

*Снижение рисков, увеличение капитализации, обеспечение будущего.  
Мировой опыт компании Geotech.*



*А.Ю.Приходько,  
к.г.-м.н., P.Geo*

- О системах VTEM и ZTEM. Принципы и основные отличия;
- Влияние аэроЭМ съемок на увеличение капитализации юниорского сектора (Швеция, Канада, Австралия, Панама)
- Результаты и примеры VTEM и ZTEM съёмок при поисках золоторудных систем и месторождений





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### Copper Reef Mining Corporation - Undrilled Albert Lake Mega-VTEM ...

[www.copperreefmining.com/s/undrilled-albert-lake.asp](http://www.copperreefmining.com/s/undrilled-albert-lake.asp)

New VTEM 35 Airborne Electro-Magnetic (VTEM) geophysical surveys have ... It takes 3 years to build a mine to a discovery soon will make all the difference.

### Western Athabasca Syndicate Completes VTEM and Radiometric ...

[www.athabascauclear.com/.../western-athabasca-syndicate-completes-vtem-and-radiom...](http://www.athabascauclear.com/.../western-athabasca-syndicate-completes-vtem-and-radiom...)

Aug 8, 2013 - Western Athabasca Syndicate Completes VTEM and Radiometric ... At Fission and Alpha's PLS high-grade discovery it is interpreted that the ...

### Troymet Completes VTEM Survey on Mc... | Troymet Exploration Corp.

<https://www.troymet.com/.../troymet-completes-vtem-survey-on-mcclarty-lake-vms-p...>

Mar 5, 2008 - Troymet Completes VTEM Survey on McClarty Lake VMS Property ... VMS discovery will also test any new targets identified by the VTEM ...

### <sup>[PDF]</sup> to read the Case Study - Crone Geophysics & Exploration Ltd.

[www.cronegeophysics.com/.../Albany-Graphite-Air-Ground-TEM\\_Expanded\\_abstract...](http://www.cronegeophysics.com/.../Albany-Graphite-Air-Ground-TEM_Expanded_abstract...)

The Albany Graphite Discovery – Airborne and Ground Time-Domain EM. Jean M. ... led to the 2010. VTEM survey and the discovery of extensive graphite min- ...

### BASE METAL DISCOVERIES IN AFRICA AND AUSTRALIA FROM ...

[www.publish.csiro.au/?act=view\\_file&file\\_id=ASEG2009ab064.pdf](http://www.publish.csiro.au/?act=view_file&file_id=ASEG2009ab064.pdf)

by M Combrinck - Cited by 1 - Related articles

airborne TDEM data acquired with the VTEM system has led to the discovery of a number ... as well as a discovery in Zambia for Zambezi Resources Limited.

### Xmet Receives Favourable Results from VTEM Survey at ... - XMET INC.

[xmet.ca/english/news/Xmet\\_NR\\_7a\\_2013\\_\\_2013%2011%2027.pdf](http://xmet.ca/english/news/Xmet_NR_7a_2013__2013%2011%2027.pdf)

Nov 27, 2013 - Xmet Receives Favourable Results from VTEM Survey at Blackflake. Project Near Zenyatta's Albany Graphite Discovery. Toronto, Ontario ...

### Detour Quebec | Our properties | Adventure Gold

[www.adventure-gold.com/our-properties/detour-quebec](http://www.adventure-gold.com/our-properties/detour-quebec)

The VTEM-type survey is known for its exceptional depth penetration and recall that the original discovery of the main zone at the Detour Lake mine, is directly ...

### Rogue Resources Inc. - News - Drilling Towards Deep-Seated VTEM ...

[www.roguerresources.ca/s/news.asp?ReportID=503087](http://www.roguerresources.ca/s/news.asp?ReportID=503087)

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### GoldQuest Commences ZTEM Airborne Survey of the Tiroo ...

[www.marketwatch.com/.../goldquest-commences-ztem-airborne-survey-of-the-tiroo-con...](http://www.marketwatch.com/.../goldquest-commences-ztem-airborne-survey-of-the-tiroo-con...)

Feb 14, 2014 - Shows the extent of the ZTEM survey, surrounding our Romero discovery where the maiden technical report describing a multi million ounce ...

### <sup>[PDF]</sup> Large-scale inversion of ZTEM data - UBC Geophysical Inversion Fa...

[gif.eos.ubc.ca/sites/default/files/HolthamOldenburg12.pdf](http://gif.eos.ubc.ca/sites/default/files/HolthamOldenburg12.pdf)

by E Holtham - 2012 - Cited by 4 - Related articles

A Z-Axis Tipper Electromagnetic Technique (ZTEM) survey is an airborne ... been discovered, many of the earth's remaining natural resources are buried deep ...

### New Concepts and Discoveries: Geological Society of Nevada 2015 ...

<https://books.google.ca/books?isbn=1605952265>

William M. Pennell , Larry J. Garside - 2015 - Science

Legault, J.M., Zhao, S., Bourmas, N., Plastow, G., and Kearvell, G., 2014, Helicopter AFMAG (ZTEM) and aeromagnetic survey results over epithermal gold and ...

### Superior Copper Announces Staking of New Claims at the ...

[www.superiorcopper.ca/.../149-superior-copper-announces-staking-of-new-claims-at-...](http://www.superiorcopper.ca/.../149-superior-copper-announces-staking-of-new-claims-at-...)

Superior Copper has commissioned Geotech Ltd. to fly an airborne ZTEM ... the Tamarack discovery in Minnesota (9 mT of 1% nickel and 0.7% copper, the ...

### register for the UGM - Geosoft

[ww2.geosoft.com/SPE-2016-01-26-GNA-RoundupUGM\\_UGMRegistrationPage.html](http://ww2.geosoft.com/SPE-2016-01-26-GNA-RoundupUGM_UGMRegistrationPage.html)

Jan 26, 2016 - The Balboa porphyry copper ZTEM discovery. Jean Legault - Chief Geophysicist (Interpretation), Geotech Ltd. Jean will illustrate the steps that ...

### Rockcliff Completes ZTEM Survey at Snow Lake Project, Preliminary ...

[www.newswire.ca/.../rockcliff-completes-ztem-survey-at-snow-lake-project-prelimina...](http://www.newswire.ca/.../rockcliff-completes-ztem-survey-at-snow-lake-project-prelimina...)

December 02, 2009- Rockcliff Completes ZTEM Survey at Snow Lake Project, ... resource exploration company focused on discovery and advancement of its ...

### <sup>[PDF]</sup> An overview of the ZTEM and AirMt airborne ... - TechnoImaging

[www.technoimaging.com/publications/ZTEM-Preview.pdf](http://www.technoimaging.com/publications/ZTEM-Preview.pdf)

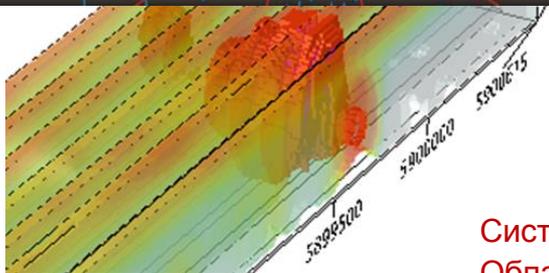
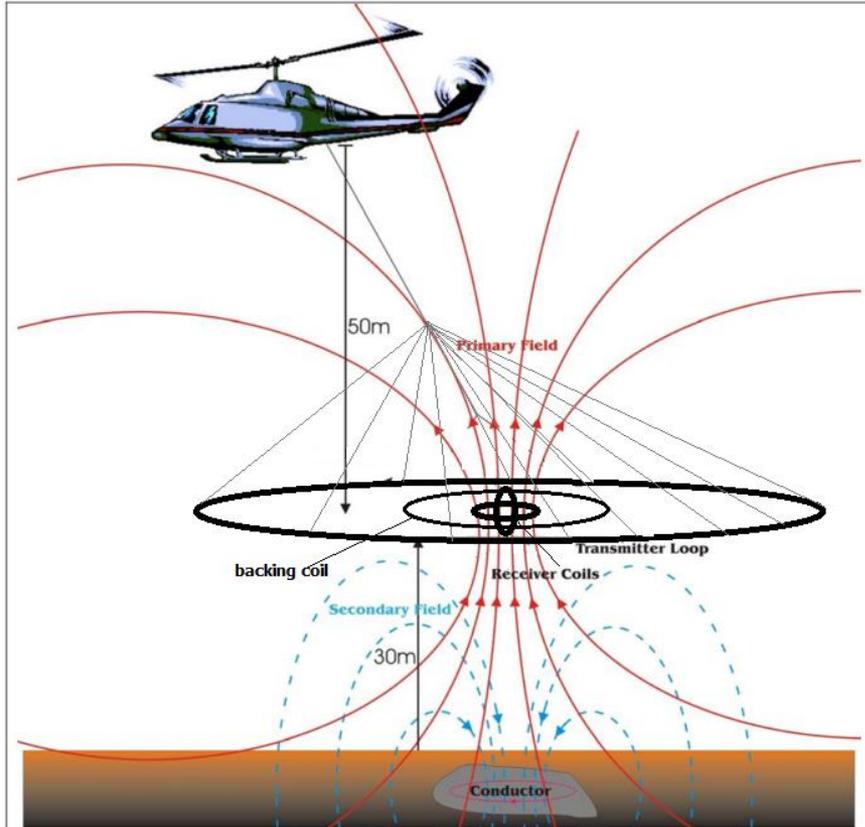
by J Legault - 2012 - Cited by 15 - Related articles

Jun 2, 2012 - wide consensus on the need to increase the 'discovery space' by exploring ... Z-axis Tipper Electromagnetic (ZTEM) and Airborne Magnetic.

