# Pitney Bowes Software
# Encom Discover 3D & MapInfo Professional

A user experience: Pitney Bowes Software applications within a Gold exploration context

*By Dr Iúma Martinez*

*Presented on behalf of Dr Iúma Martinez by:*

*Chris Jenkins (Natural Resources PBS)*

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# Goldstone Resources – Background in Brief

GoldStone is an AIM listed exploration company with exploration skills that focus on gold in West and Central Africa. The company's projects are located in Ghana, Senegal and Gabon, and range from grassroots to advanced exploration.

The **Homase-Akrokerri** licenses are located near AngloGold Ashanti's Obuasi mine within the well mineralised Ashanti Gold Belt in Ghana where more than **seventy million ounces of gold** have been discovered.

The objective of exploration on the Homase-Akrokerri license areas is to find extensions of the known ore body along strike and below the presently known JORC compliant gold resource and to explore an area typified by intense artisanal mining in the Akrokerri license area. The combined JORC compliant gold resource for the Homase-Akrokerri project presently is 405,556 ounces at an average grade of 1.42 grams per tonne.

The **Manso Amenfi** joint venture complements the more advanced Homase-Akrokerri licences in Ghana. First results from a permit wide soil survey yielded several gold in soil anomalies, some of which are in excess of five kilometres long.

In Senegal the company holds the **Sangola** Permis de Recherche, which has never been explored by modern exploration methods. A permit wide termite mound sampling programme has identified 3 distinct and robust gold in soil anomalies.  All of these anomalies are associated with the gold-fertile MTZ structure which acts as a conduit for mineralising fluids and which is believed to be responsible for several gold discoveries further to the North East of the license area (for example the three million ounce Massawa gold deposit).

http://www.goldstoneresources.com/

# Goldstone Resources – Background in Brief

The Oyem and Ngoutou permits in Gabon (Central Africa) were granted during April 2011. Both permits contain robust gold in soil anomalies in excess of 15 kilometres length. Exploration has commenced on both permits. **Most of the examples in this presentation deal with the Homase-Akrokerri project and illustrate how the Discover software has helped guide the drilling programme.**

A photograph of the Homase Pit looking north, taken during 2009. The long axis of the pit measures approximately700 metres.

GoldStone presently drills inclined boreholes to test if higher grade mineralisation extends down dip below the pit and if it would be suitable to deeper open pit or underground mining.

# Goldstone Resources – Background in Brief

## Operating in the Ashanti Gold Belt

Regionally the Homase License is located within the well mineralised Ashanti Gold Belt where more than seventy million ounces of gold have been discovered.

Approximately 248 boreholes (excluding trenches and rip logs which account for another 138 logs) were drilled by previous explorers to quantify the continuous gold mineralisation along more than three kilometres strike length.

Some of the most significant intersects drilled range from 7.3 – 19.7 Au grade (g/t) (over a width of 6 to 7 m). The total gold resource is 6.32 million tonnes of ore at an average grade of 1.4 g/t gold, containing 282,608 ounces of gold.

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# Encom Discover & MapInfo Pro

## How does Goldstone use it?

- 3D fly-throughs for Gold and other mineral exploration projects
- Assay, lithology & other down hole data 3D views
- Drillhole-model intercepts in 3D (pierce points)
- Cross sections with assay histograms
- 3D long sections of supplied resource models
- Downhole compositioning, generating 3D coordinates
- Voronoi polygons for drill hole planning
- Contours from SRTM GDEM data
- Hydrological analysis on SRTM data (streams, sources, outlets) for soil sampling planning
- Maps for presentations
- Isosurfaces, wireframes and other visuals
- Basic MMI data processing and interpretation
- IP, VTEM, aeromagnetic, geology and  soil data overlays for sampling programs
- MMI data Response ratio calculations and plots

# Encom Discover & MapInfo Pro

## Position within the exploration project lifecycle

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**Early Stage Regional / Greenfields Exploration**

2D GIS platforms (**MapInfo & Encom Discover**).

Good image processing software (ERDAS/ ERMAPPER) may be a bonus for generating structurally enhanced imagery for target selection (kimberlites)

There is also a focus on geophysical data acquisition software (**PBS Encom Profile Analyst**).

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Plus 3rd Party Resource Estimation Software

**Mid Stage**

Holes being drilled, targets still being explored for, need for assay data management, true 3D GIS queries & geological modelling and possibly resource modelling**, (Mining and Resources Estimation based applications).**

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**Mid Stage**

Picking up large historical drillhole database, target well defined, resource models & other datasets need to be useable and presentable to investors, drillhole planning utilities critical **(MapInfo Pro & Encom Discover 3D**).

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**Late Stage**

Detailed mine planning , 3D CAD modelling (**Autodesk** and other mine design applications)

# Goldstone Resources sits in the mid phase

New targets are being explored for in Senegal, Gabon, Ghana but at the same time There is a well defined resource and historical database for Homase and Akrokerri.

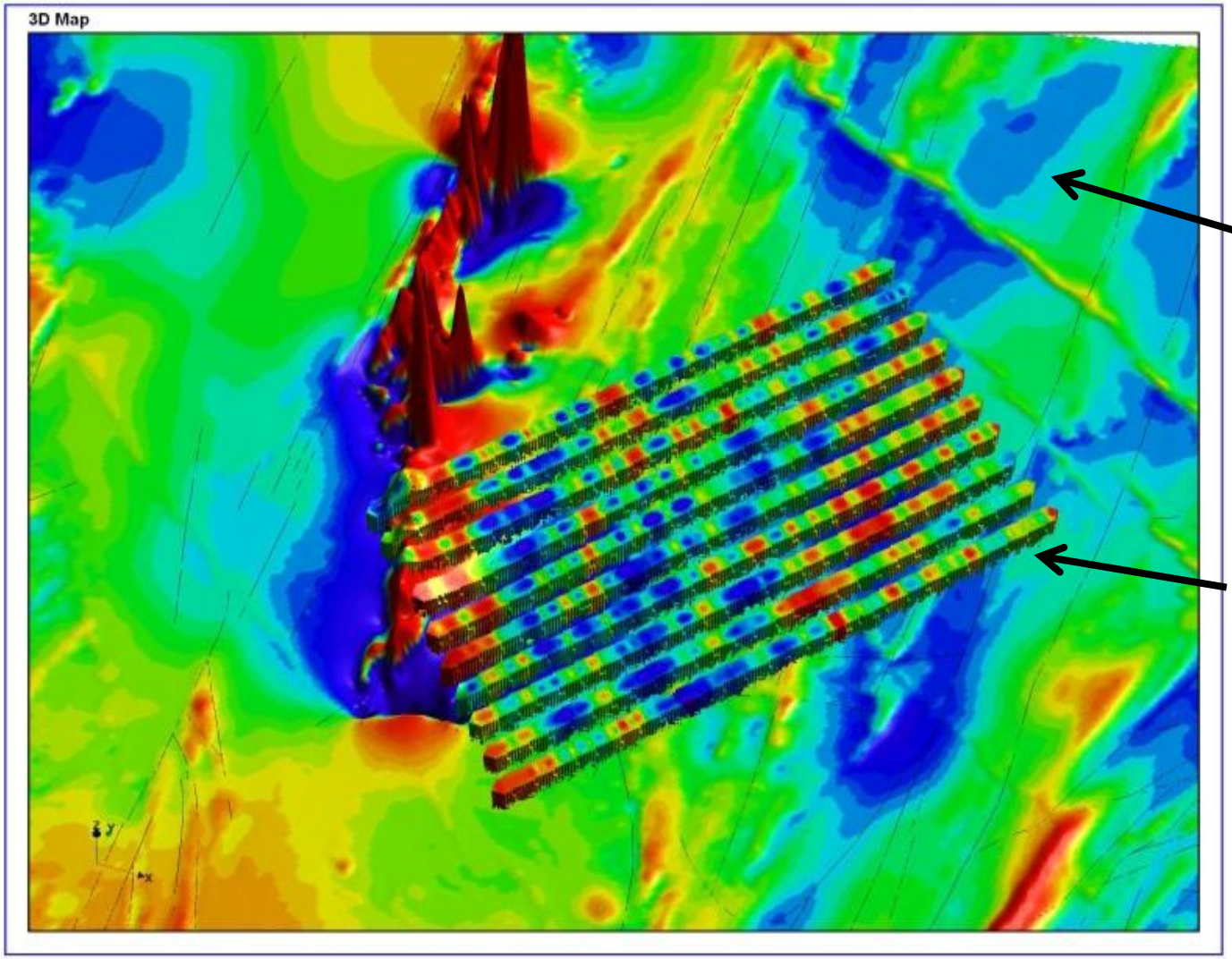
Resource modelling is done by contractors based on Datamine, so there is no critical need for true 3D modelling capabilities.

