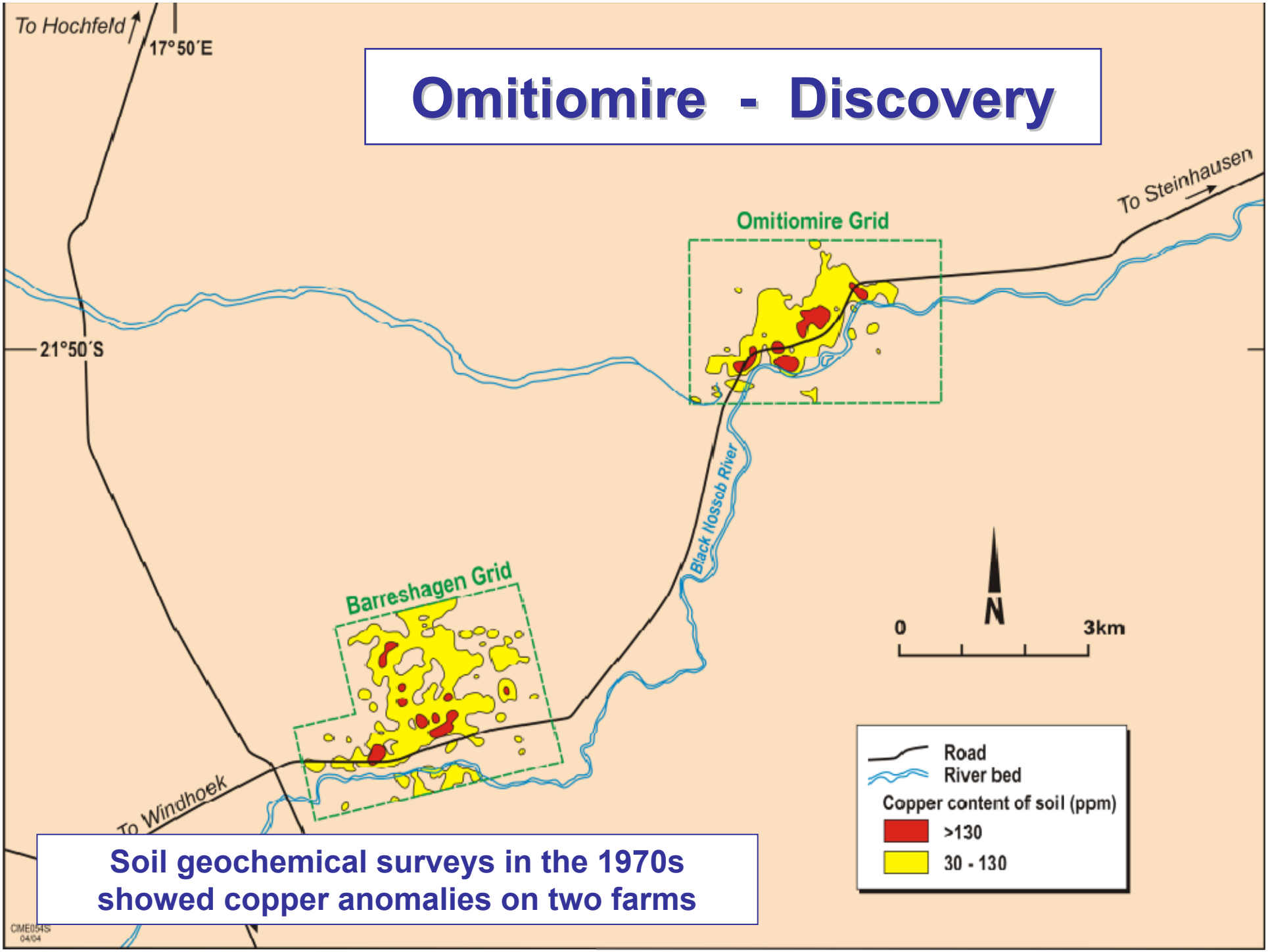
Project area - Semi-arid grazing land on the edge of the Kalahari