VTEM система относится к методу переходных процессов. Имеет самое лучшее соотношение сигнал/шум при высоком дипольном моменте (от 400 тыс до 1.5 млн NIA)

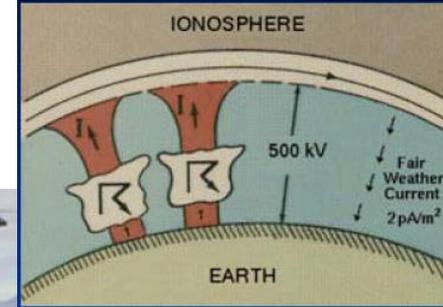
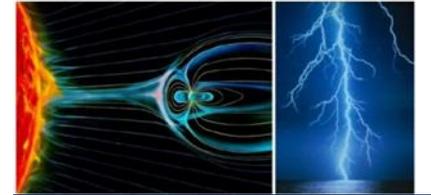
# VTEM

Всего проведено съемок около 3 000 000 пог.км



# ZTEM

Всего проведено съемок около 500 000 пог. км



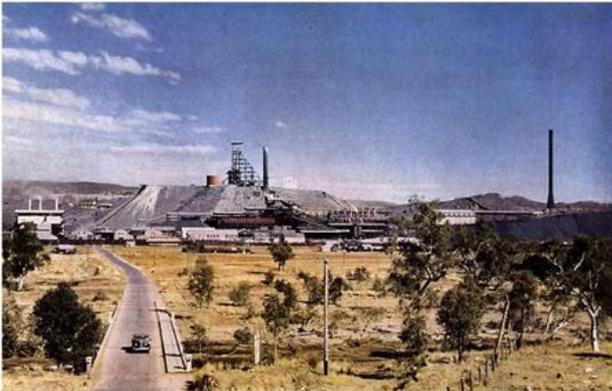
Система ZTEM – магнитовариационный метод из области аудиоманнитотеллурики. Обладает максимальной глубиной исследований из всех аэроЭМ систем и технологий

**VTEM**

# SWEDEN



**MINERAL, MINING SECTOR  
INVESTMENT AND BUSINESS GUIDE**  
VOLUME 1  
STRATEGIC INFORMATION AND REGULATIONS



International Business Publications, USA  
Washington DC, USA - Sweden

## METALS

**Copper.**—Avalon Minerals Ltd. of Australia acquired the Adak and the Viscaria copper projects from Phelps Dodge Exploration Sweden AB, which was a wholly owned subsidiary of Freeport-McMoran Copper and Gold Inc. of the United States, in 2008. The Adak project contained four historical mines—the Adak, the Brannmyran, the Lindskold, and the Rudtjebacken—and is located in the Skelleftea mining district of northern Sweden. Avalon Resources was interested in Adak because of the exploration potential surrounding the existing mines and at depth, and because of its strategic location within trucking distance of existing concentration facilities. Avalon Resources considered Adak to be a promising brownfields project in an active mining district. A 600-kilometer (km)-line airborne detailed versatile time domain electromagnetic (VTEM)

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For additional analytical, business and investment opportunities information,  
please contact Global Investment & Business Center, USA  
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- 46 -

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geophysical survey was completed in 2009. The VTEM data were being interpreted by Southern Geosciences Consultants (SGC) of Australia with the aim of generating exploratory resource drilling targets (Avalon Minerals Ltd., 2009a).

The historic Viscaria Mine is located 4 km from Luossavaara-Kiirunavaara AB's (LKAB) Kiruna Mine in the Norrbotten area of northern Sweden. Avalon acquired the exploration licenses for the Viscaria deposit. Avalon's regional exploration area covered conductive target zones identified from historical airborne electromagnetic (EM) data for 111 square kilometers of prospective ground. SGC was reprocessing the EM data to identify the conductivity features to drill. Avalon's aim was to delineate sufficient resources at Viscaria to sustain a return to copper mining operations by 2012. Avalon announced a phase 1 scenario for Viscaria whereby a 300,000-metric-ton (t) plant would process ore grading 3% copper to produce 36,000 t of copper concentrate grading 25% copper for a copper content of 9,000 t. The capital cost was estimated to be \$30 million (Avalon Minerals Ltd., 2009c).

Стоимостъ акции



**VTEM**

**Investment Highlights**

- Situated in one of the most productive mining regions with a centralized and well-developed mining infrastructure
- 43-101 released May 2013; recommendation to define the Rocky Lake VMS Project as an economic mineral resource
- Work permits obtained for a two phase drilling program planned for 2013-2014 exploration season
- Massive sulphide mineralization with visible chalcopyrite confirmed on the main Rocky Lake target
- Massive sulphide mineralization confirmed on 3 additional Geotech VTEM targets
- 41 new targets identified through additional Geotech VTEM surveys
- New discoveries: Potential for additional discoveries at Rocky Lake, Namew Lake , Mugaha, and Carrot River

*This document contains forward-looking statements that are subject to a number of known and unknown risks, uncertainties, and other factors that may cause actual results to differ materially from those anticipated. Factors that could cause such differences include uncertainties inherent to geological interpretations, changes in world gold and equity markets, the cost and supply of materials and regulations affecting the mining industry, etc. Although we believe the expectations reflected in our forward-looking statements are reasonable, results may vary and we cannot guarantee future results, levels of activity or the achievement of stated goals.*

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First Quantum Minerals Limited (TSE:FM)

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- Shares Issue
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- Shares Fully
- Market Cap
- Shares Held & Directors

**8.56 +0.33 (4.01%)**

Delayed: 12:39PM EDT  
TSE data delayed by 15 mins - Disclaimer  
Currency in CAD

Range 8.32 - 8.60  
52 week 2.15 - 18.56  
Open 8.54  
Vol / Avg 3.57M/8.63M  
Mkt cap 5.56B  
P/E -

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S&P TSX 14,073.13 0.86%  
FM 8.56 4.01%

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**Стоимость акции**



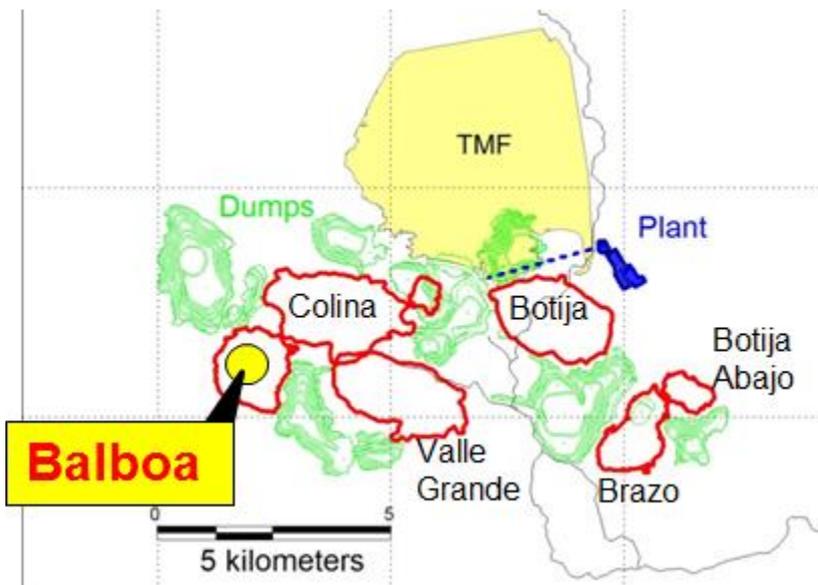
**Quantum Minerals Corp.  
Канада, Манитоба, (2014)**

# ZTEM

Открытие медно-порфирового месторождения Balboa, в районе где проводилось множество предшествующих работ включая бурение.

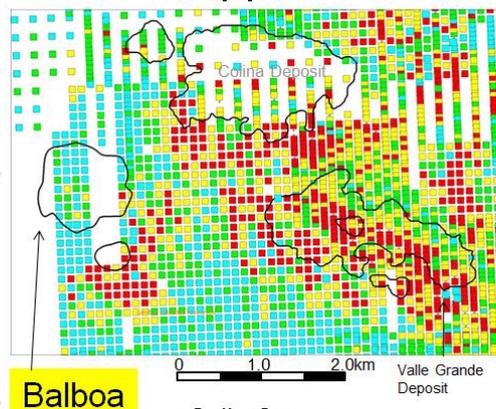
2,1 млрд тонн 0,41% Cu

First Quantum Minerals Ltd.  
Панама, (2010)



## Soil Anomalies

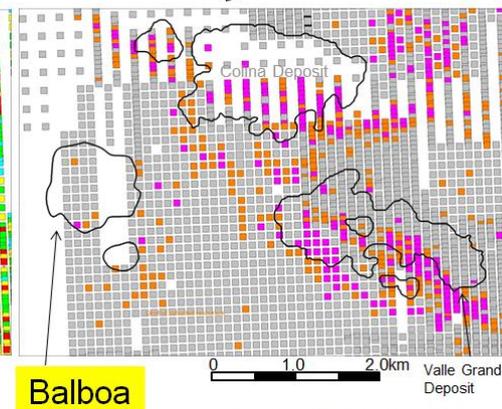
### Copper



Soil - Cu ppm

- 400-1,000
- 200-400
- 100-200
- <100

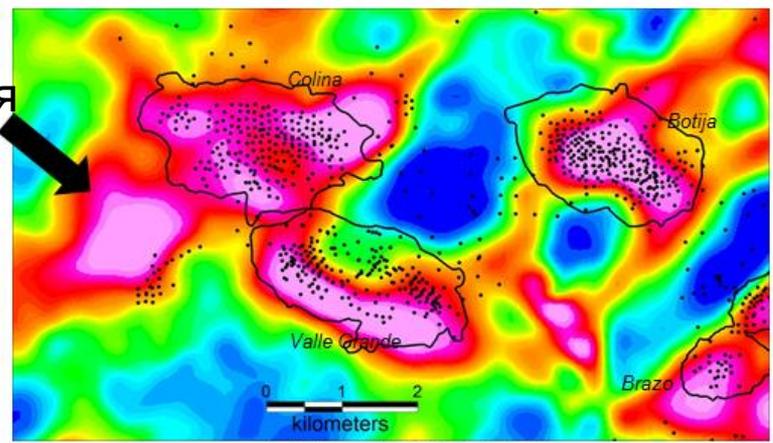
### Molybdenum



Soil - Mo ppm

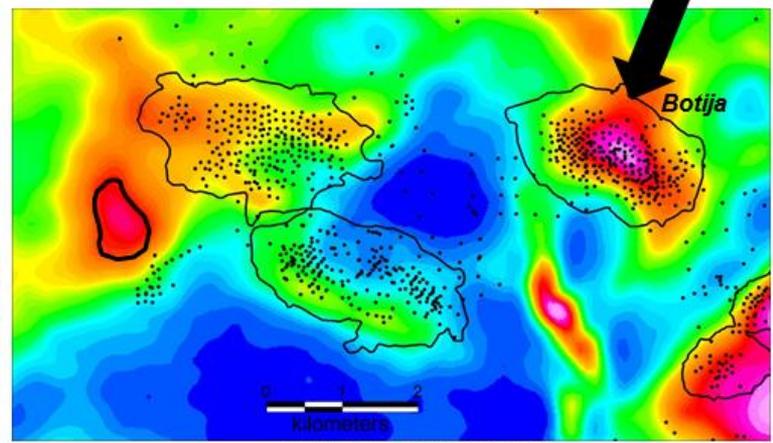
- >50
- 20-50
- <20

Аномалия  
Balboa



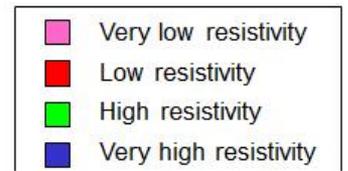
360Hz Total Phase Rotated In-phase

**SHALLOW**

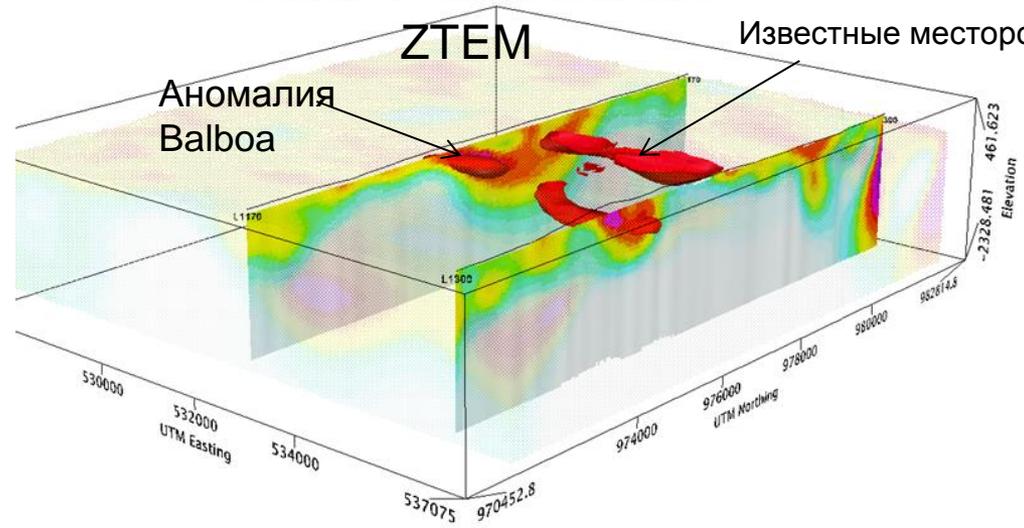


45Hz Total Phase Rotated In-phase

**DEEP**



**Balboa – 3D Inversion Results**



## Стоимость акции

First Quantum Minerals Limited (TSE:FM)