The need is rather for a software with a rapid turn around time for great drill hole planning sections and 3d visualization tools for generating presentation materials for investors.

Discover 3D meets these needs very well – better than most of higher end complex 3D GIS packages. At the same time it has analytical capabilities that are very useful for the drill hole planning process.

These include amongst others the down hole decomposition tool (for generating pierce points) and surface modelling utilities –which are particularly useful for generating pre and Post mining activity surfaces.

# Excellent platform for integrating aeromagentic data and VTEM voxel data




Aeromagnetic data

VTEM voxel data

(please note:
Not a Goldstone Resources example)

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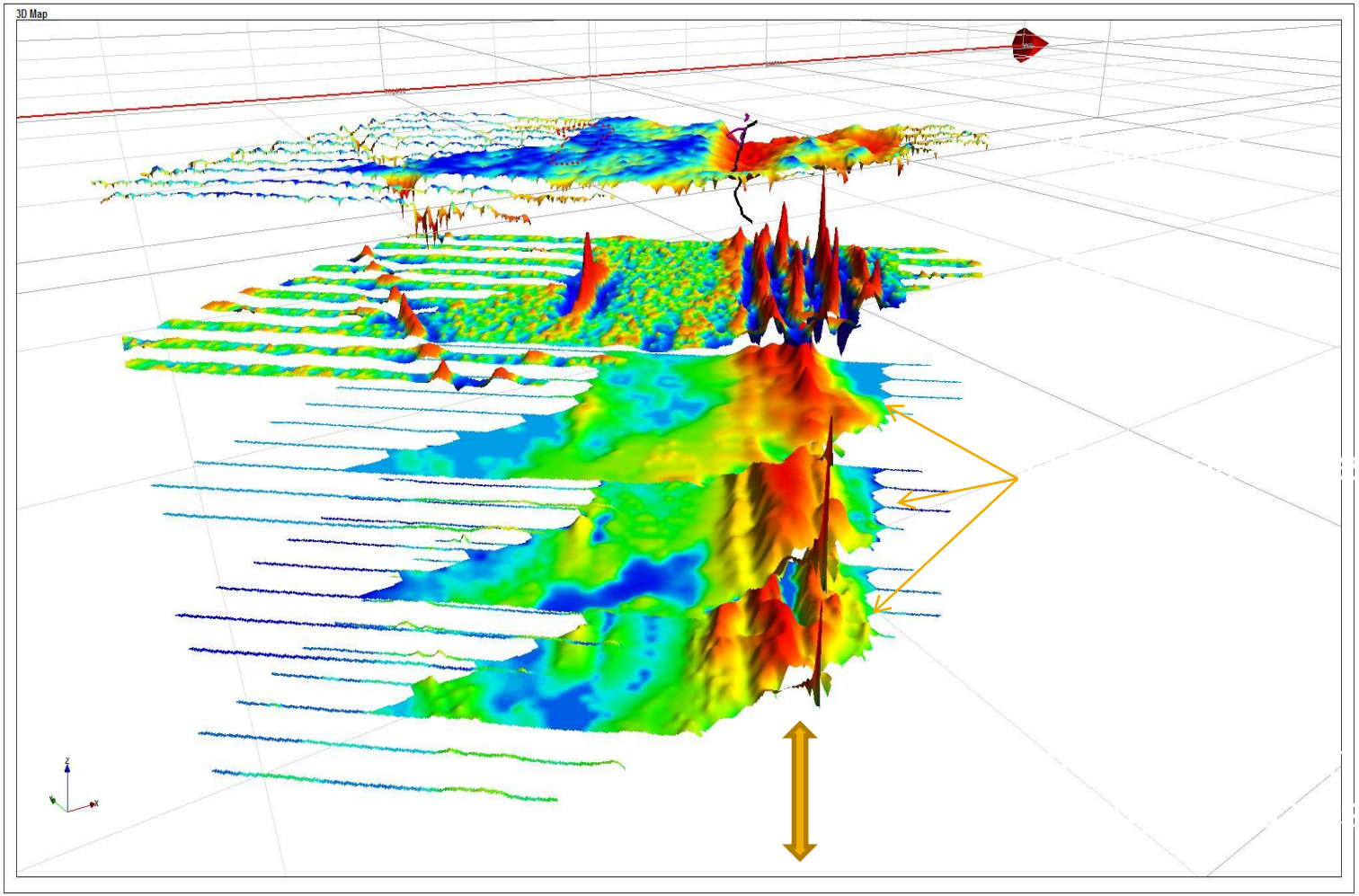
# Multiple geophysical data surfaces with overlapping anomalies (Homase)