Some local residents wouldn't look too out-of-place in inland Australia


Others would turn a few heads

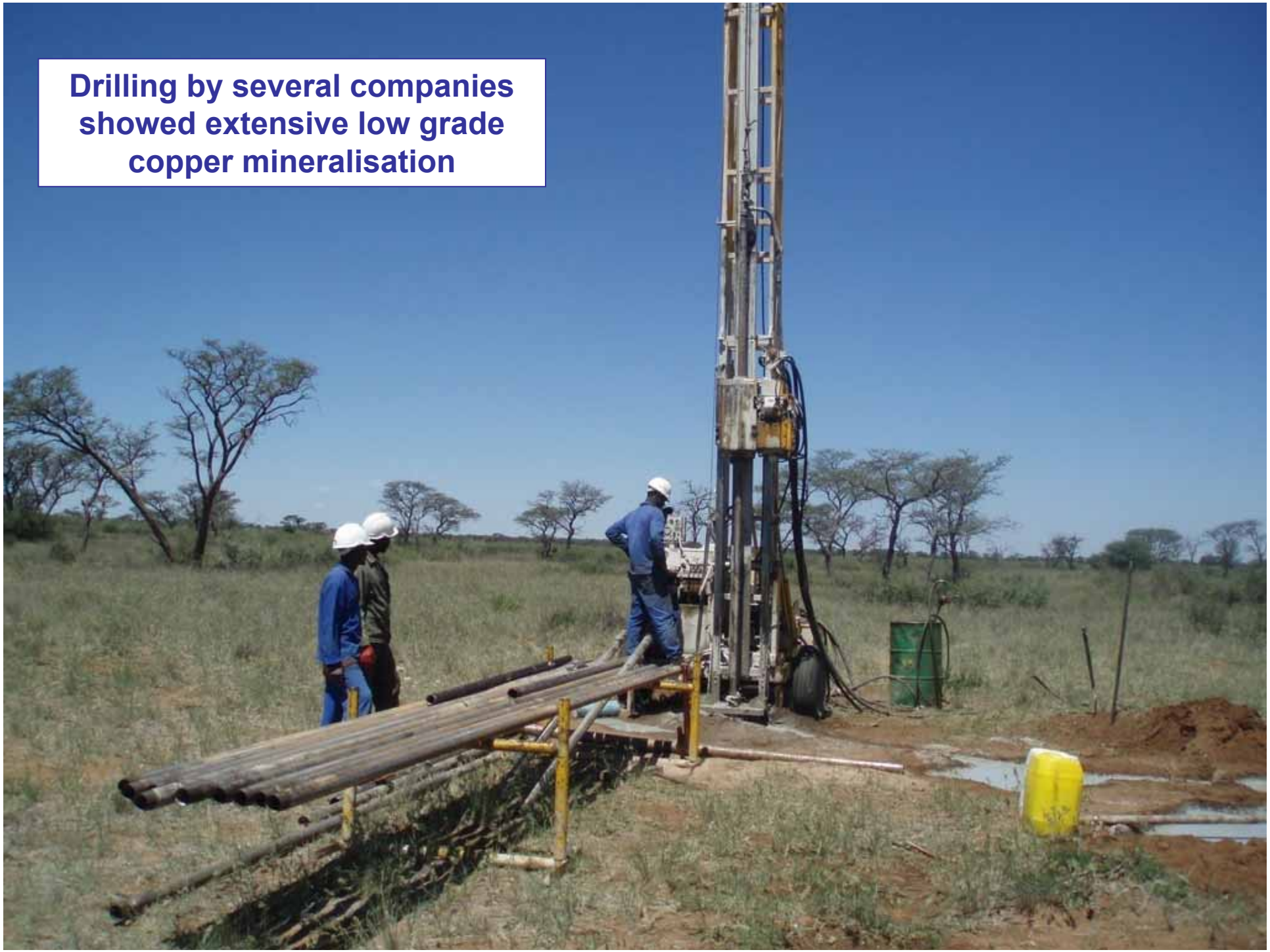


Simplified Geological Setting

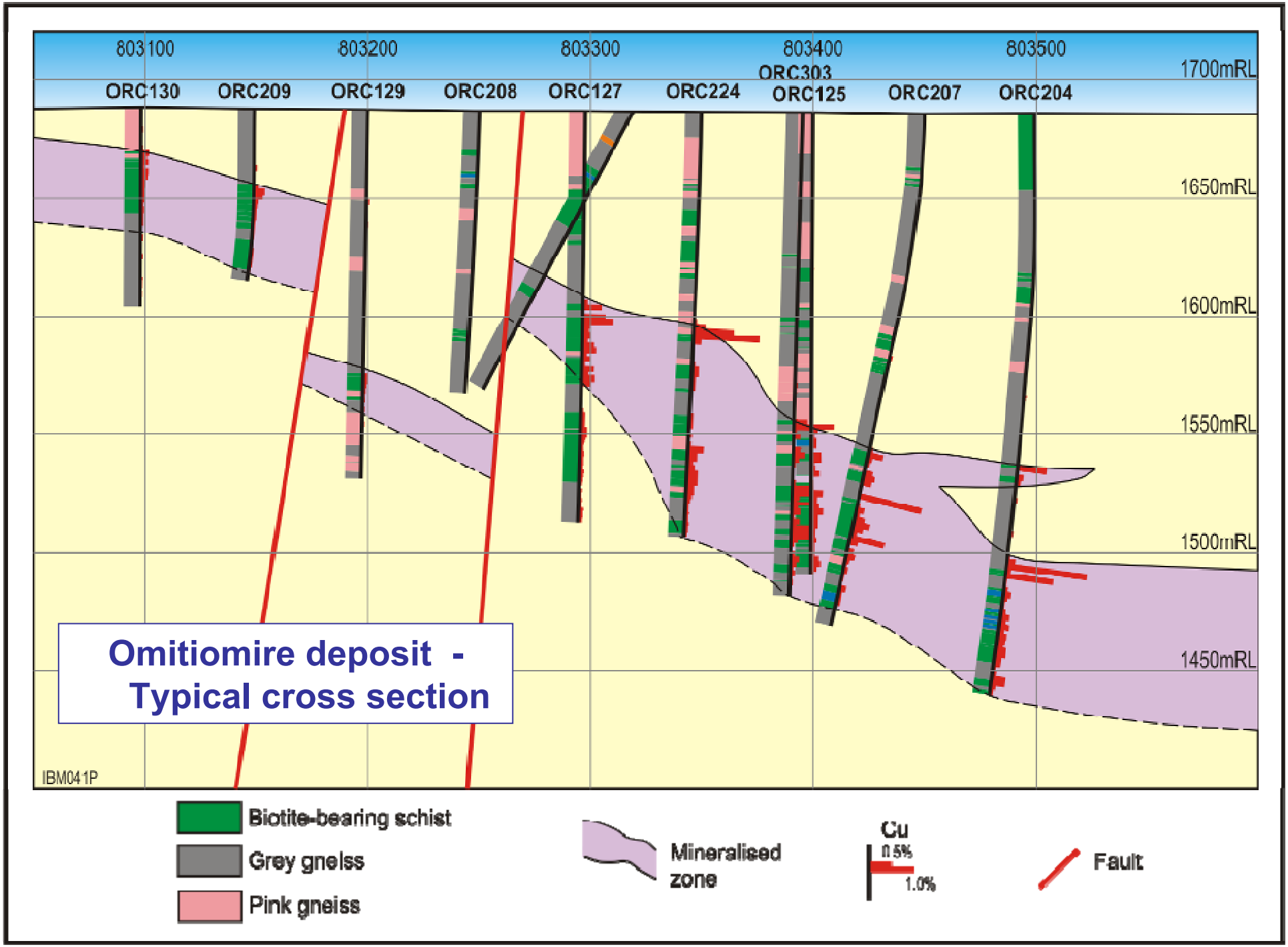


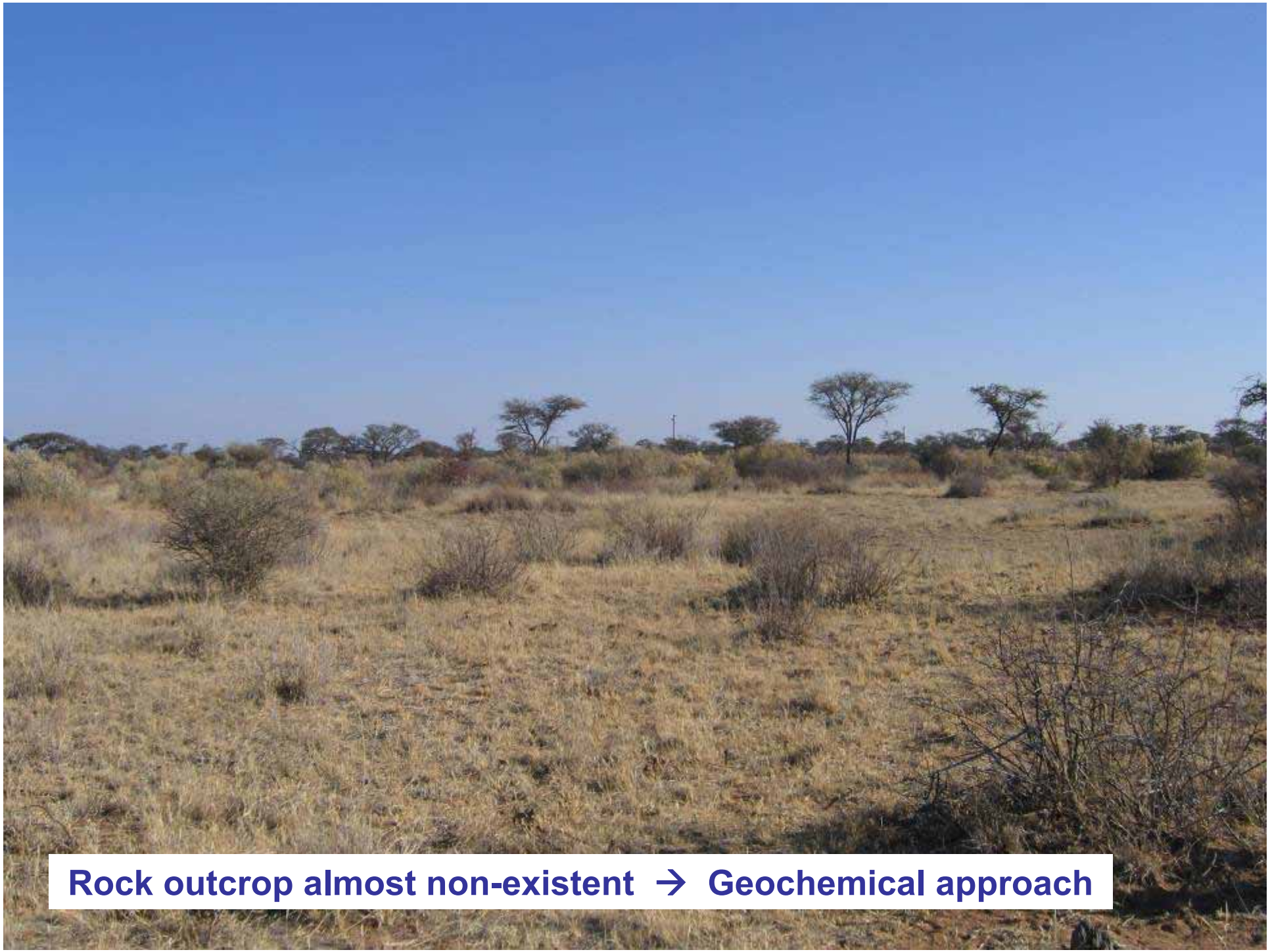
Omitiomire - Discovery

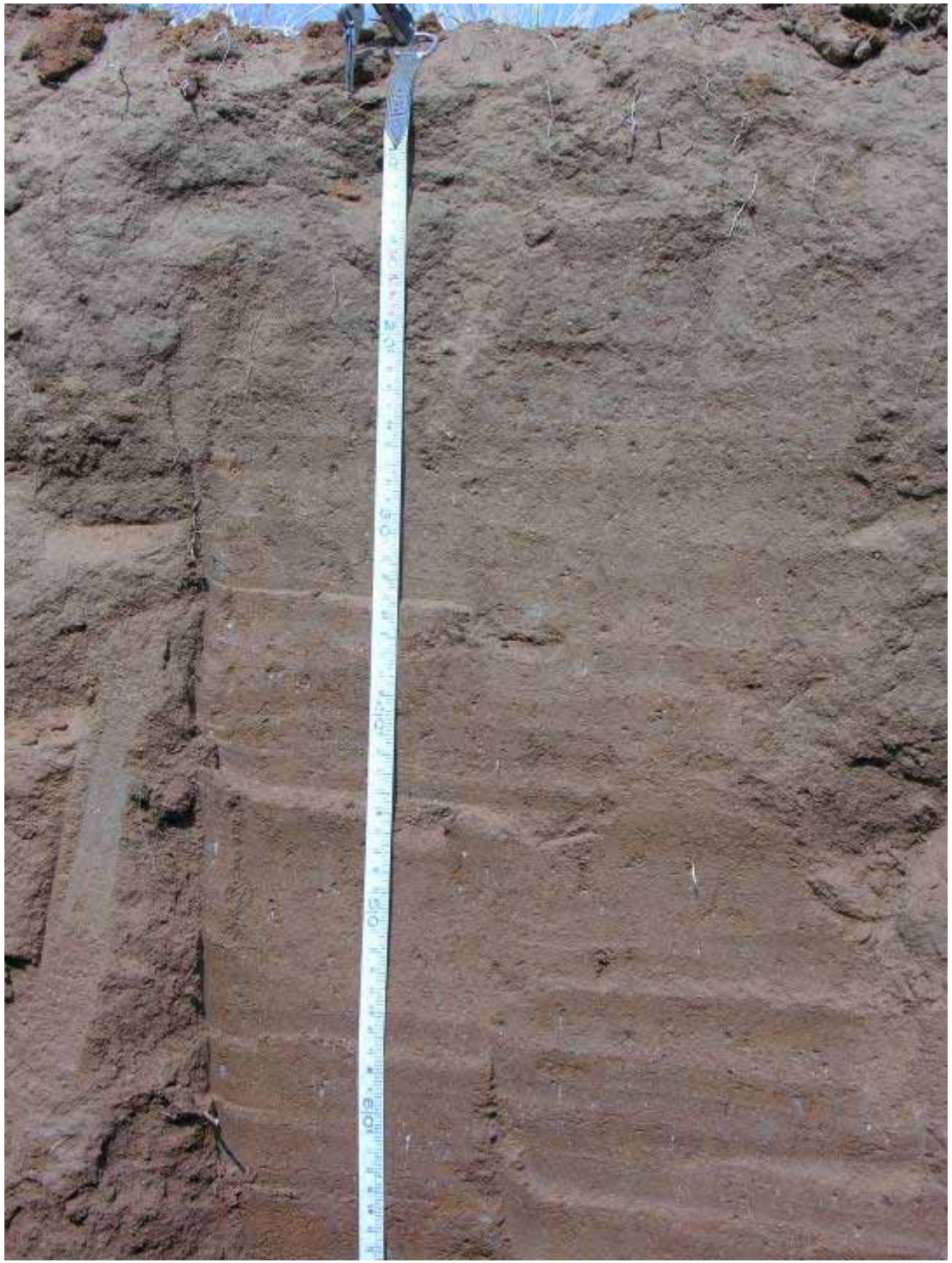
Soil geochemical surveys in the 1970s showed copper anomalies on two farms


Drilling by several companies showed extensive low grade copper mineralisation


Deposit style - Disseminated chalcocite in
biotite-amphibole-epidote-magnetite schist


803100
803200
803300
803400
803500
ORC130
ORC209
ORC129
ORC208
ORC127
ORC224
ORC303
ORC125
ORC207
ORC204
1700mRL
1650mRL
1600mRL
1550mRL
1500mRL
1450mRL
Omitiomire deposit -
Typical cross section
IBM041P
Biotite-bearing schist
Grey gneiss
Pink gneiss
Mineralised zone
Cu
0.5%
1.0%
Fault