## Fox Resources Ltd. Западная Австралия (2006)

### VTEM opening up the Pilbara

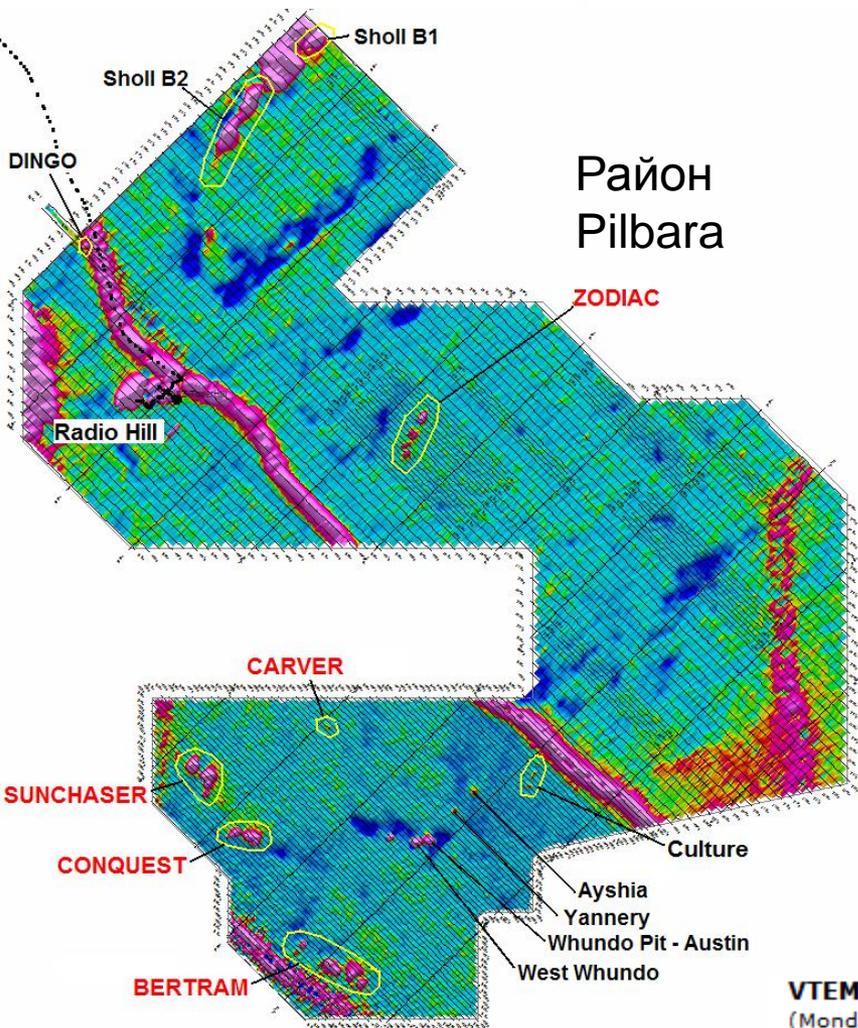
Tuesday, 10 October 2006  
Michael Vaughan

THE results of a recent Geotech versatile time-domain electromagnetic (VTEM) geophysical survey on Fox Resources' ground in the Pilbara has set the company up with "two or three years" of work and could be the turning point in the recognition of the Pilbara as a base metals province in Australia.

### VTEM creating its own Legend

(Monday, 4 December 2006)

LEGEND Mining has discovered six new base metal targets on its Pilbara tenements after a Geotech versatile time-domain electromagnetic (VTEM) survey, giving more support to the theory that VTEM could open up the Pilbara as a new base metals province.  
[Full Story...](#)



Карта VTEM аномалий

Fox Resources Limited (ASX:FXR)

Compare:    S&P/ASX 200  INL  HWE  MLD  MAS  CGM  AJM  MIN  PLS

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Zoom: [1m](#) [3m](#) [6m](#) [YTD](#) [1y](#) [5y](#) [10y](#) [All](#)

May 12, 2006 - Dec 29, 2006 +0.78 (75.61%)

## VTEM opening up the Pilbara

Tuesday, 10 October 2006

Michael Vaughan

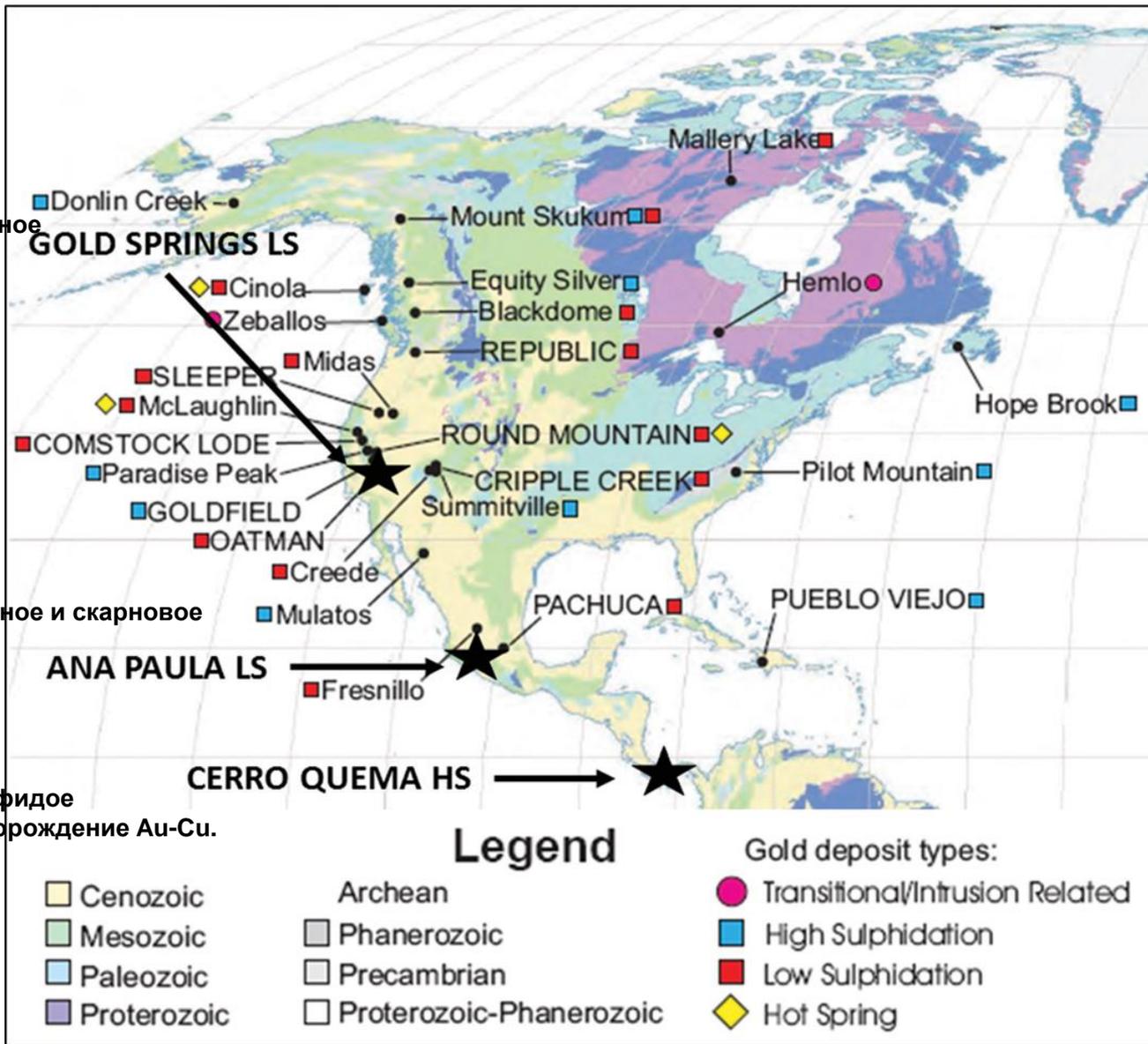
**THE results of a recent Geotech versatile time-domain electromagnetic (VTEM) geophysical survey on Fox Resources' ground in the Pilbara has set the company up with "two or three years" of work and could be the turning point in the recognition of the Pilbara as a base metals province in Australia.**