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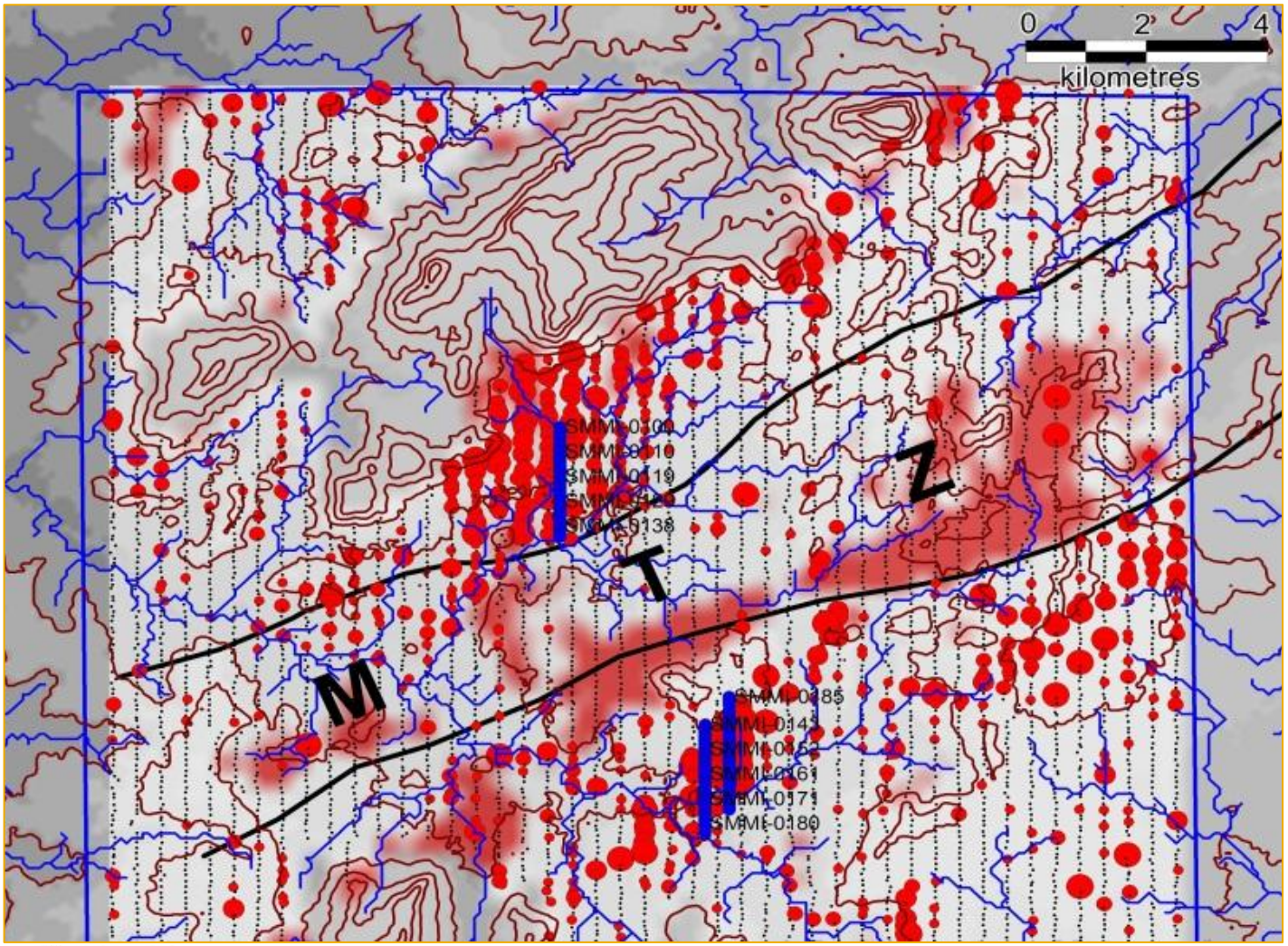
# Integrating soil geochemistry thematics with gridded soil geochemistry data




Graduated Au symbols (red) shown over gridded Ag data (greyscale/red image) and a topographic map.

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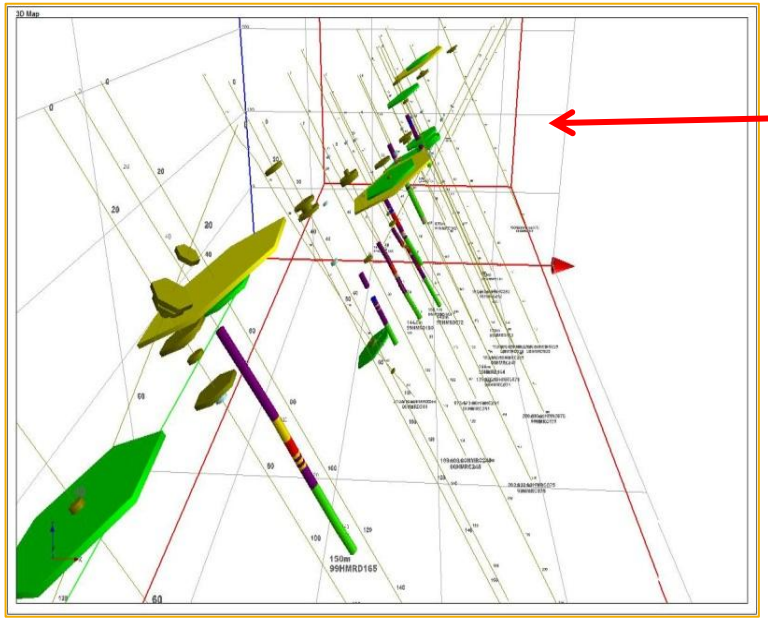
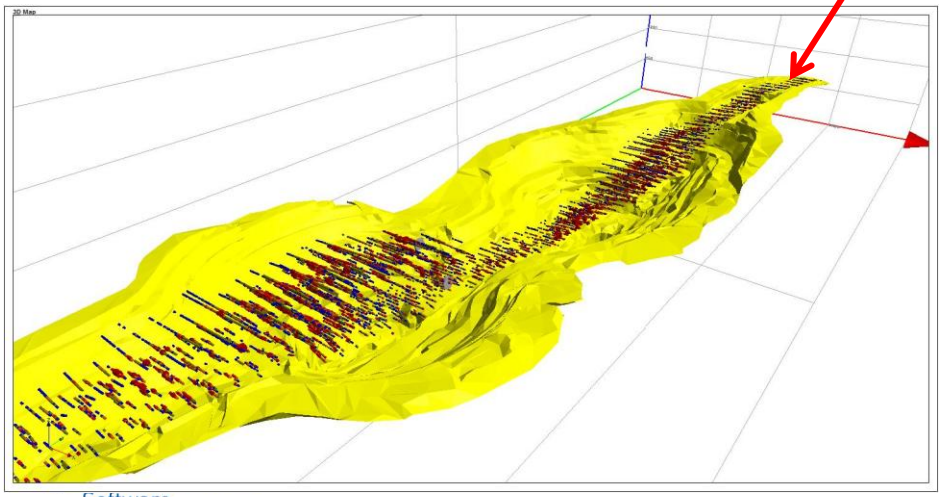
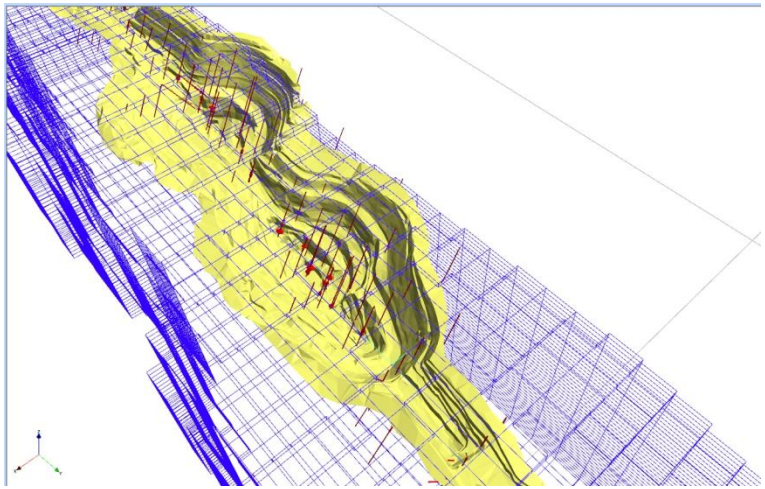
# Thematic display of Downhole data



Graduated assay data and lithological data

Rip log data





Software

# Fly through generation

During 2002 and 2003 AngloGold-Ashanti (“AGA”) extracted approximately 40,000 ounces of gold from two open pits.