Rock outcrop almost non-existent → Geochemical approach



Soil Profile

Kalahari sand-sheet, up to several metres thick, blankets the area

A Tertiary (Miocene?) surface, with associated soil profile, caps the sand-sheet

The sand has been affected by biological activity - especially termites

→ Copper in soil reflects copper in underlying Proterozoic bedrock

Decision to Use XRF

No analytical laboratory in Namibia

→ Samples must be sent to Johannesburg

→ Freight cost added to analytical cost

In 2008, turn-around time was up to 6 weeks

Decision to purchase an XRF analyser was based on -

- Time saving
- Cost saving

Decision to Dry & Sieve Samples

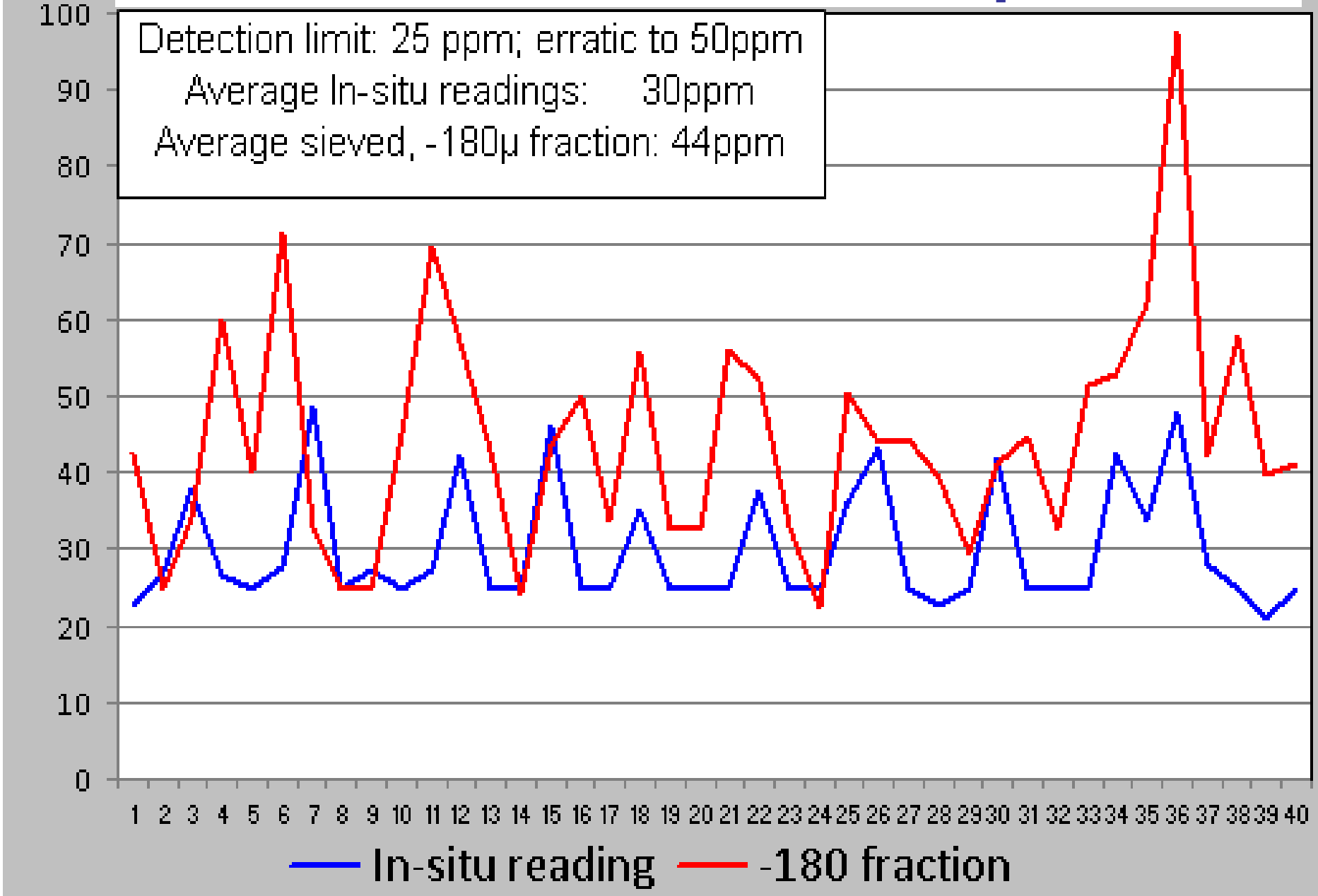
In situ analysis

- Saves time – no sieving, easy data transfer
- No sample handling – minimises errors in sample swaps or numbering

Analysis after drying & sieving

- Low risk to expensive equipment
- - 180µ fraction has higher Cu conc
  → more samples > detection limit
- Wet samples could mask results?
- Cheap manpower in Africa

In Situ vs Sieved Samples



Field Procedures

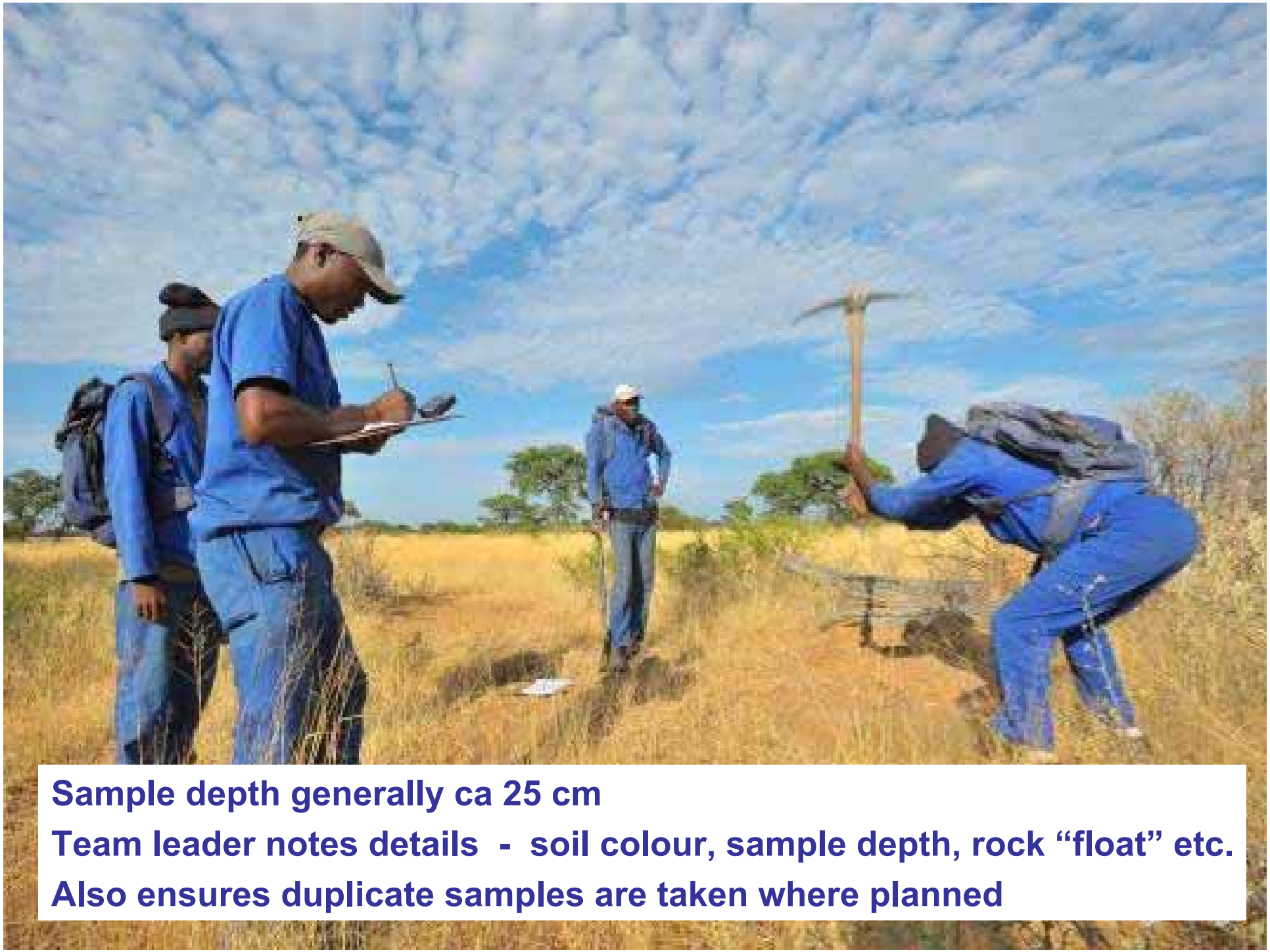
Geologist (on right) briefing team leader on sample sites


Planning day’s work


Five men per crew - team leader, driver, three samplers.
Cost: A$100 /day including food rations


Locating sample position with GPS

Commencing sample hole



Sample depth generally ca 25 cm

Team leader notes details - soil colour, sample depth, rock “float” etc.