Пресс-релиз

Съемка VTEM



# VTEM и ZTEM при поисках эпитермальных золоторудных месторождений

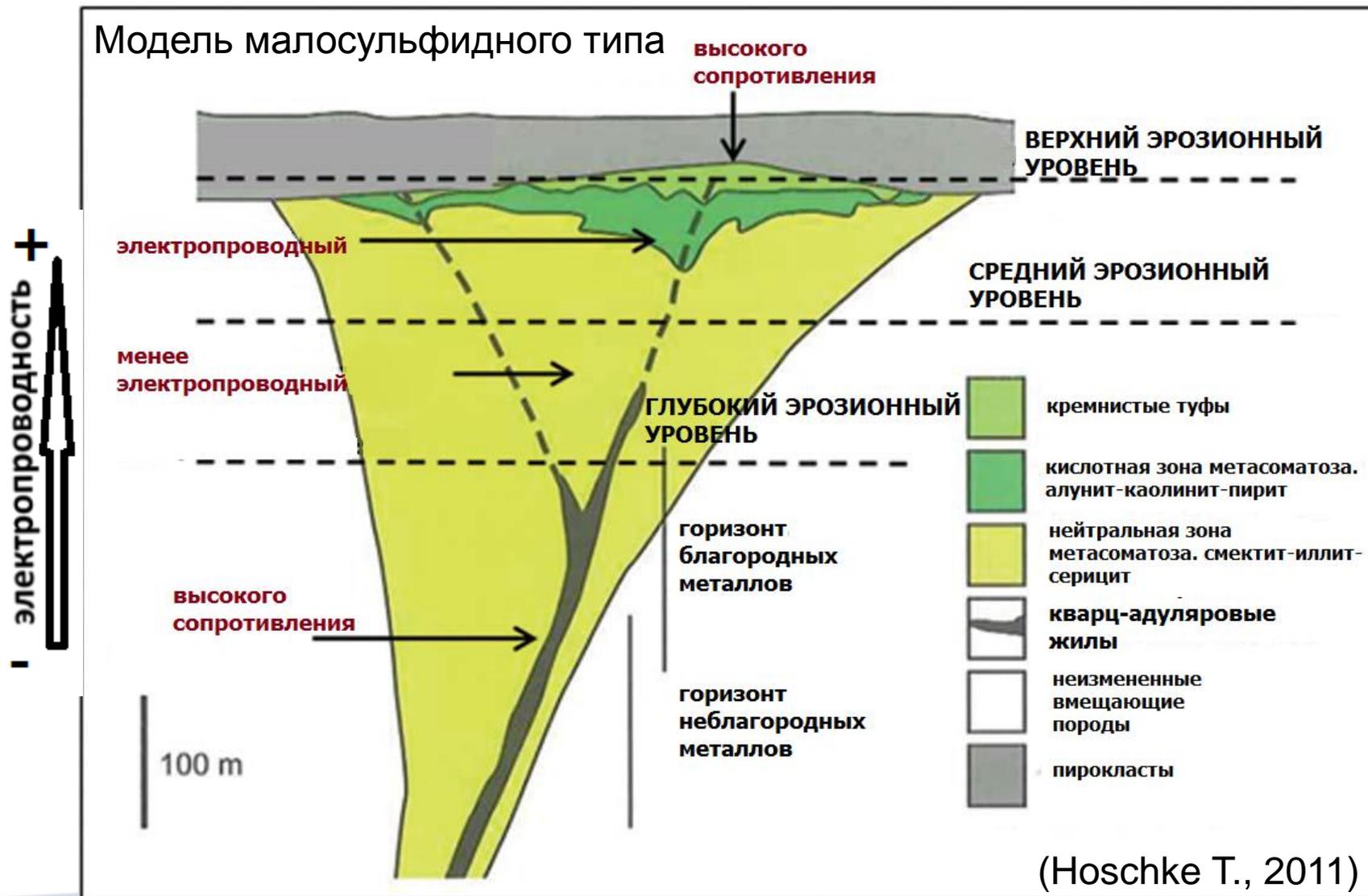


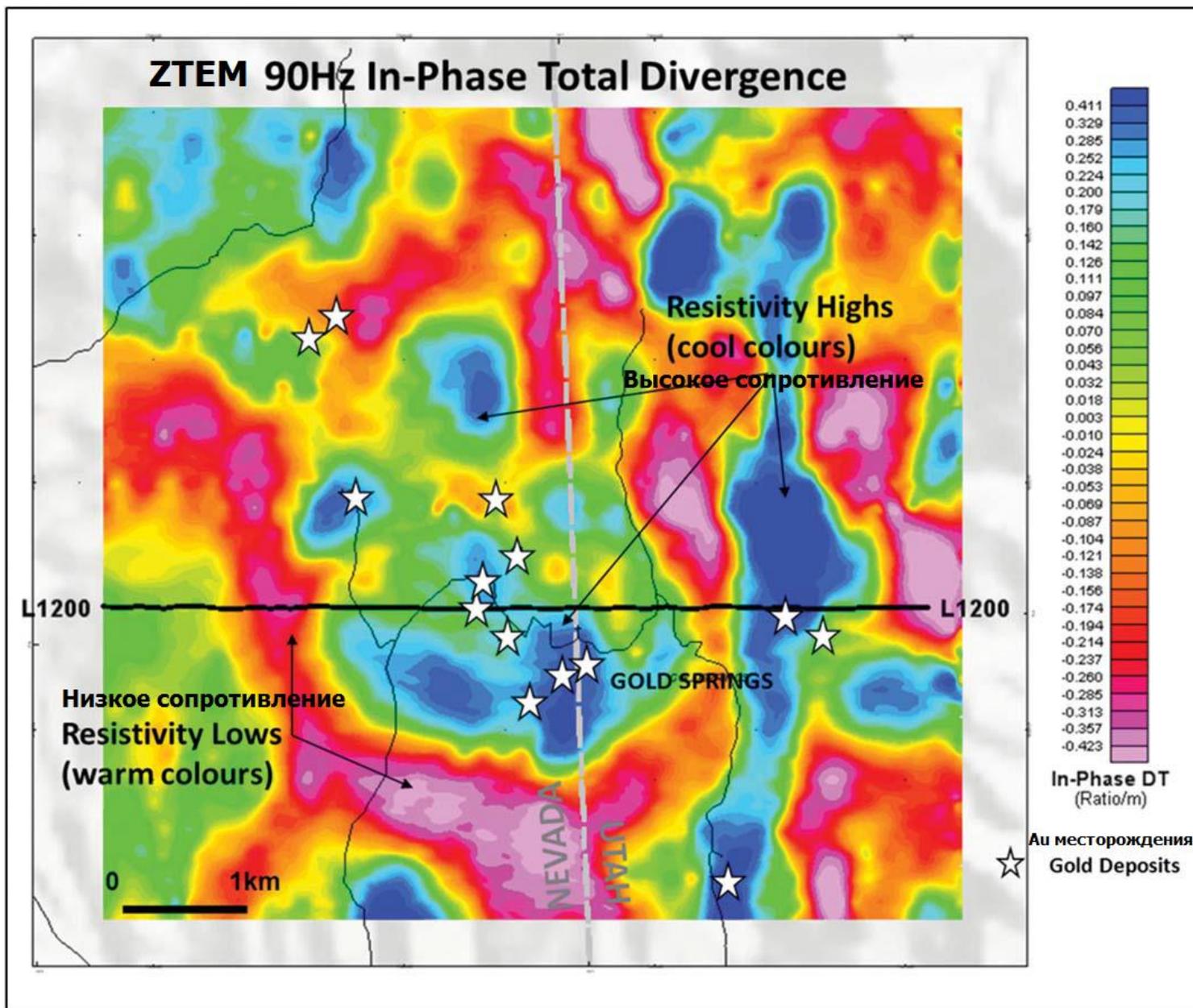
Невада. Мало сульфидное эпитермальное м-е Au.  
**ZTEM**

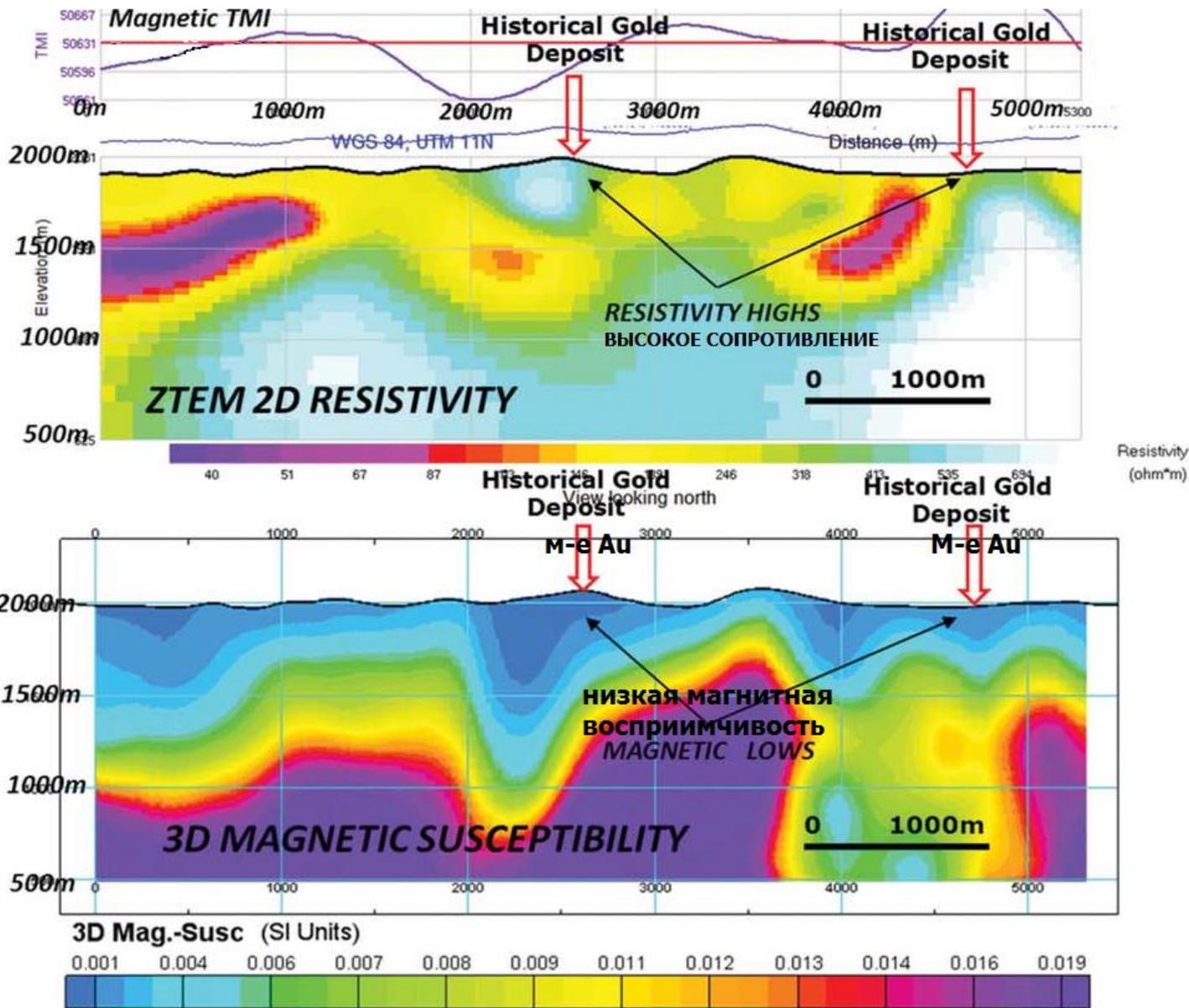
Мексика. Эпитермальное и скарновое м-я Au.  
**ZTEM**