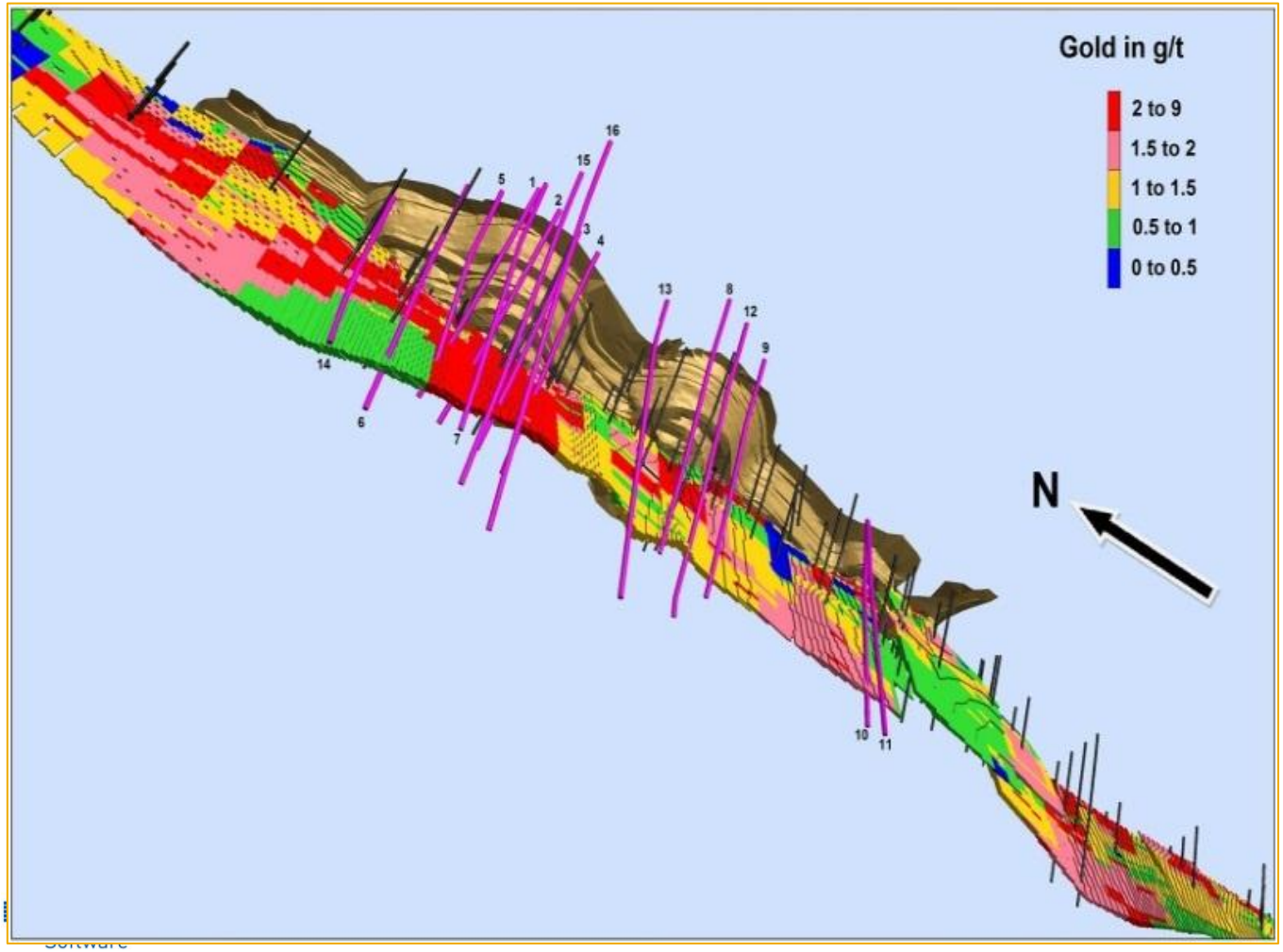
These pits and the pre-mining drill holes and associated assays are depicted in the Discover™ 3D fly through as one flies first beneath the ore body and then above ground north eastwards along the ore body. The fly through highlights the undepleted resource wire frame (orange), the drill hole traces and associated assays (size modulated by Au in ppm) and the pit morphologies.

The resource model clearly shows how the mineralisation in the Homase Pits area extends below the pits and the down dip exploration potential.

Existing TAB files, datasets and flight paths can also be used. Flight controls such as pause, hover and rotation above a point can be applied to the path and a wide range of compressed AVI formats can be exported including amongst others the MPEG-4 Codec.

# 3D long sections of model based on assay data

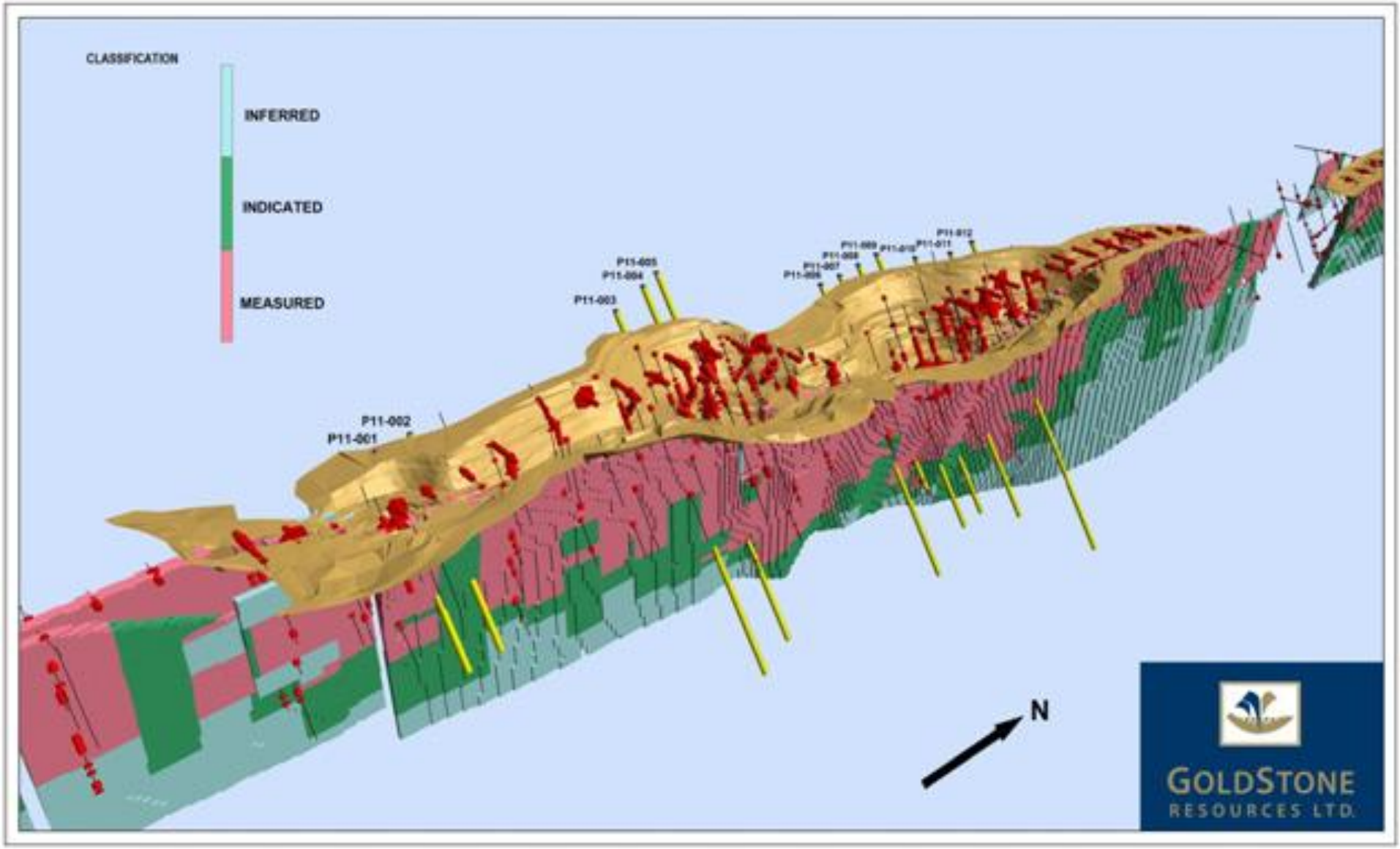
A 3D model of the Homase open pit and the gold resource. The highest grade ore blocks are shown in red, while lower grade ore blocks are shown in “cooler” colours. Boreholes planned to test the down-dip extent of the high grade ore shoots are shown in yellow on the next slide.