Also ensures duplicate samples are taken where planned

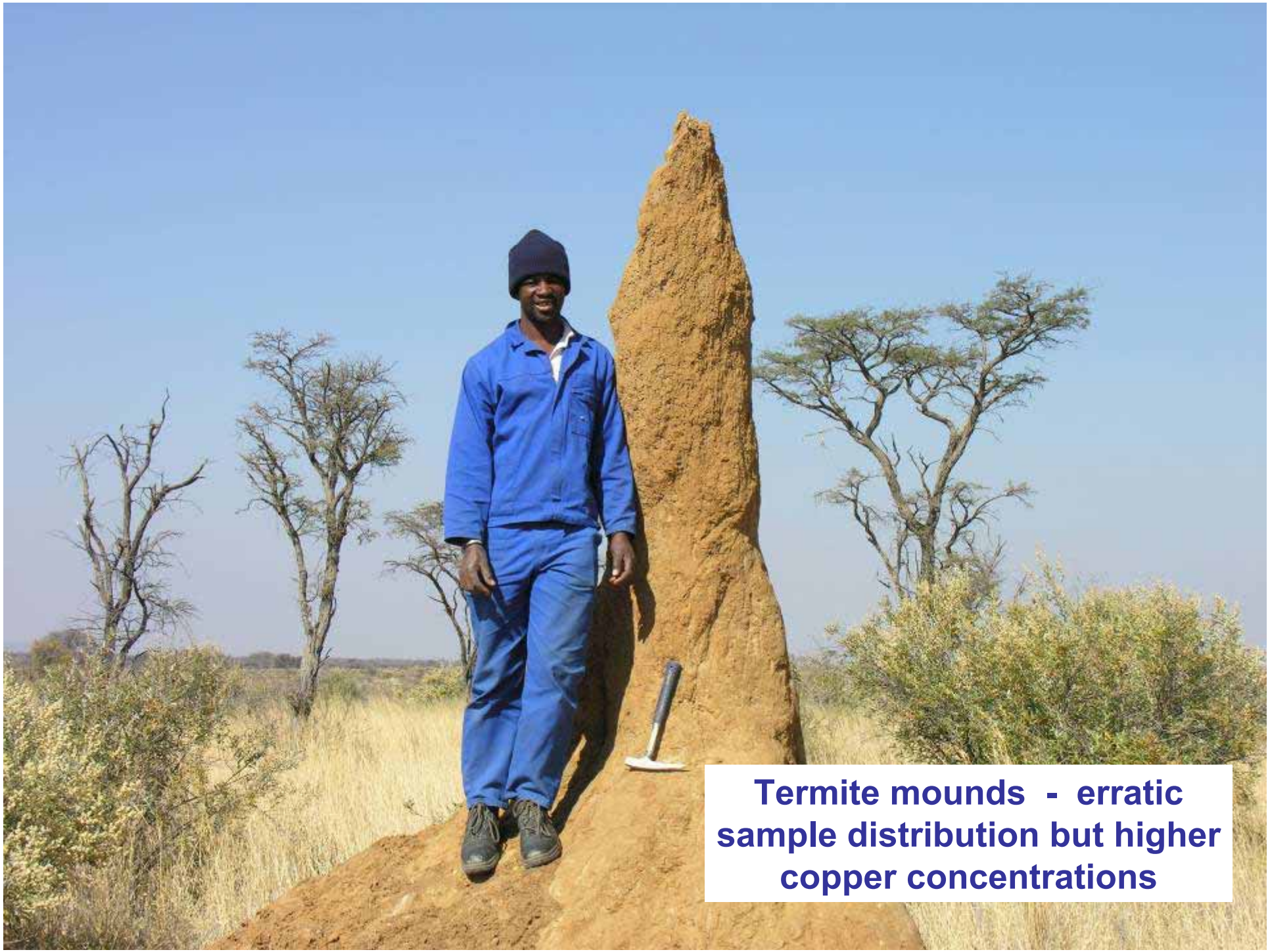

Collecting sample

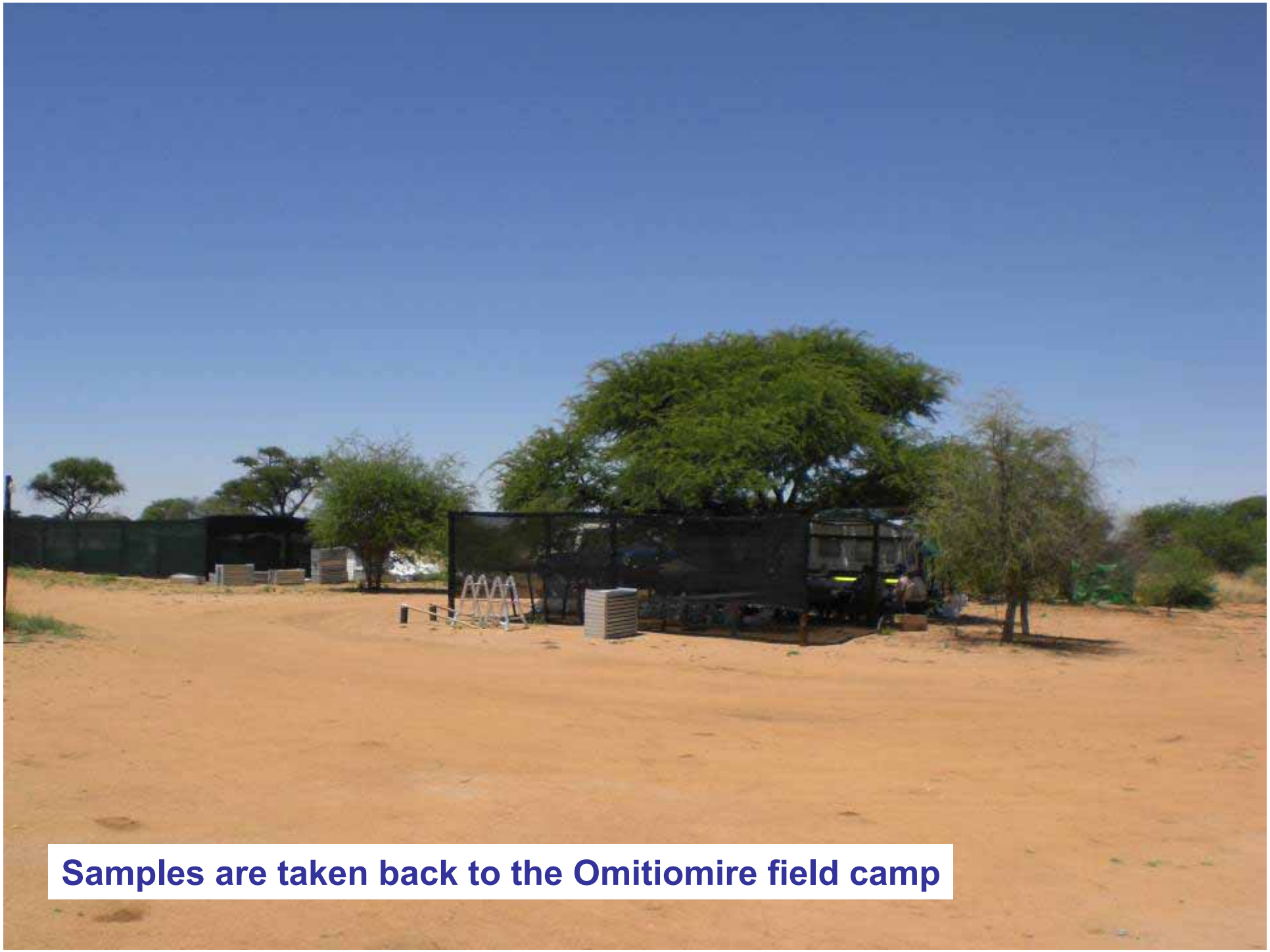
Sieving sample - 2 mm sieve


Bagging sample


Rehabilitating sample site

Then the team walks to the next sample site
The team typically covers 24 km of sample line per day