Панама. Высокосульфидное Эпитермальное месторождение Au-Cu.  
**VTEM**

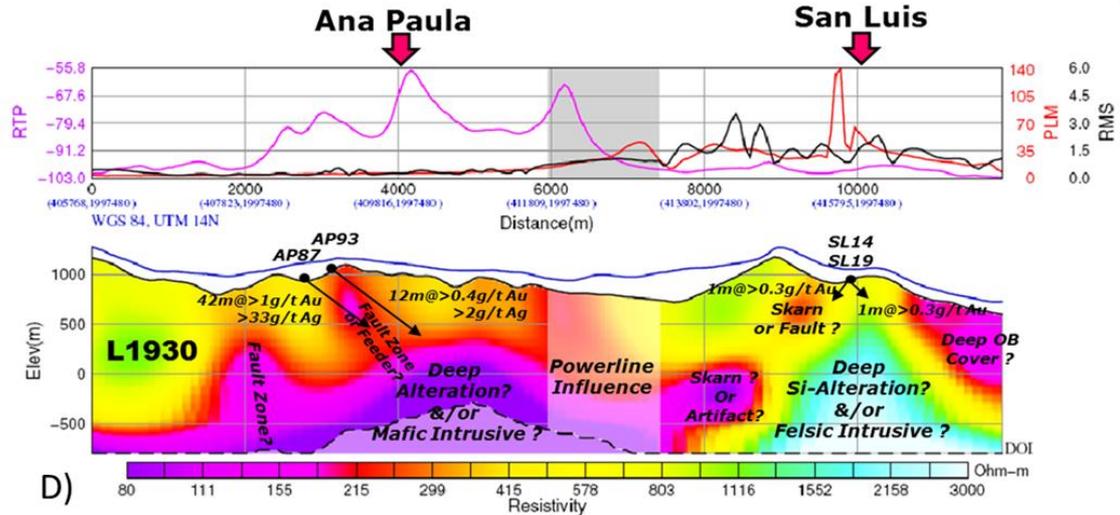
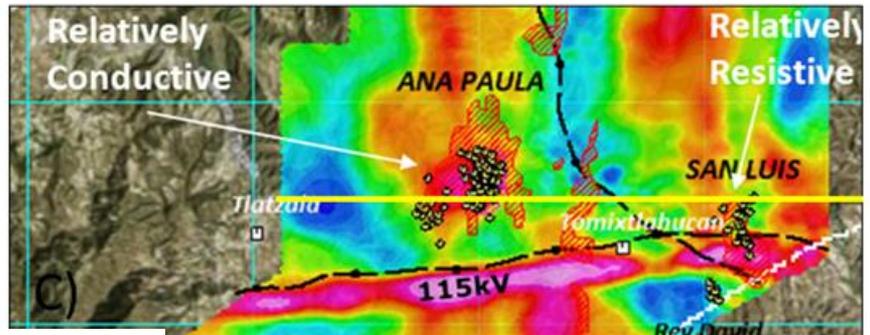
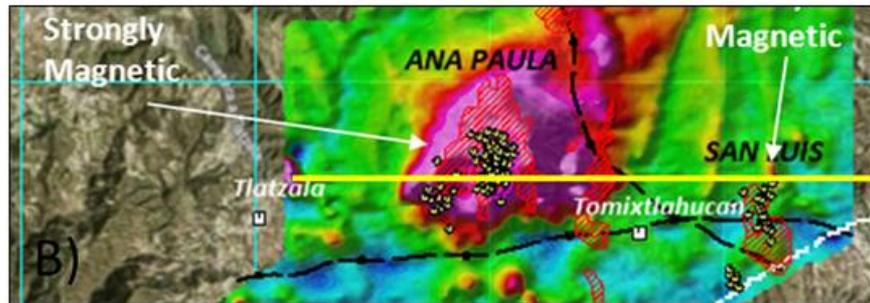
Морфология и физсвойства: погребённая, субвертикальная зона окварцевания высокого уд.эл. сопротивления с «выносом» магнетита.



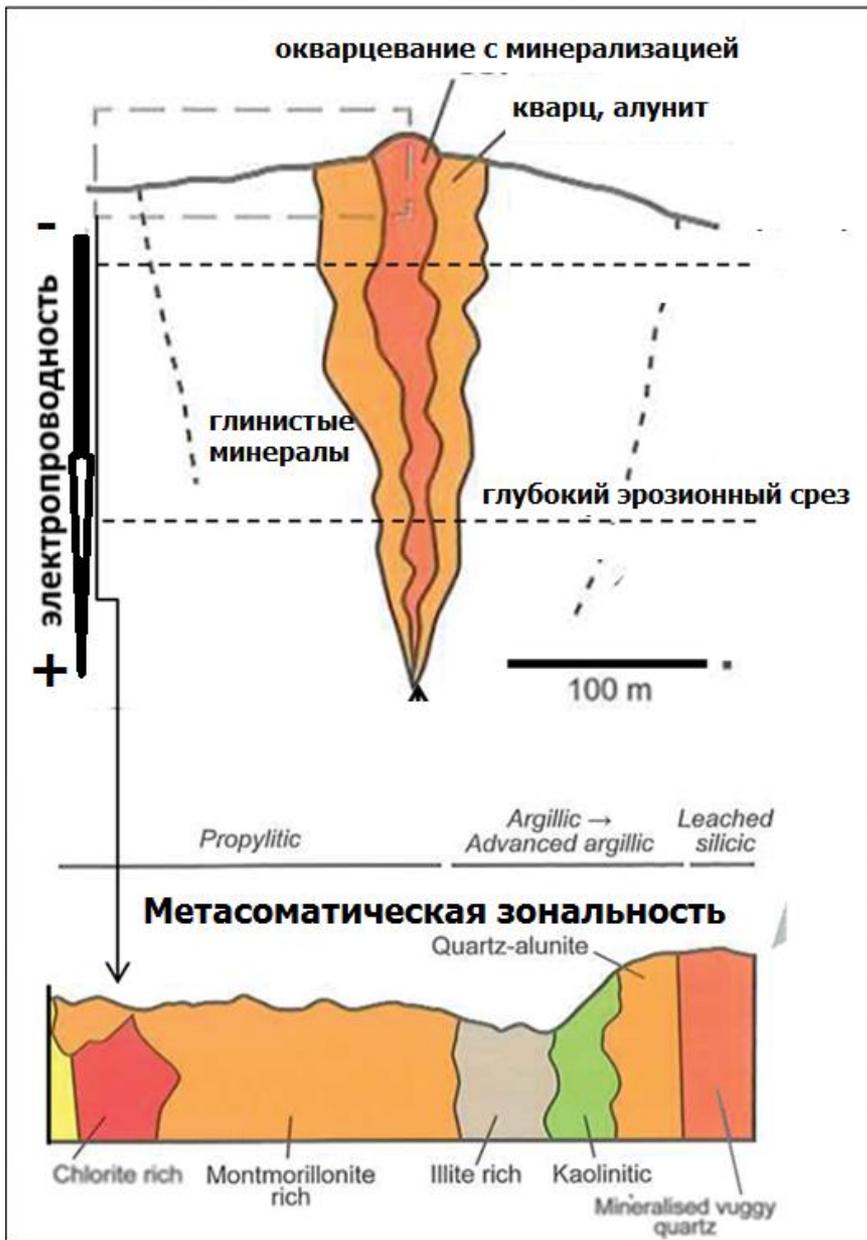




# Эпитермальное, малосульфидное м-е Au-Ag Ana Paula, Мексика, золоторудный пояс Гуэрреро



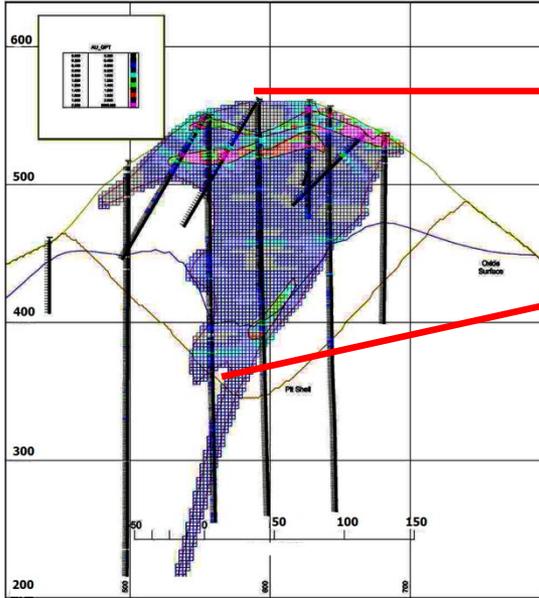
## Модель эпитермального м-я, высокосульфидизированный тип



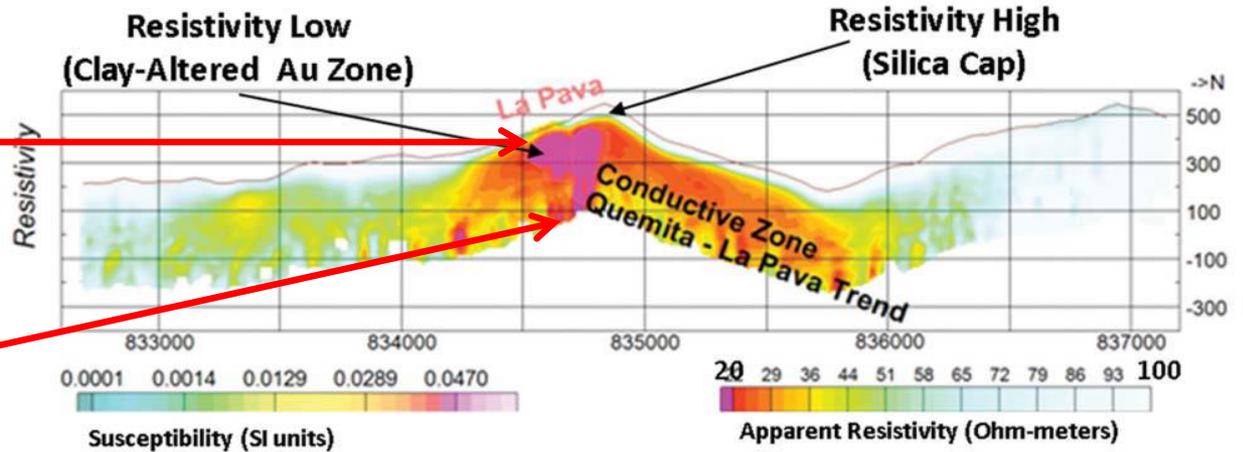
Минерализация и продукты метасоматоза приводят к понижению электрического сопротивления