The resource model clearly shows how the mineralisation in the Homase Pits area extends below the pits and the down dip exploration potential.

Discover 3D and the Drill hole module are fundamental to the Goldstone Resources drilling programmes

A 3D model of the Homase open pit and the gold resource. The ore blocks that could be estimated with the highest confidence (measured category) are shown in pink.



# Creation of pre- and post-mining surfaces

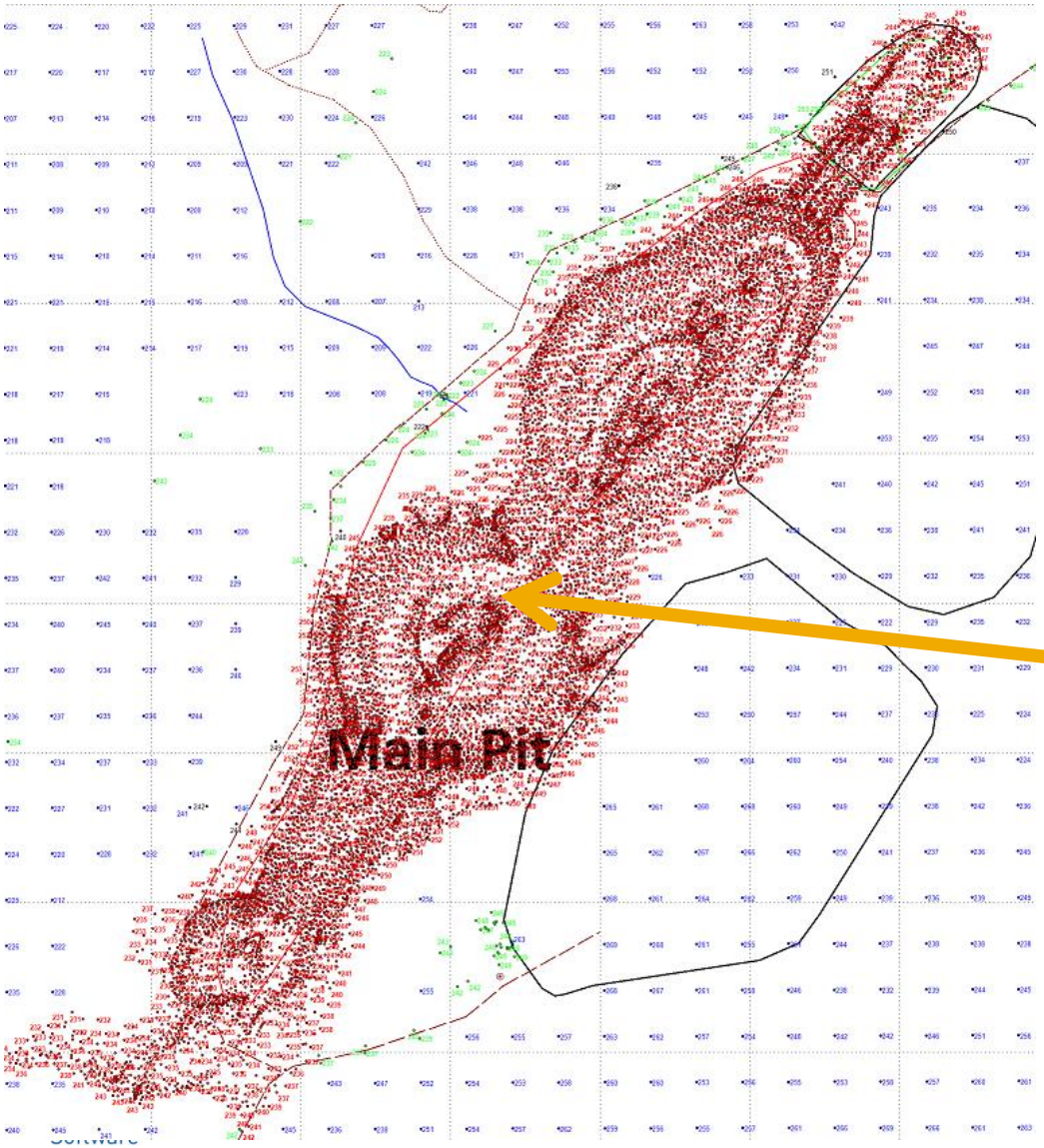
Pre- and post-mining surfaces can be generated by overlaying, editing and merging various point datasets that document the mining surface through time.

For example the post-mining surface may be created through a combination :

- Aster GDEM data
- Surveyed pit data
- Historical drill hole data
- Recent survey data

Pre- and post-mining surfaces are important when it comes to assessing the expected /remaining resource. While a resource model may be generated from the historical and current data it needs to be “truncated” with reference to the post-mining surface in order that true remaining resource estimates may be determined