Termite mounds - erratic sample distribution but higher copper concentrations



Samples are taken back to the Omitiomire field camp

Samples being sun-dried

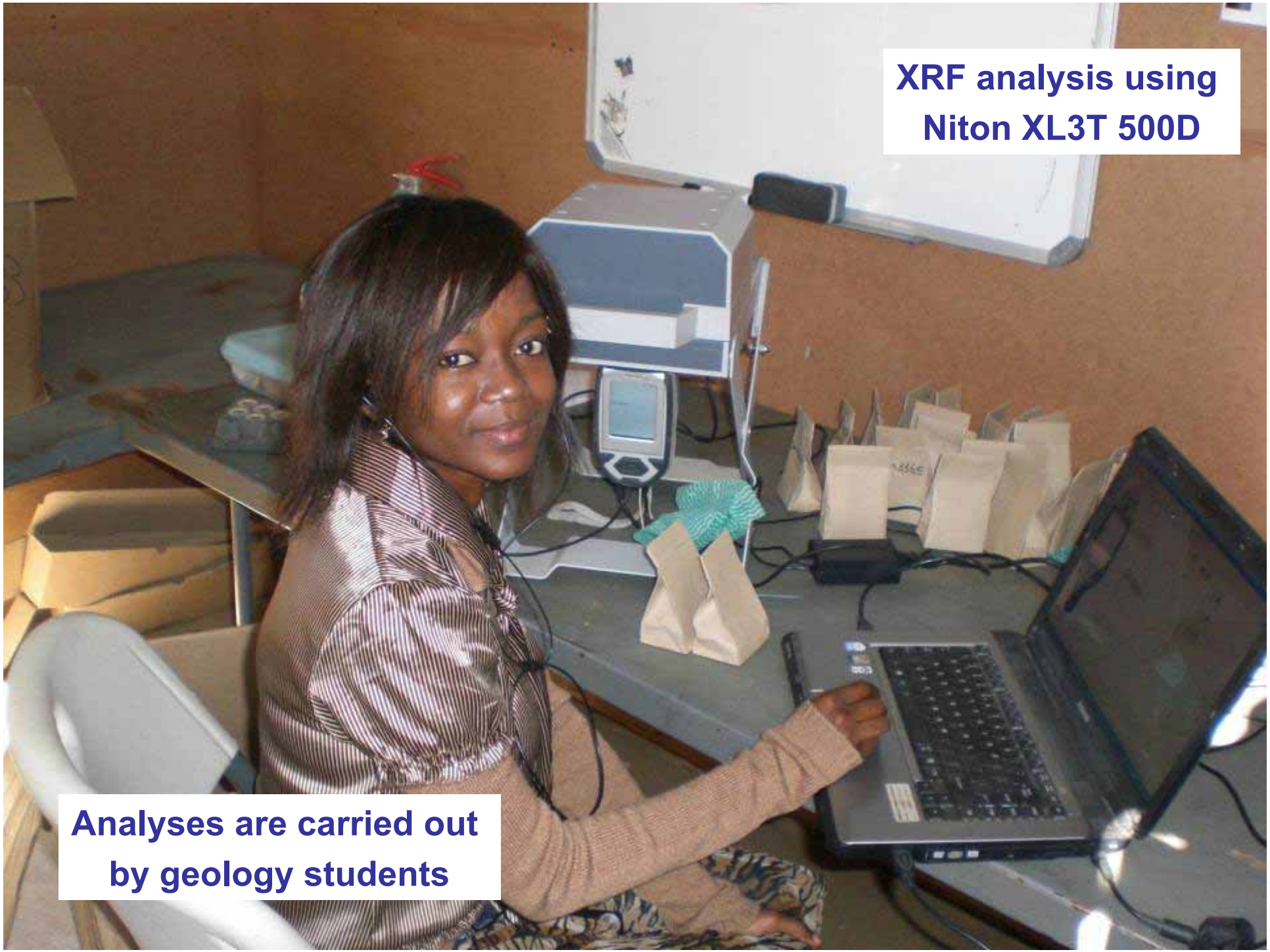

Dried samples are sieved to - 180µ

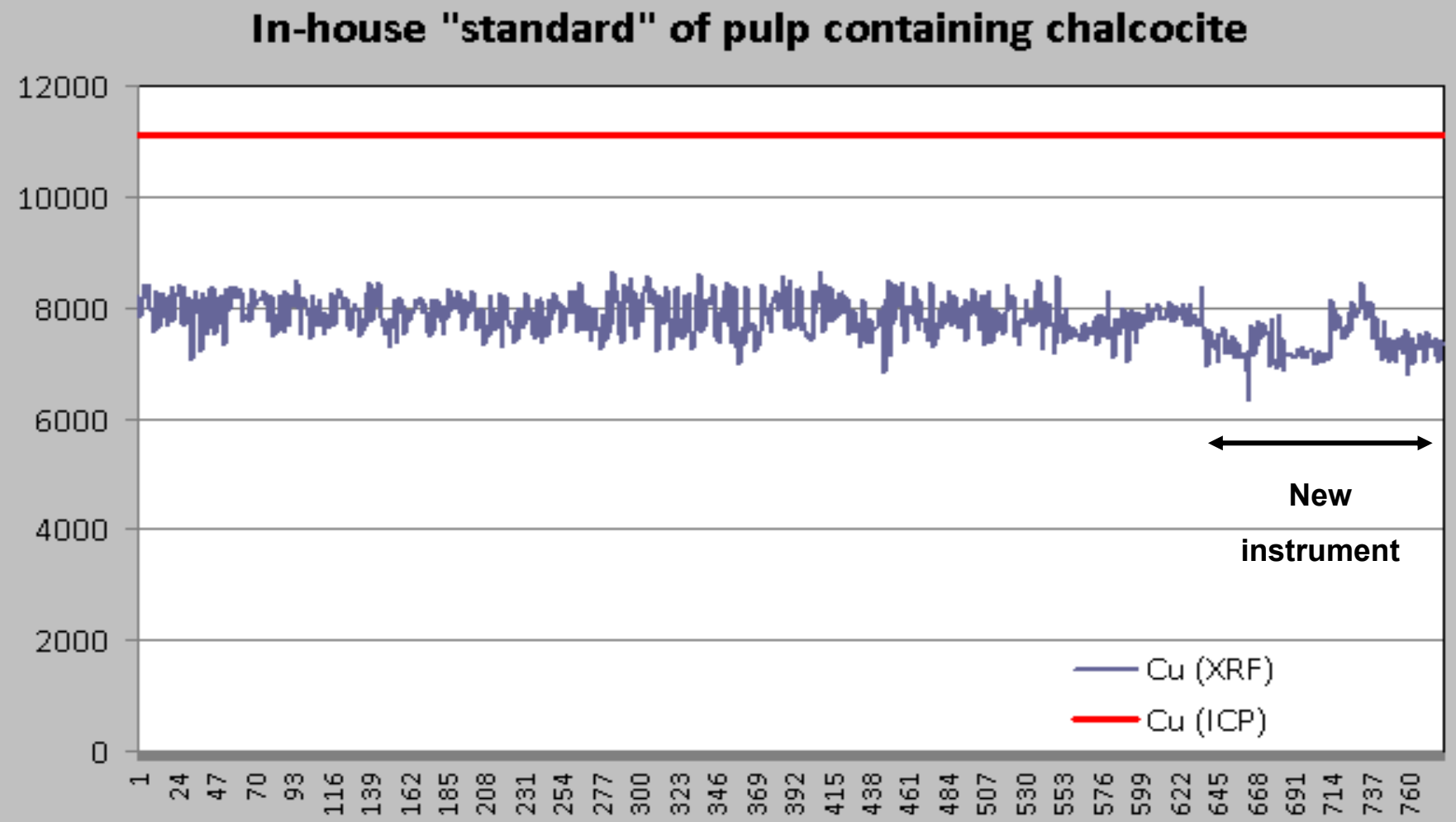
Team leader checking correct sample packet

Samples ready for analysis

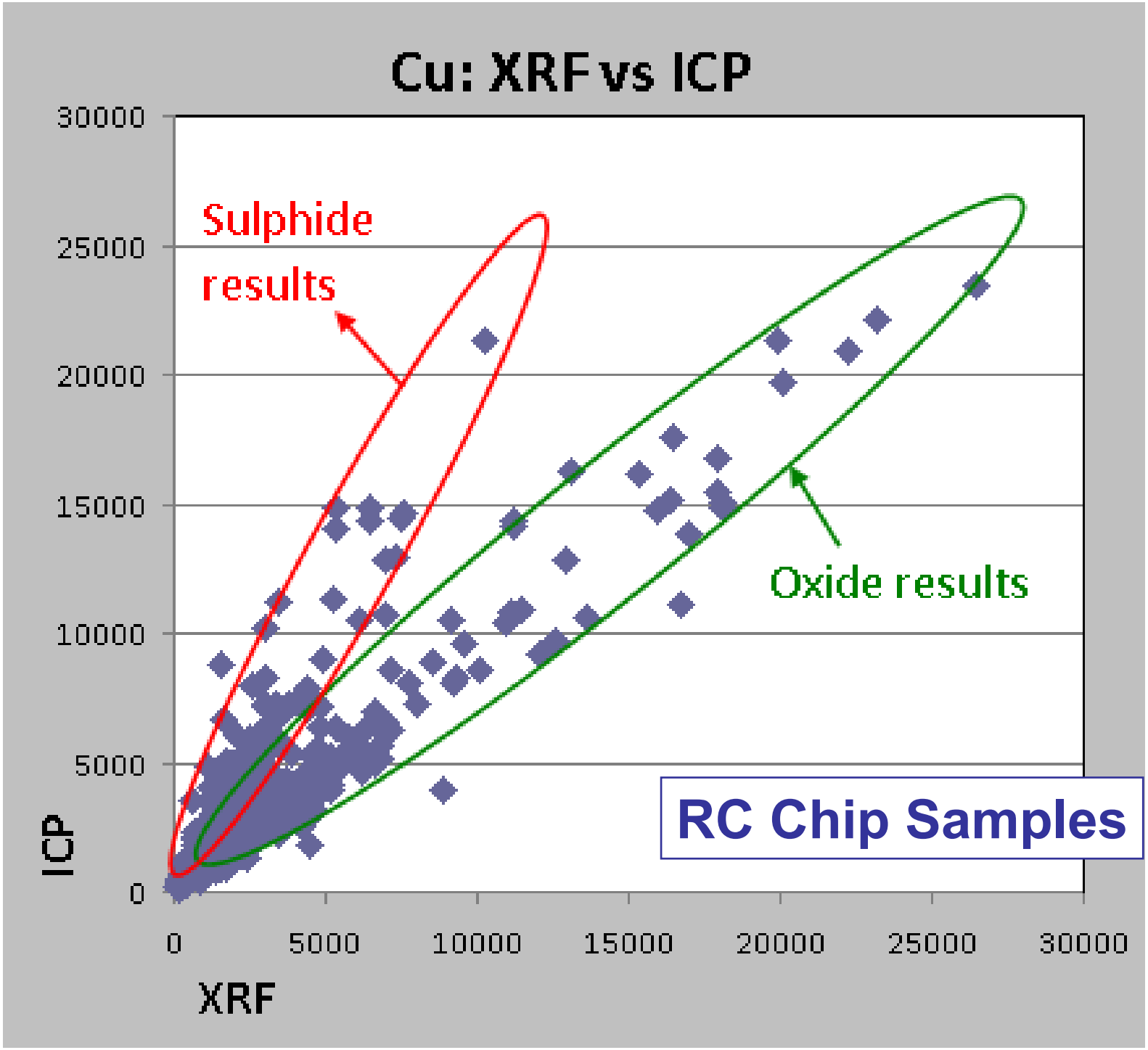

Interested spectator


XRF analyser is kept in a “lab” on site


XRF analysis using
Niton XL3T 500D
Analyses are carried out
by geology students


In-house "standard" of pulp containing chalcocite
12000
10000
8000
6000
4000
2000
0
1
24
47
70
93
116
139
162
185
208
231
254
277
300
323
346
369
392
415
438
461
484
507
530
553
576
599
622
645
668
691
714
737
760
New
instrument
Cu (XRF)
Cu (ICP)

XRF vs ICP


Cu: XRF vs ICP
30000
25000
20000
15000
10000
5000
0
ICP
0
5000
10000
15000
20000
25000
30000
XRF
Sulphide results
Oxide results
RC Chip Samples

Comparison - ICP & XRF in Drill Samples

RC Chip Samples:

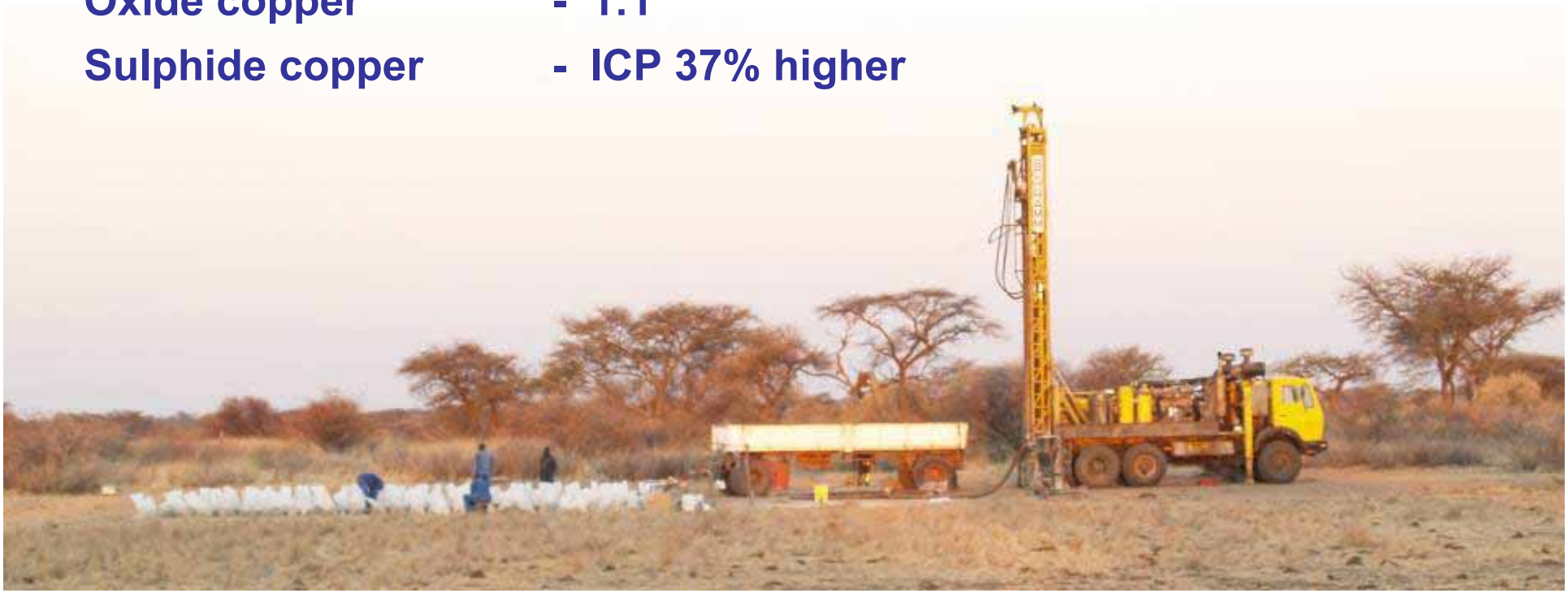
Oxide copper - 1:1

Sulphide copper - ICP 72% higher than XRF

Milled RC Samples:

Oxide copper - 1:1

Sulphide copper - ICP 37% higher



XRF under-estimates the copper content in sulphide copper samples.
XRF is used to scan all drill samples and select samples for ICP assay

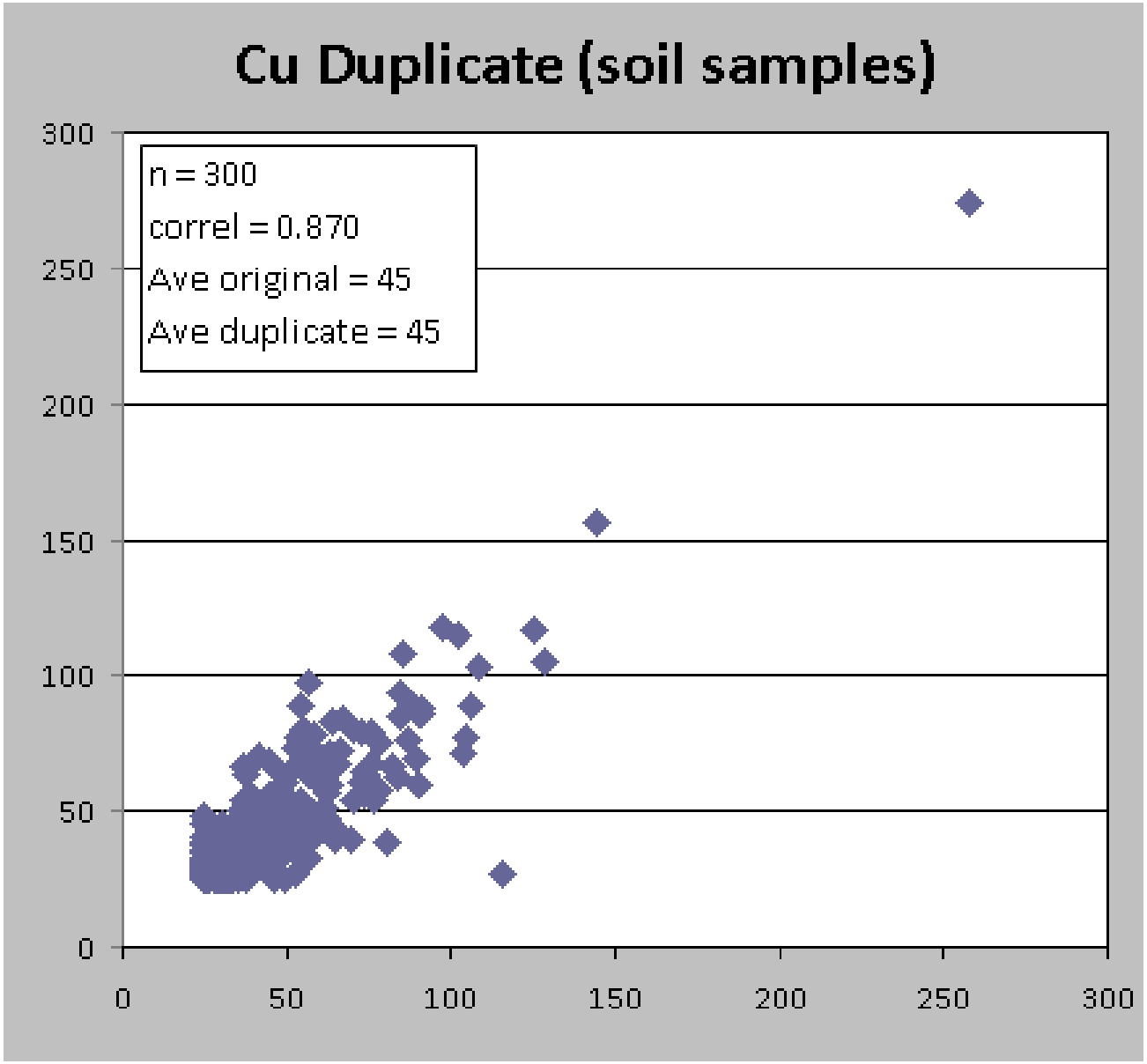
QC in Soil Sample Batches

- External standards
- Internal standards
- Duplicate every 40 samples
- Anomalous samples re-analysed
- Occasional blanks

Mismatches in Duplicates

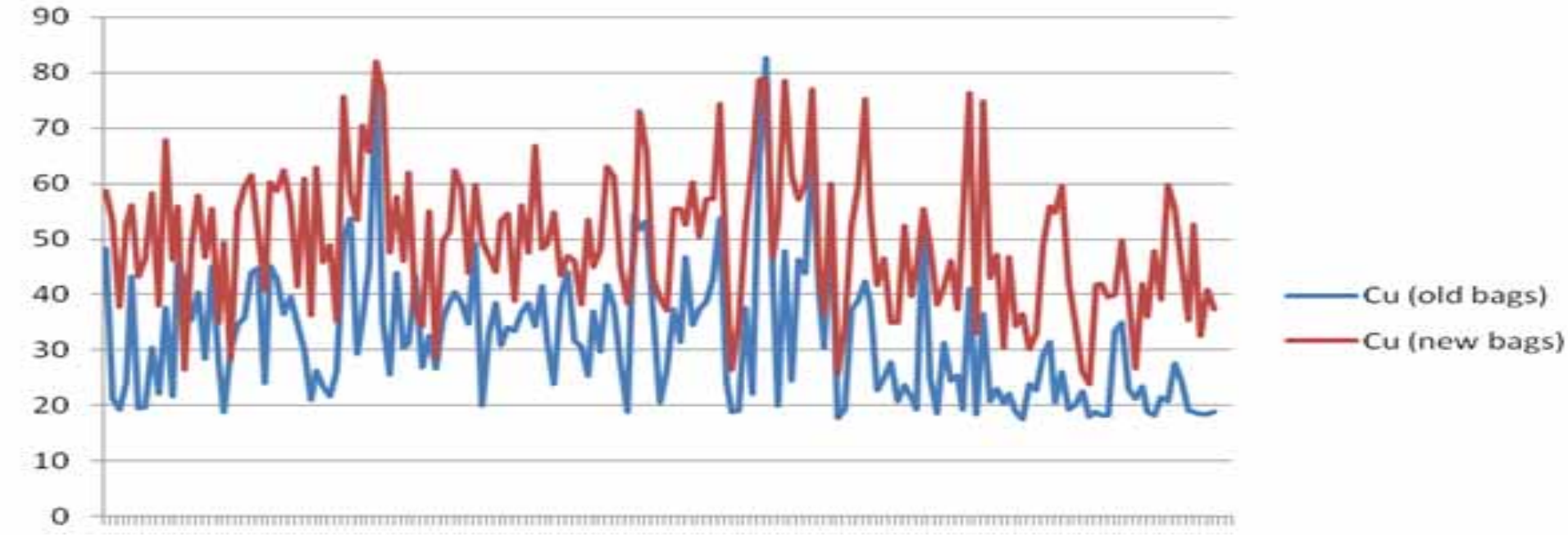
Mismatches in duplicates most likely relate to sample swaps during sieving and numbering of bags