VTEM

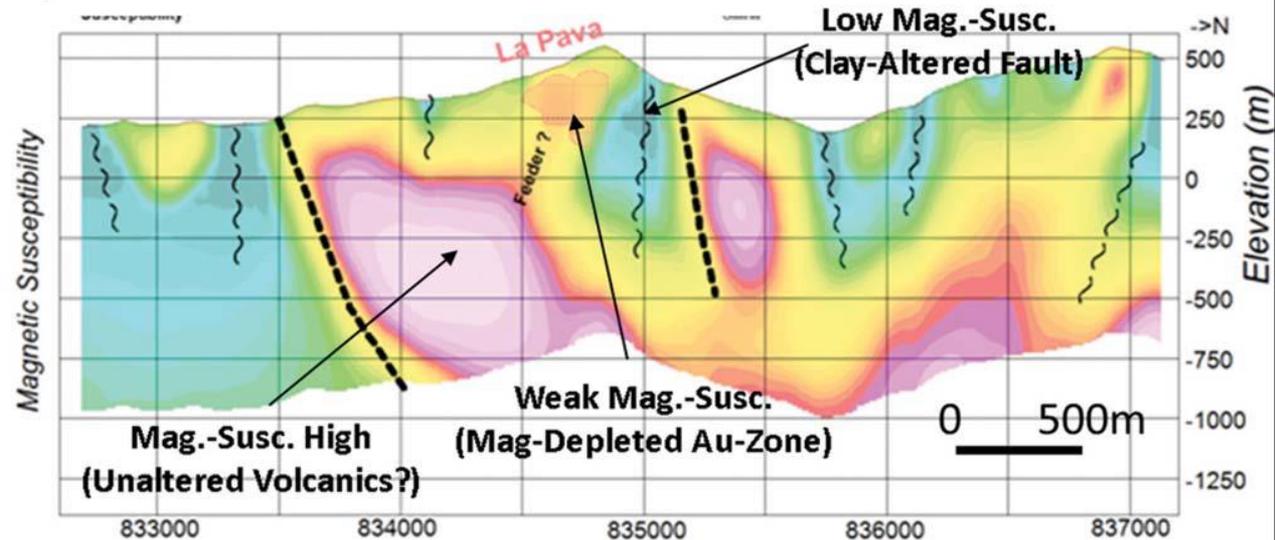
Контур рудного тела  
LaPava по бурению



A) L2790 - VTEM 1D RDI RESISTIVITY-DEPTH IMAGE

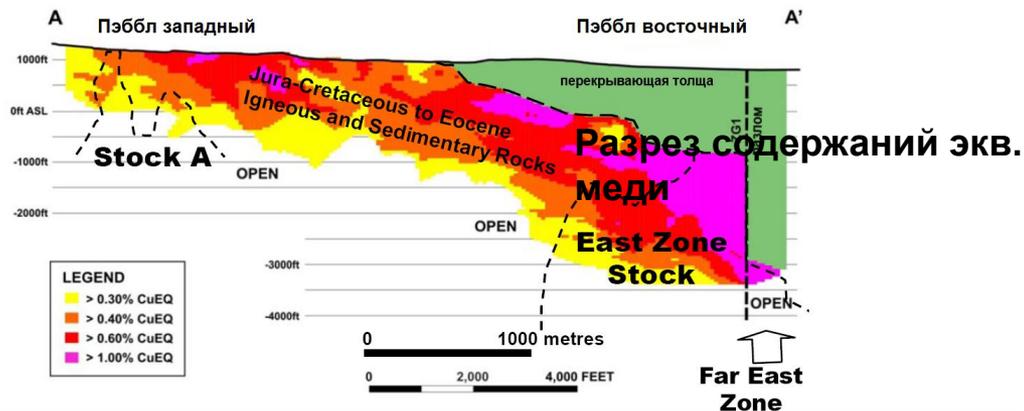
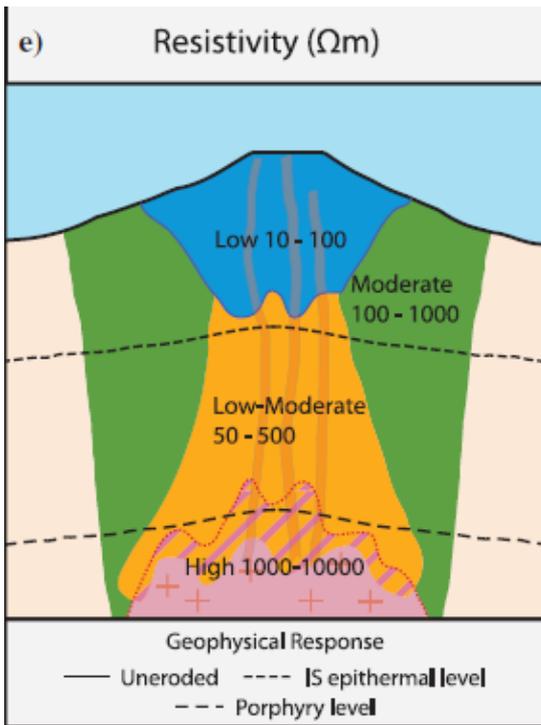


B) L2790 - 3D MAGNETIC SUSCEPTIBILITY-DEPTH IMAGE

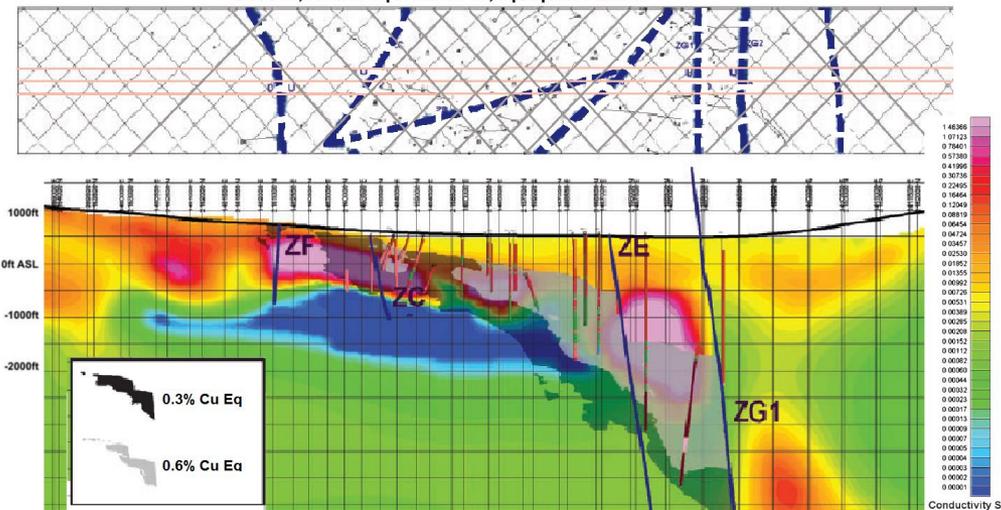


# Порфирировые медно-золоторудные системы

## Пебл месторождение, Аляска



Пэббл, 3D инверсия ZTEM, профиль 10120

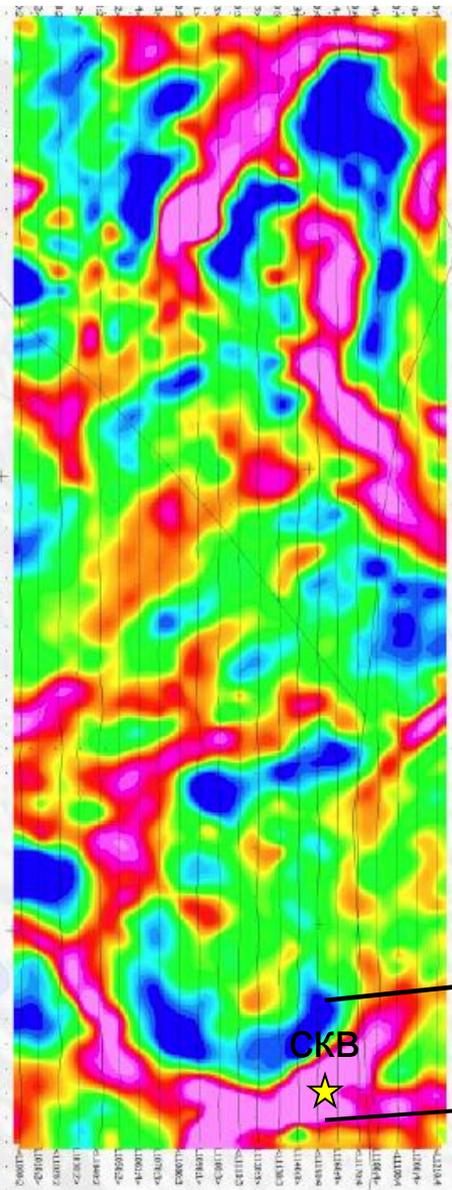


Разрез электропроводности ZTEM

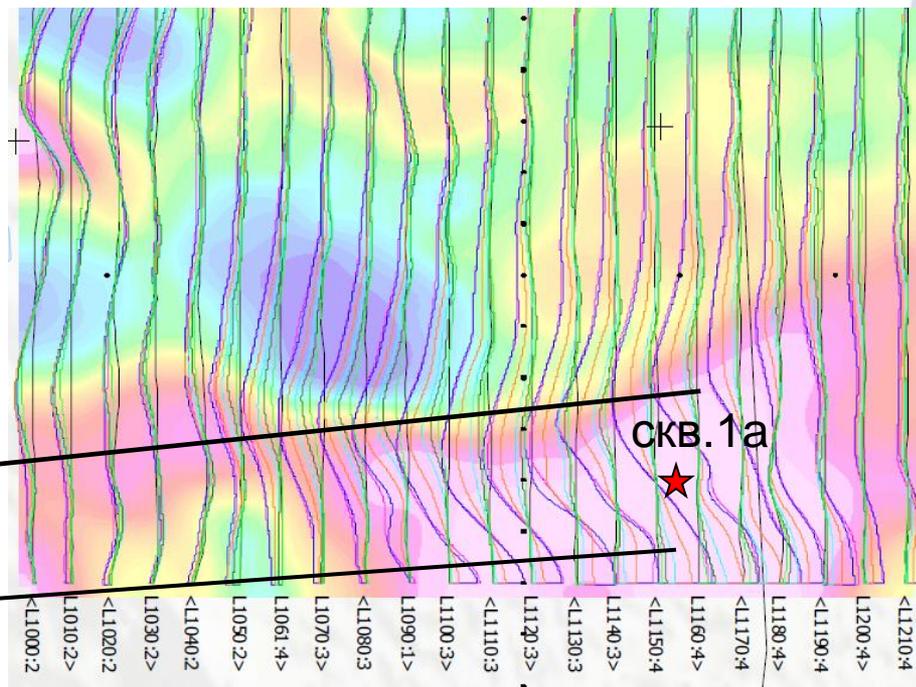
# ZTEM – золото-медно-порфировые месторождения

Казахстан, Карагандинская область  
Уч. Алтыншоки

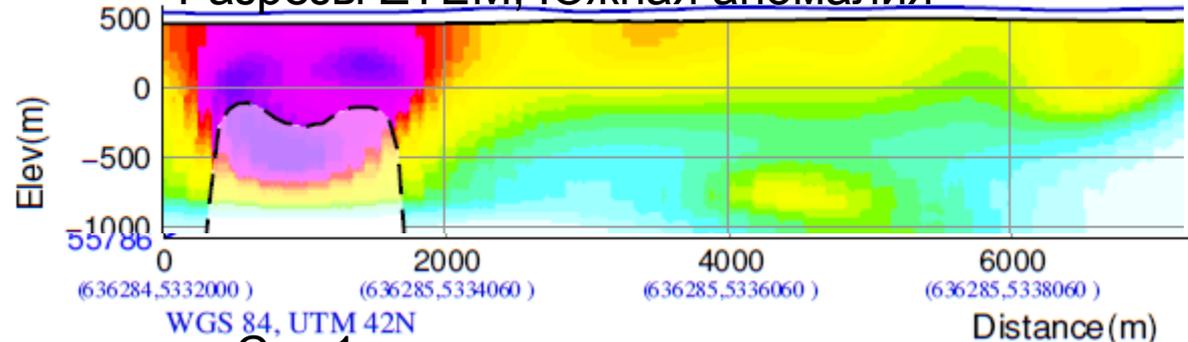
25Hz Total  
Divergence  
In-Phase  
(DT) Grid