# Creation of pre- and post-mining surfaces




Several point datasets

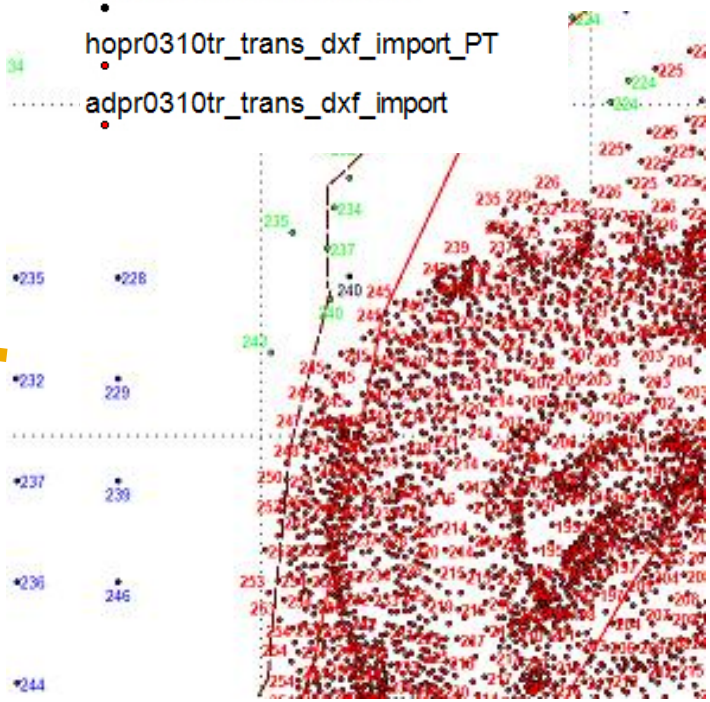
XYASTGTM2_wgsGCS_outside_pit

Calibrated_aseidu_outside_pit

historical_utm_outside_pit

hopr0310tr_trans_dxf_import_PT

adpr0310tr_trans_dxf_import



# Creation of pre- and post-mining surfaces

What the Google Earth image of the pits look like in 2D:

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# Creation of pre- and post-mining surfaces

What the Google Earth DTM of the pits look like in 3D with GE DTM applied

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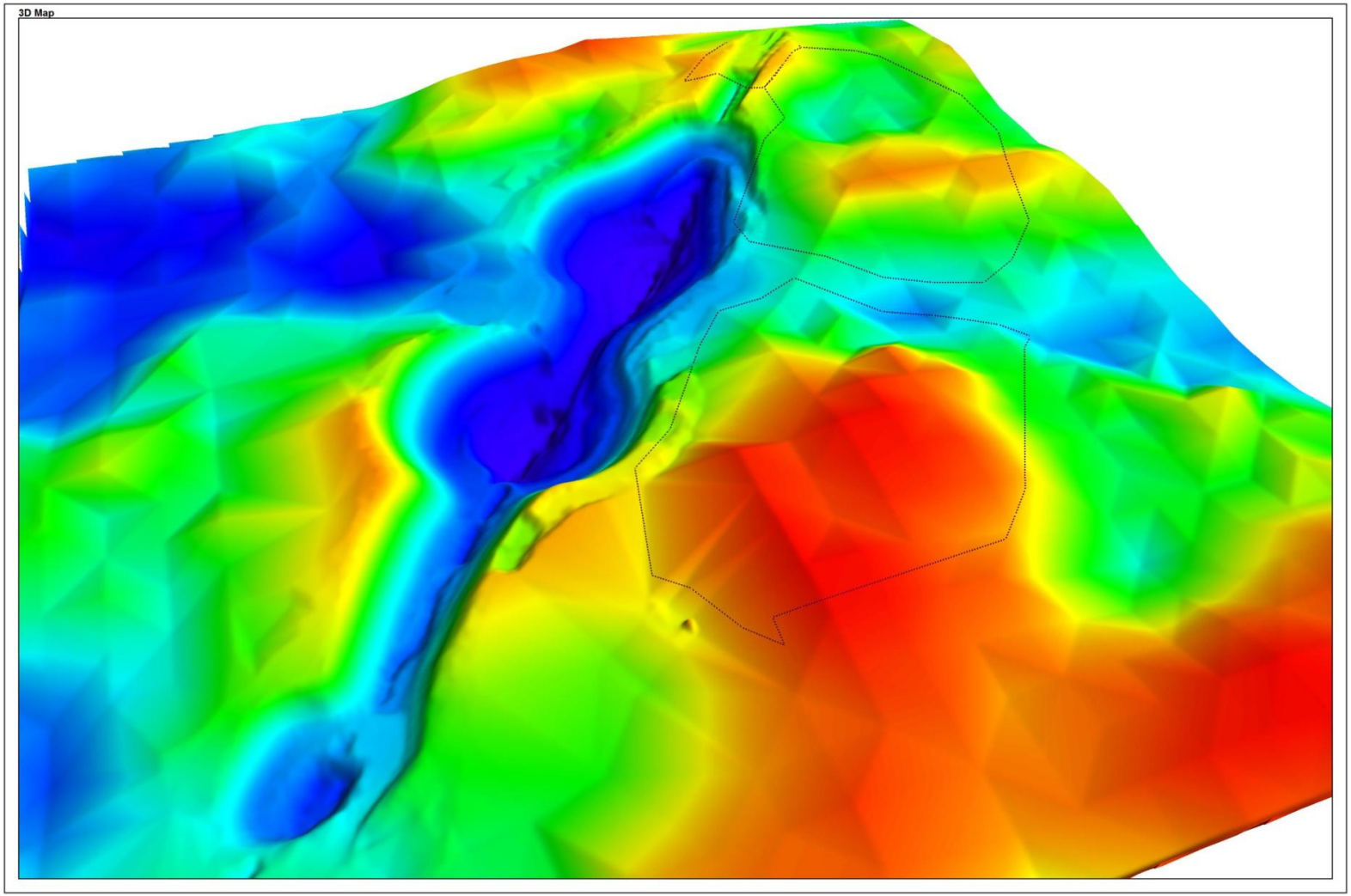
# What the post-mining DTM looks like in Discover 3D:

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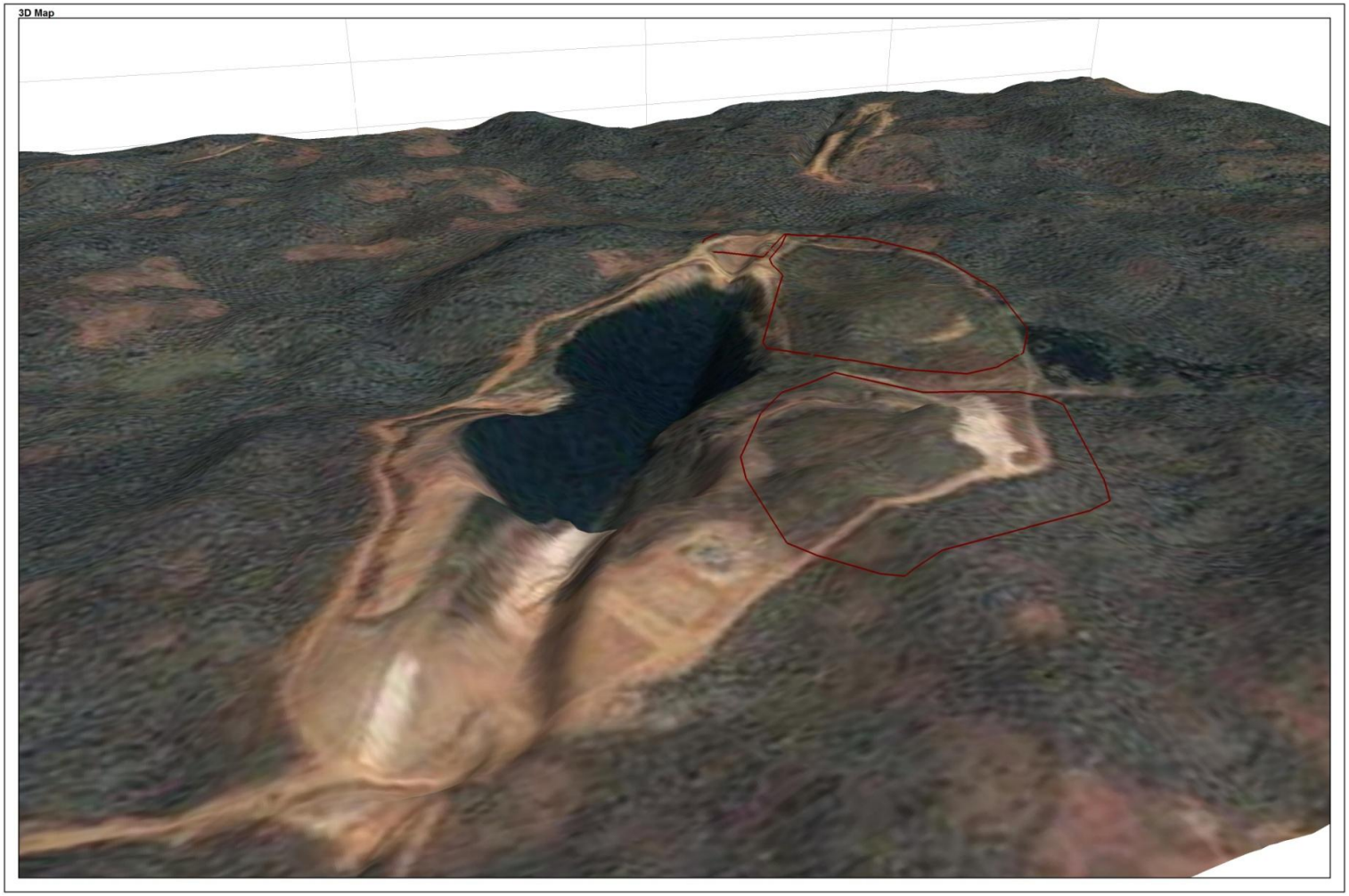
# 2D GE image draped on post-mining DTM in Discover 3D