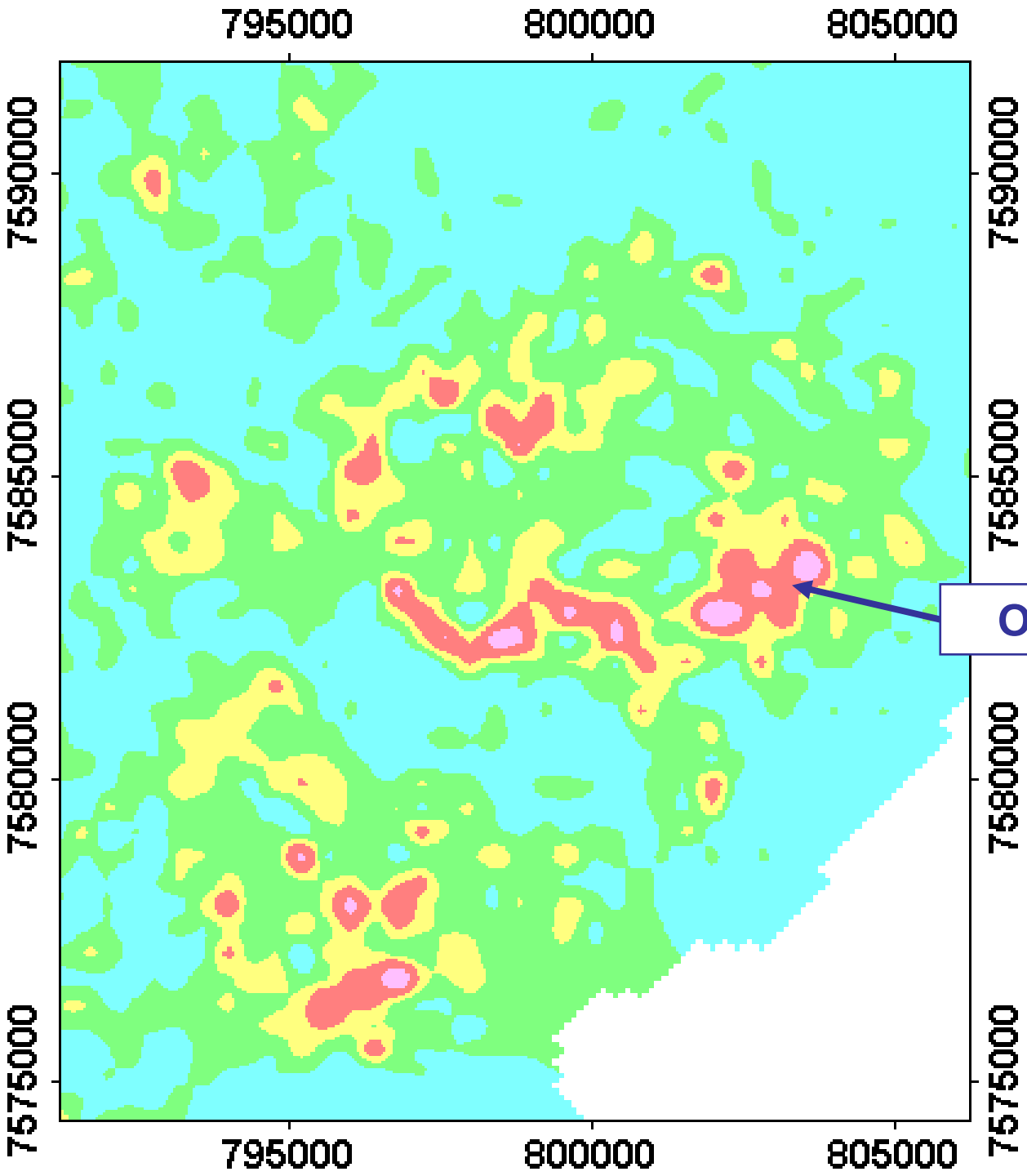
One grid was re-sampled



Example of Inconsistency

- Initially samples were read within sample packets
- A shift in results coincided with a new batch of sample packets
- The new sample packets increased readings by 17 ppm on average
- The change was due to increased copper in the new packets
- Samples are now read on a glass slide



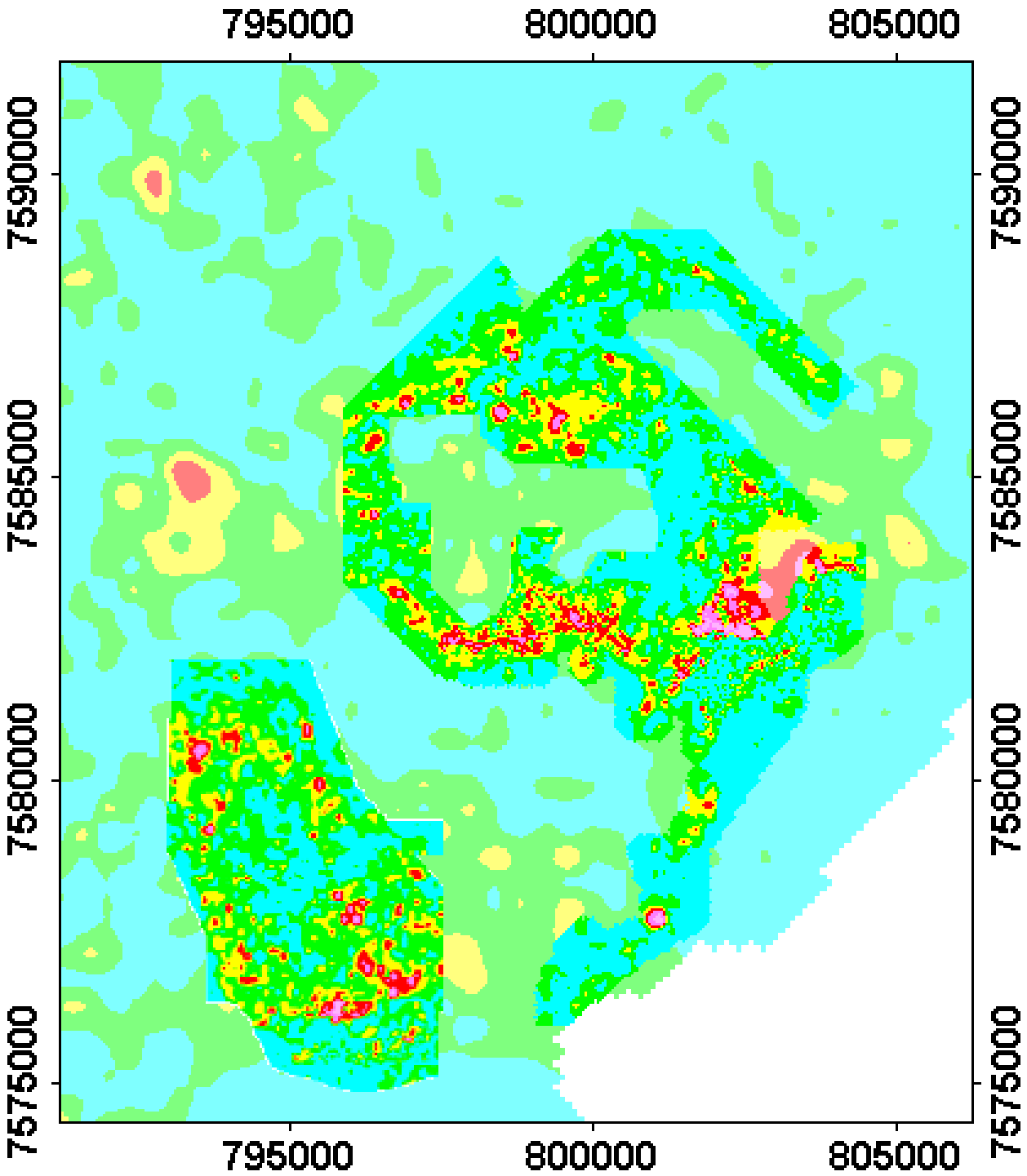


Sample Spacing

Initially samples were taken on a 400m x 400m grid

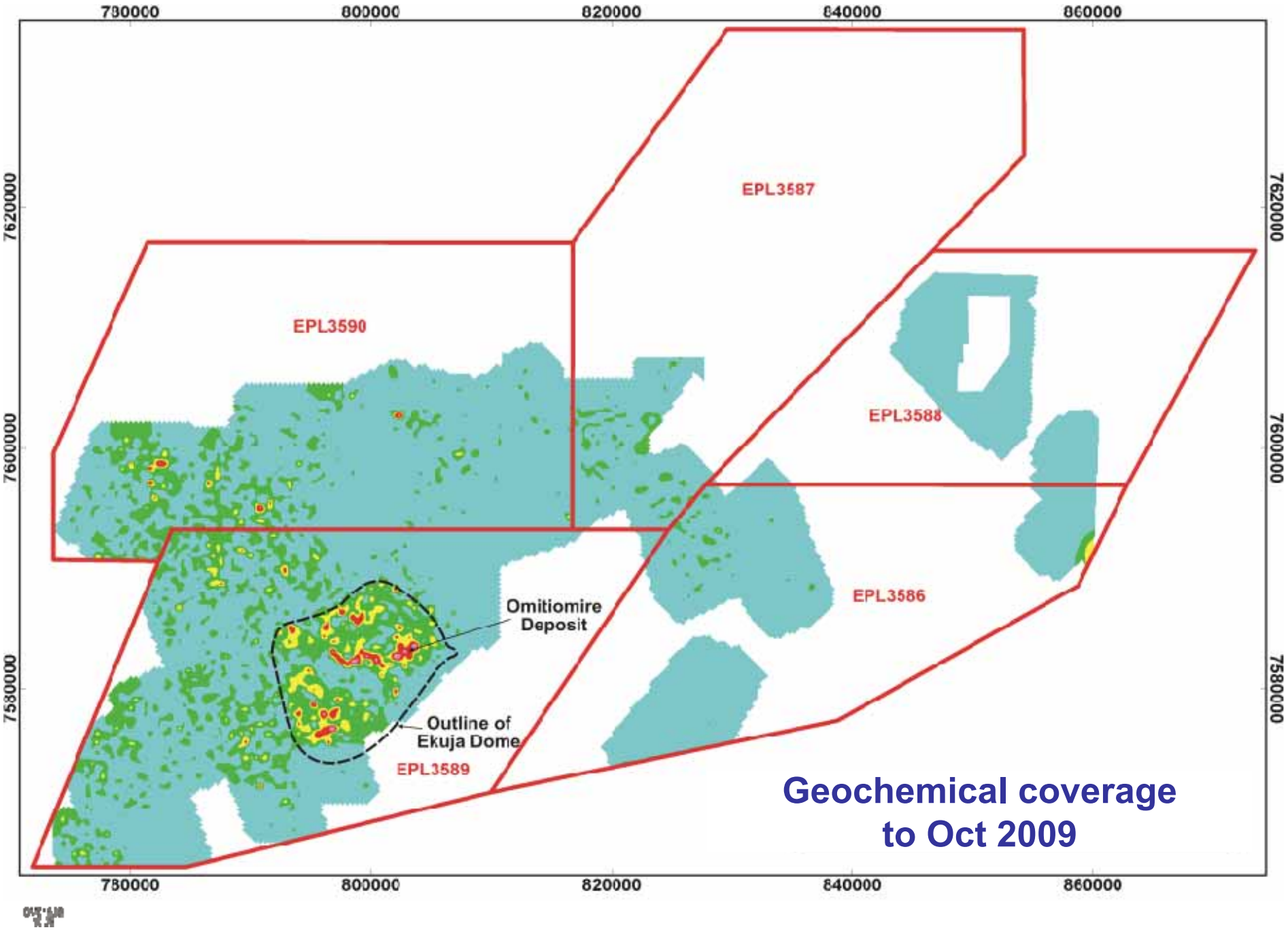
OMITIOMIRE DEPOSIT

Blue	< 1 STD
Green	1 - 2 STD
Yellow	2 - 4 STD
Red	4 - 8 STD
Magenta	> 8 STD



Sample Spacing

Follow-up 100m x 100m and 50m x 50m spacing gives good correlation with initial anomalies