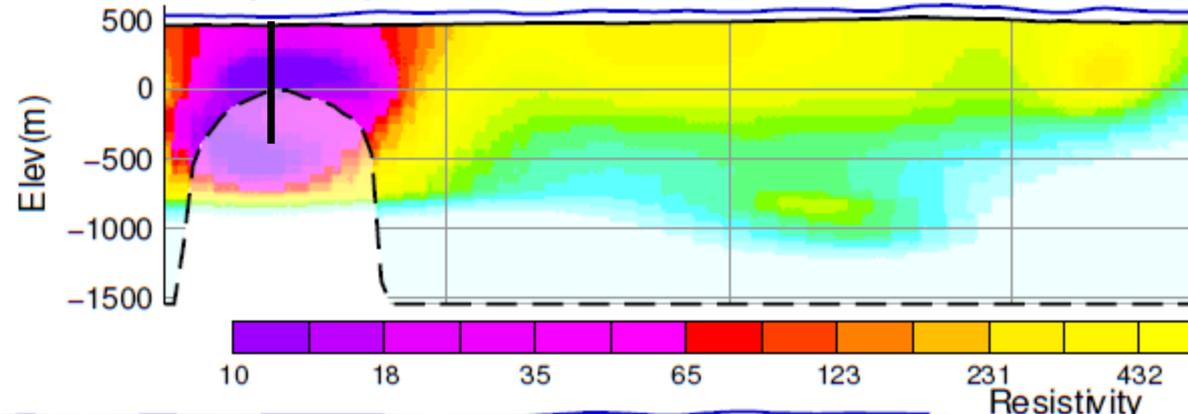
ZTEM In-Phase  
75 Hz (phase rotated)



Разрезы ZTEM, Южная аномалия

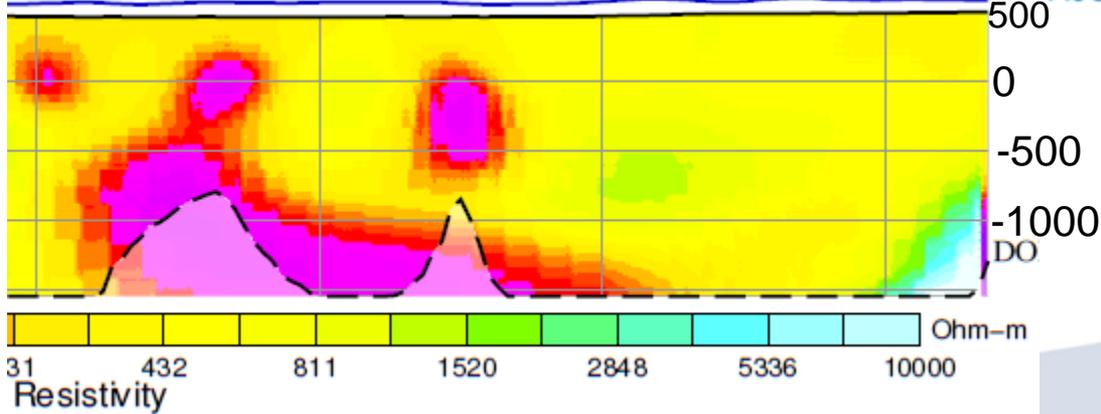
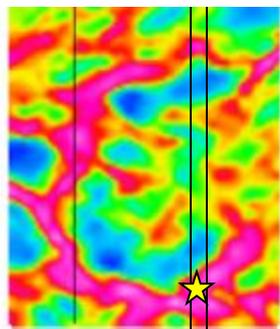


Скв 1а

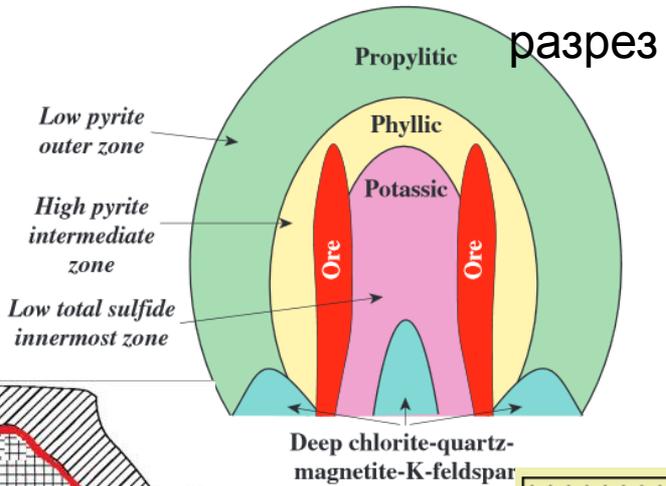


Скважина 1а  
Глубина 800 м  
Халькопирит-пиритовая  
минерализация в инт.  
238-800 м

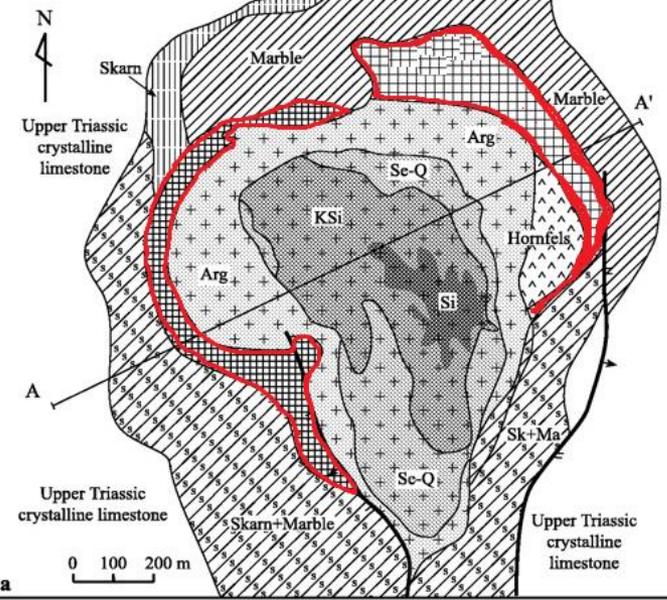
2 км



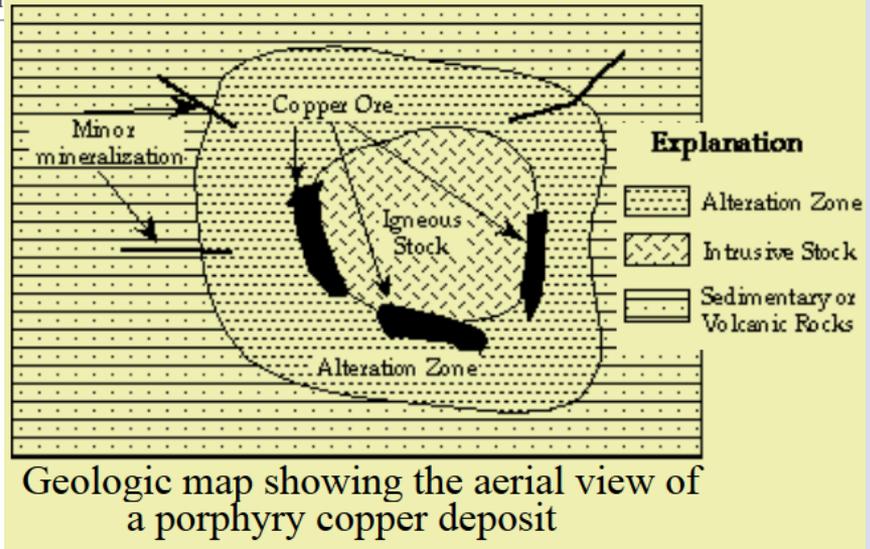
# Типичная геологическая модель медно-порфирирового оруденения



план

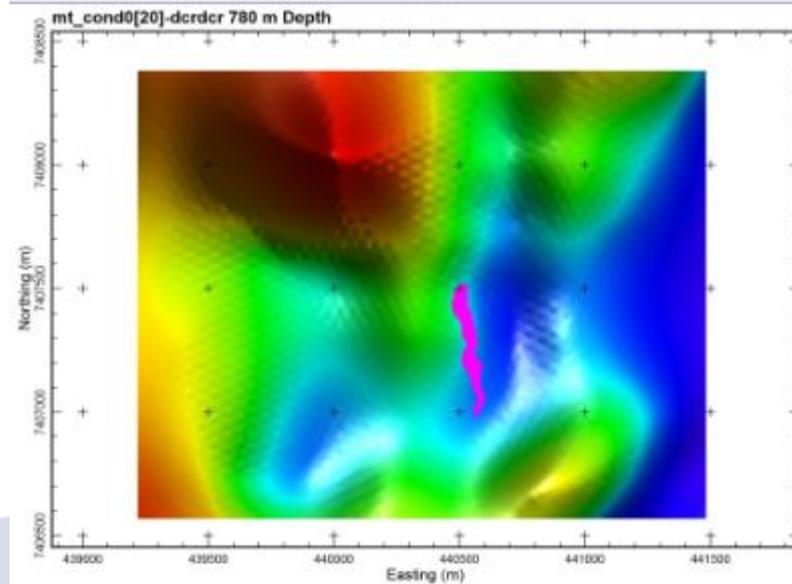
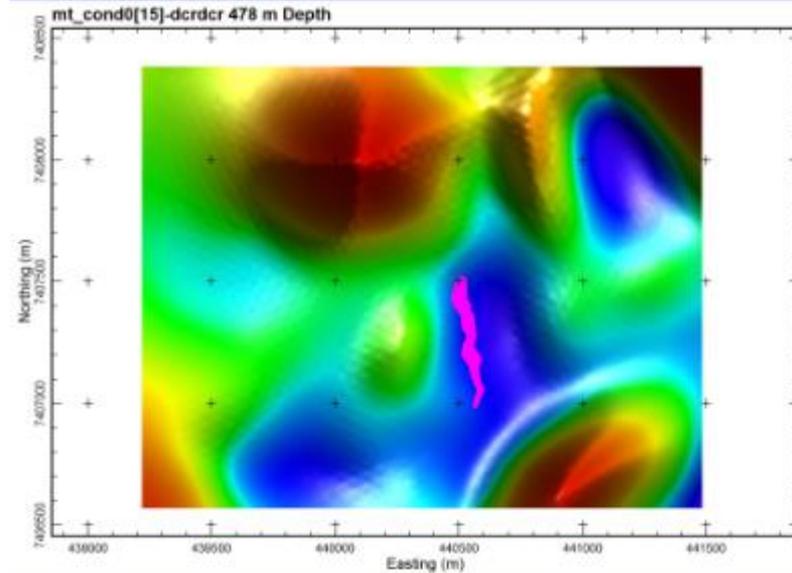
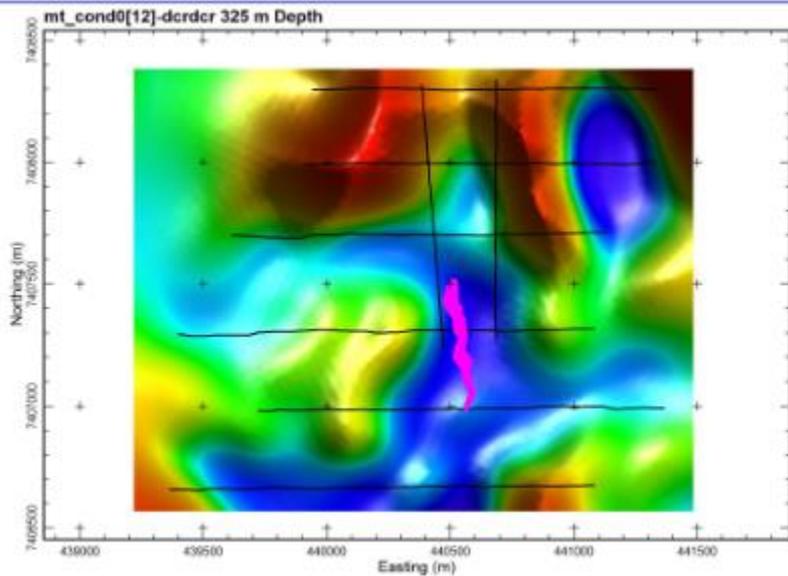