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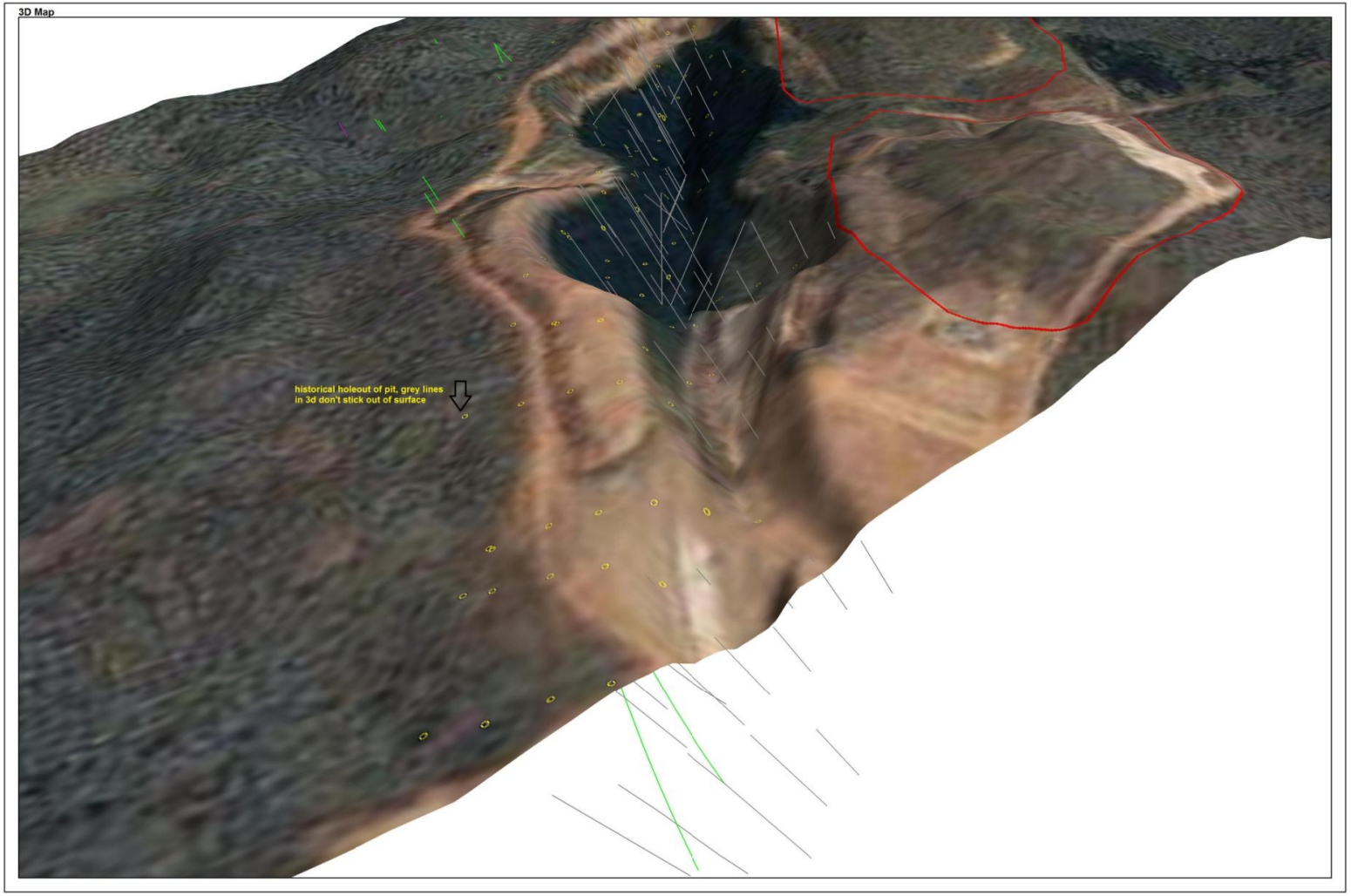
# QAQC of the surface using the drill hole database in Discover 3D