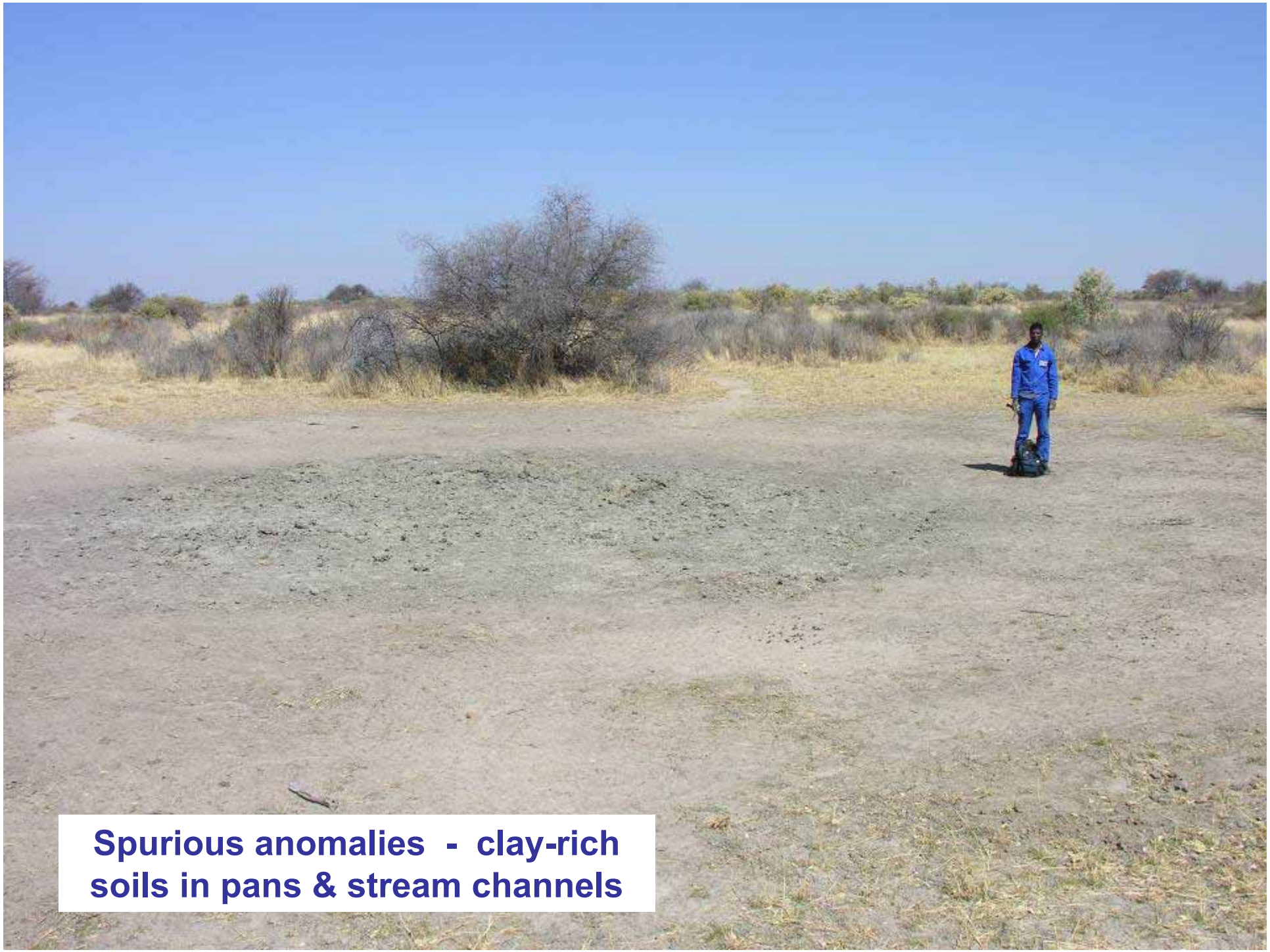

780000
800000
820000
840000
860000
7620000
7600000
7580000
EPL3587
EPL3590
EPL3588
EPL3586
EPL3589
Omitiomire
Deposit
Outline of
Ekuja Dome
Geochemical coverage
to Oct 2009

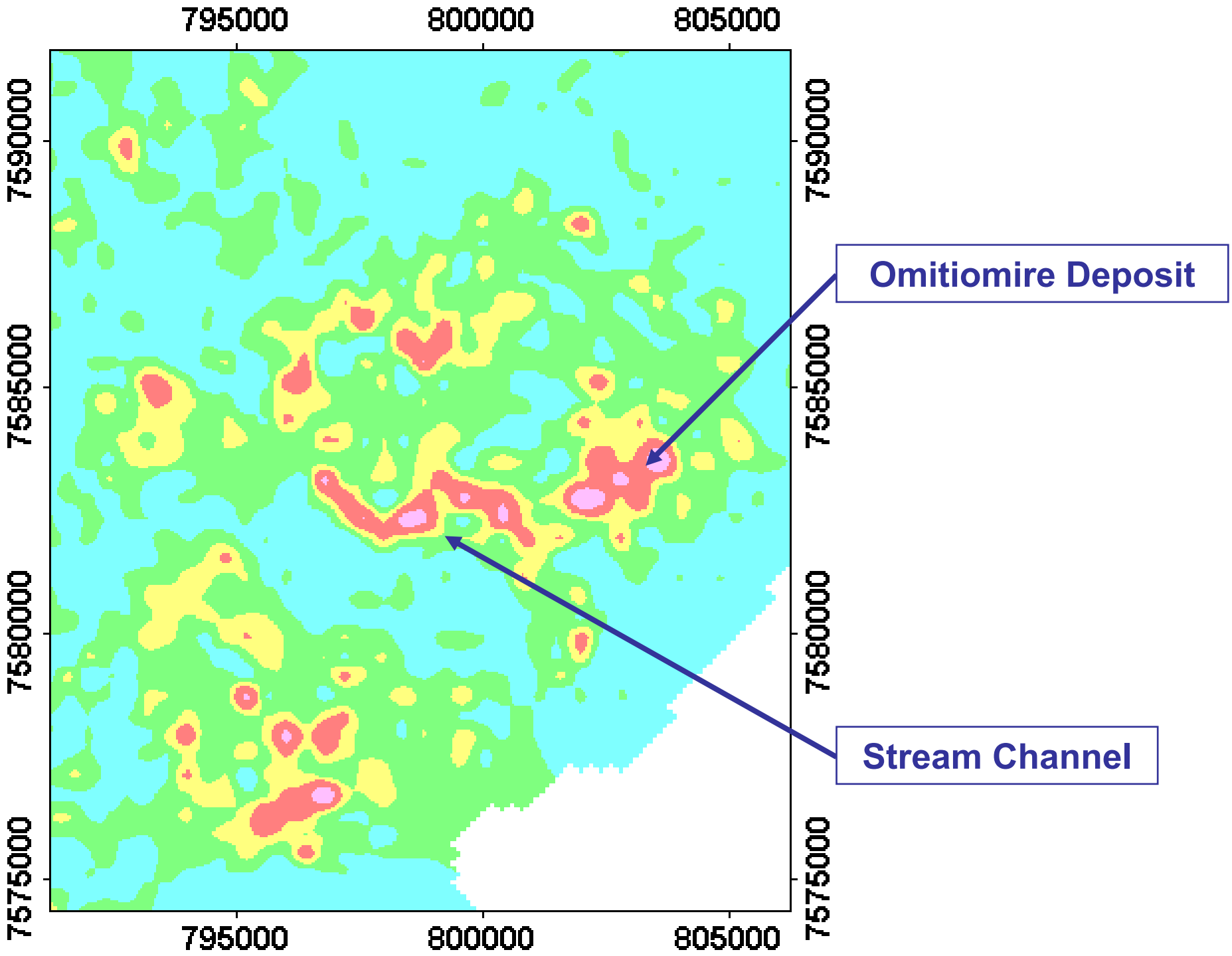
Follow-up of Anomalies

Anomalies are being followed up by RAB drilling

In most cases, elevated copper has been intersected

One hole intersected 11m at 0.9% Cu beneath 6m sand cover


Spurious anomalies - clay-rich
soils in pans & stream channels


795000
800000
805000
7590000
7585000
7580000
7575000
Omitiomire Deposit
Stream Channel

Cost Saving

- 22,000 soil samples taken in one year and analysed with one XRF instrument
- A multi-element package plus transport would cost about A$30 per sample, totalling A$660,000
- XRF costs are estimated at $3 per sample including instrument depreciation plus R&D testwork, totalling A$66,000

A big “thank-you” to our field team