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# Hydrology analysis tools

JunctionType

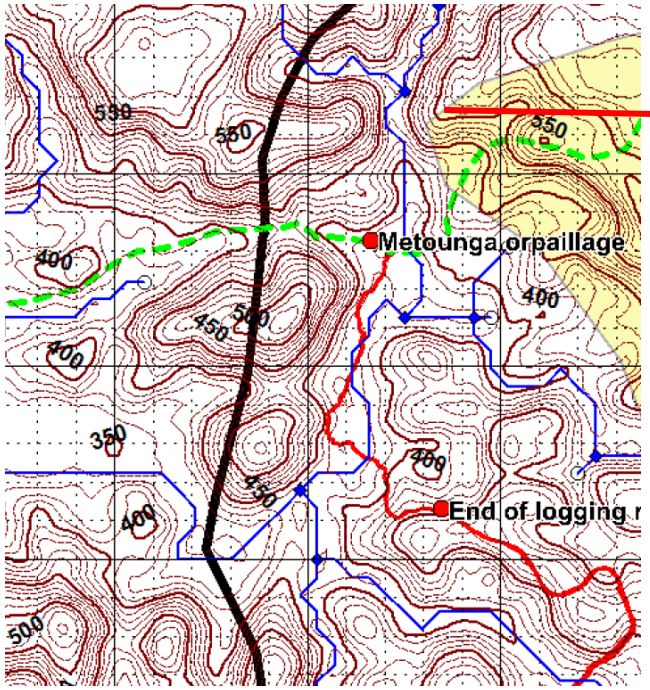
- Outlet
- Source
- Stream Confluence

Stream

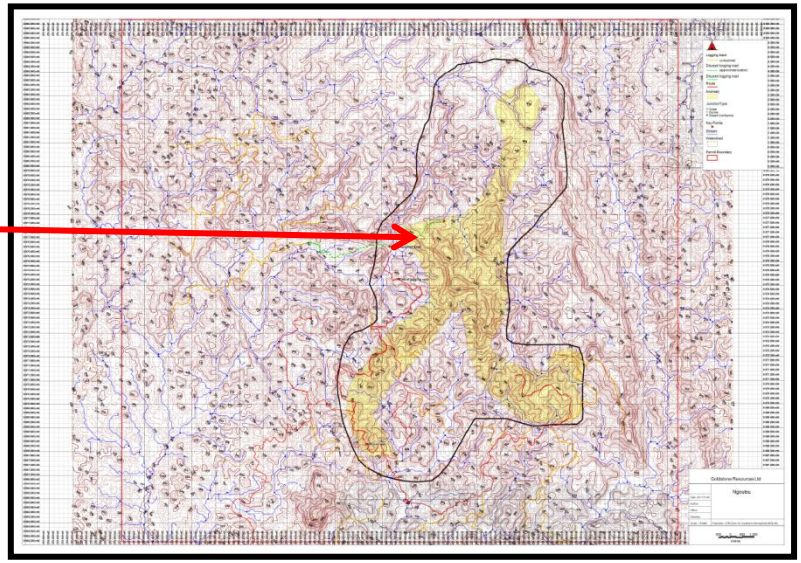
Watershed

Such maps can help in planning stream sediment and other geochemical surface sampling programs.

They may also provide insight into understanding observed soil anomalies and dispersion patterns, and aid identifying primary mineral sources.




Logging track
(unexplored)
Disused looging road
(approximate location)
Disused logging road
Route
Anomaly
JunctionType
Outlet
Source
Stream Confluence
Key Points
Stream
Watershed
Permit Boundary



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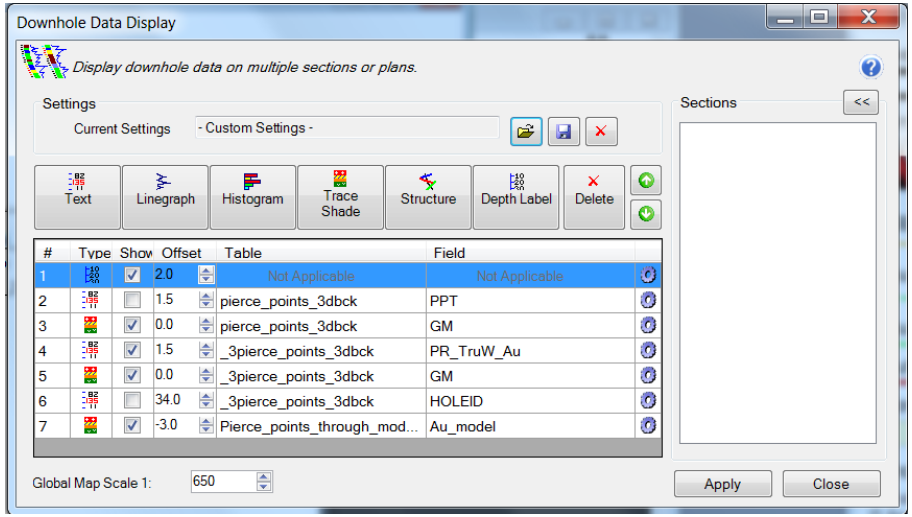
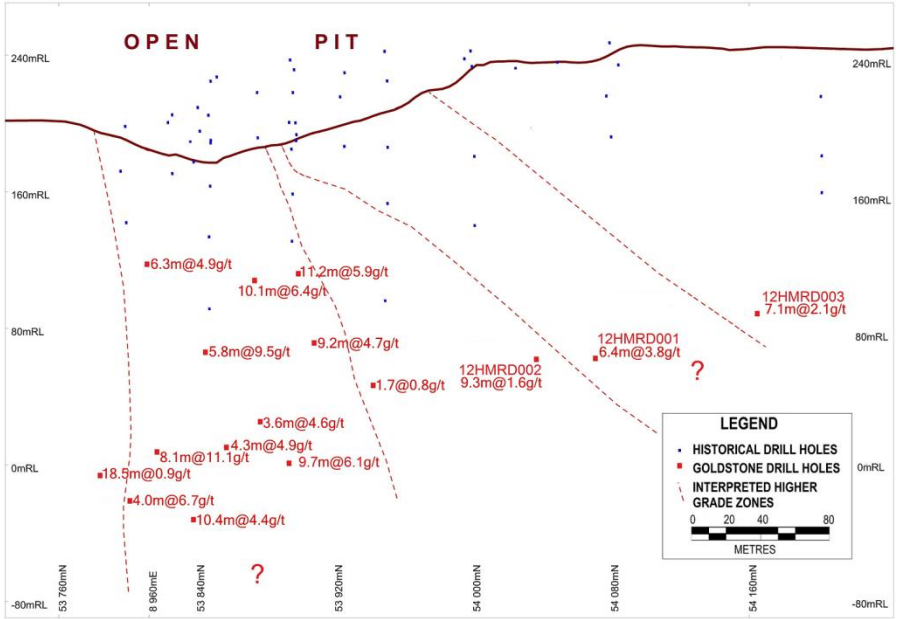
# Displaying down hole data




Display down hole data is a very useful tool for generating a variety of Section types.

Tracks can be set to reference assay data , pierce points or other types of Down hole datasets.




Compared to other high end platforms with superior 3d capabilities (e.g. GOCAD) this is the kind of tool which is far more versatile in the Discover Environment.

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# Dr Uma Martinez' Comments

•Excellent platform for integrating aeromagentic data and VTEM voxel data
While other packages such as GOCAD and SURPAC require some data manipulation to integrate VTEM and other geophysical grid data, Discover 3D facilitates rapid and easy integration of these data types

•Multiple surfaces may be stacked and displayed in 3D so as to highlight overlapping anomalies across various geophysical and other datasets

•Graduated symbology and legend editor tools enable huge drill hole datasets to be displayed clearly in 3D when thematized by assay values and lithology (other packages are often not as versatile in this respect)

•The Discover3D Fly through creation wizard enables one to capture X, Y, Z coordinates for the flight path by manually moving around in the view and capturing eye / look locations.

•The Discover 3D software enables relationships between the resource model and borehole data to be critically examined and used to plan future boreholes

•The surface module and 2D thematic  mapping tools are particularly useful for gridding soil geochemistry, termite mound and MMI data – useful features for planning soil sampling programs.

# Thank you for listening

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# Acknowledgements:

Dr Hendrik Schloeman (Head of Exploration, Goldstone Resources) and Mr Jurie Wessels (CEO, Goldstone Resources) are gratefully acknowledged for permitting me to include the information presented here.

Further Information:
The GIS applications discussed in this presentation have been generated for Goldstone Resources by Giscapetown (cc). For further information on kimberlite exploration applications, structurally enhanced images or similar software support services please see /contact:

http://www.giscapetown.com/

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