план

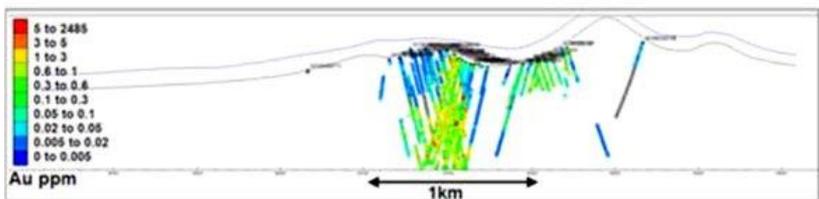
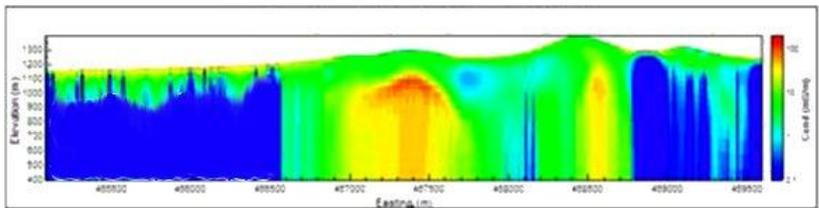




Месторождение Морошка  
Наземные МТ  
Карта эл.сопротивления



Танзания, Lake Victoria Goldfields.  
Золоторудное м-е Tusker

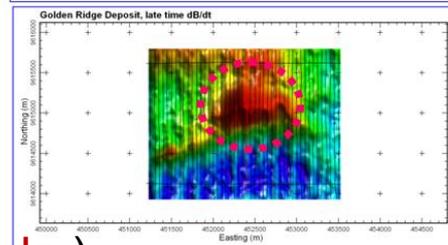
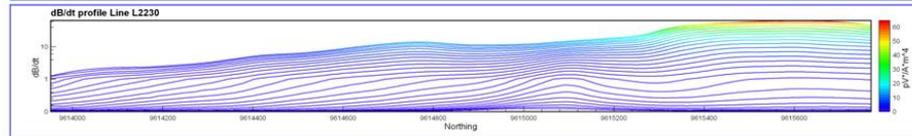
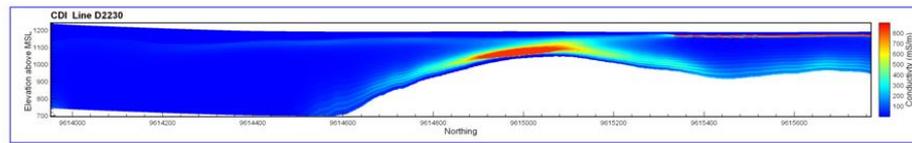


(123 млн тонн руды, 1.5 г/т)

## Мезотермальный тип

## VTEM

Golden Ridge Deposit, Tanzania (mesothermal lode gold deposits, associated with significant sulphidization)

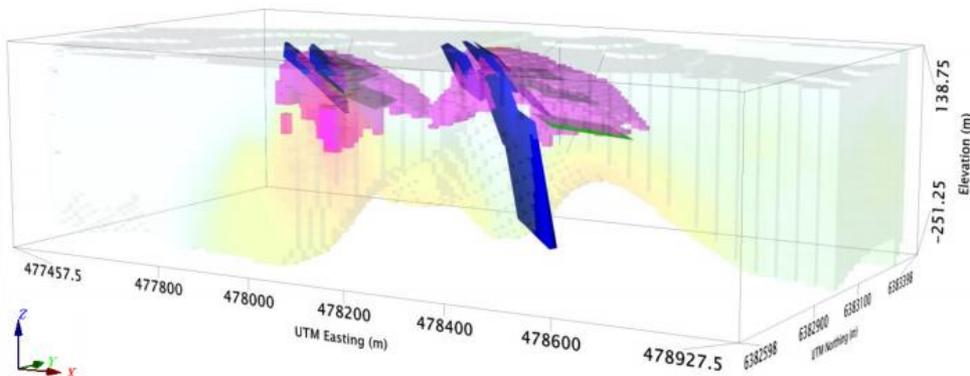


CONDUCTIVITY DEPTH IMAGE  
Derived from VTEM dB/dt  
Golden Ridge  
Flown: October, 2005



Золоторудный проект в Лабрадоре (Labrador)

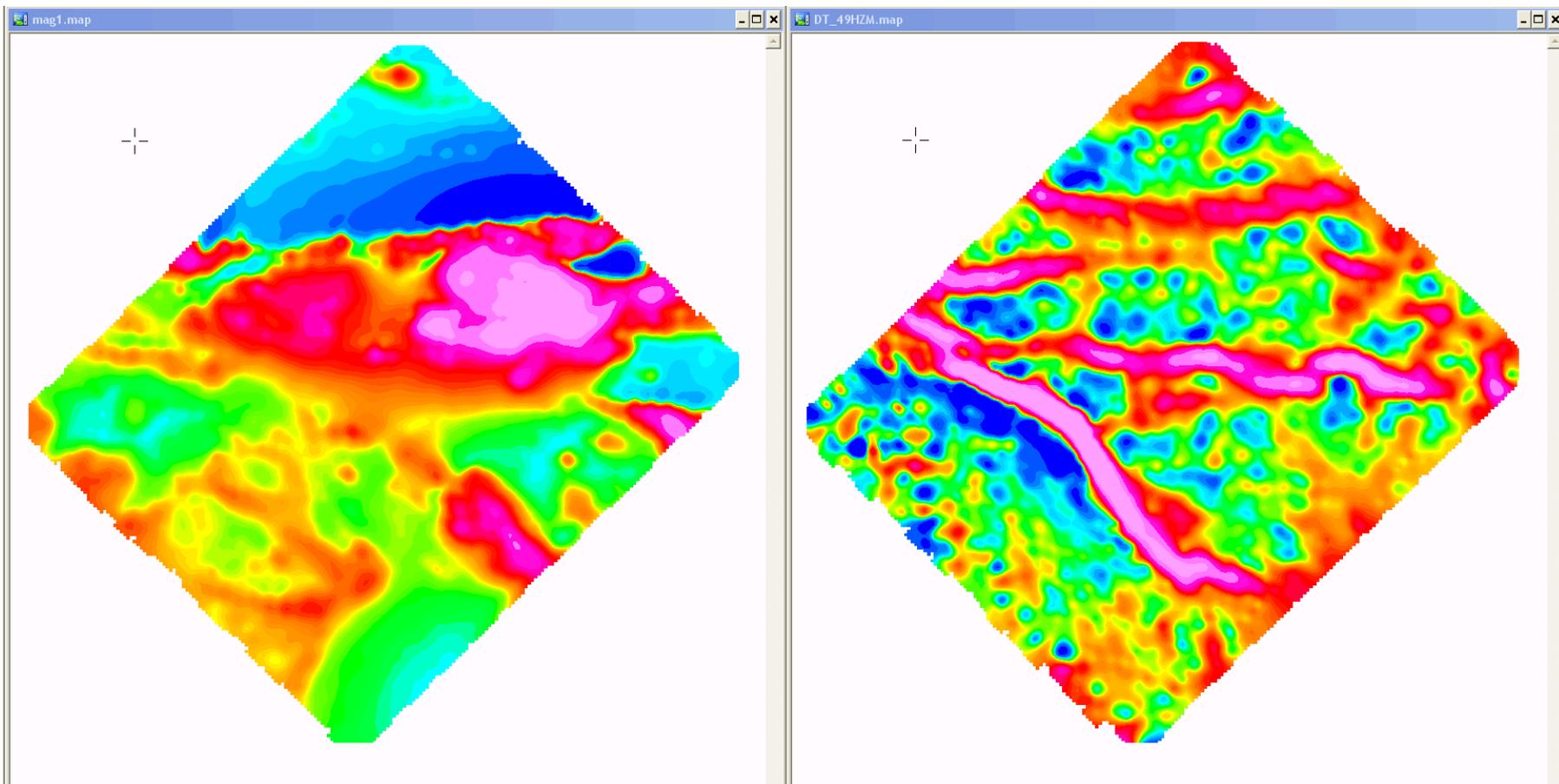
GEOTECH LTD. AIRBORNE GEOPHYSICAL SURVEYS Target East A - 3D View of Resistivity Depth Voxel with Plate Models



2 Moz Au (62 т), 2,9 г/т

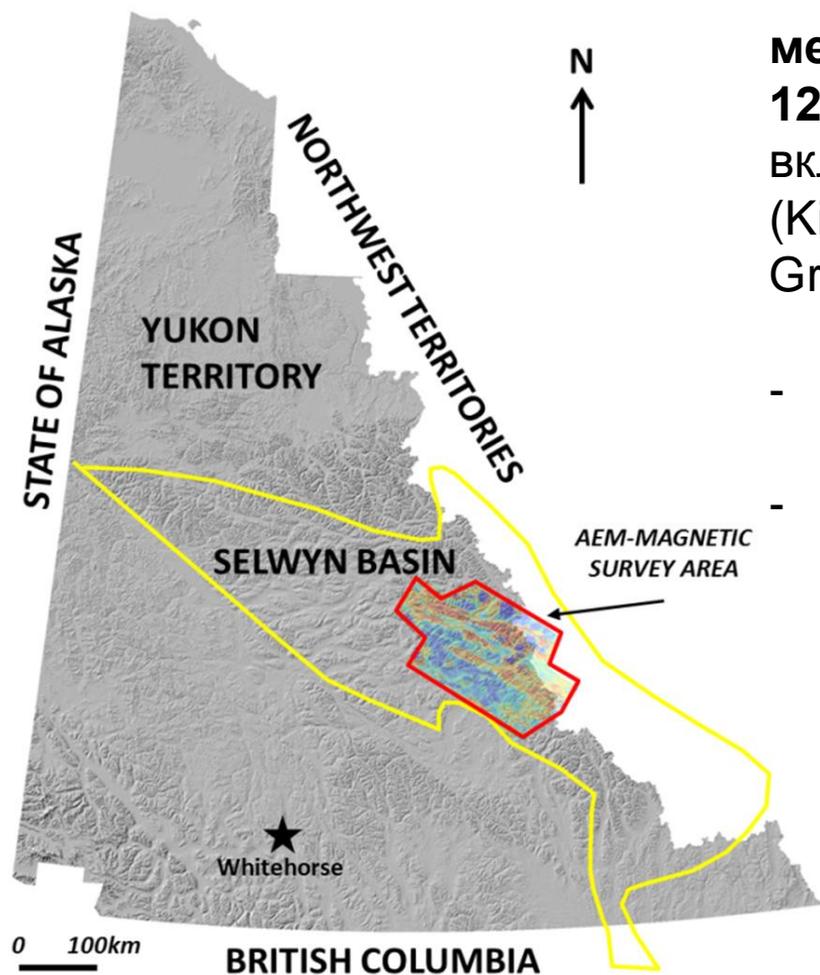
Магнитное поле

ZTEM 49 Hz DT

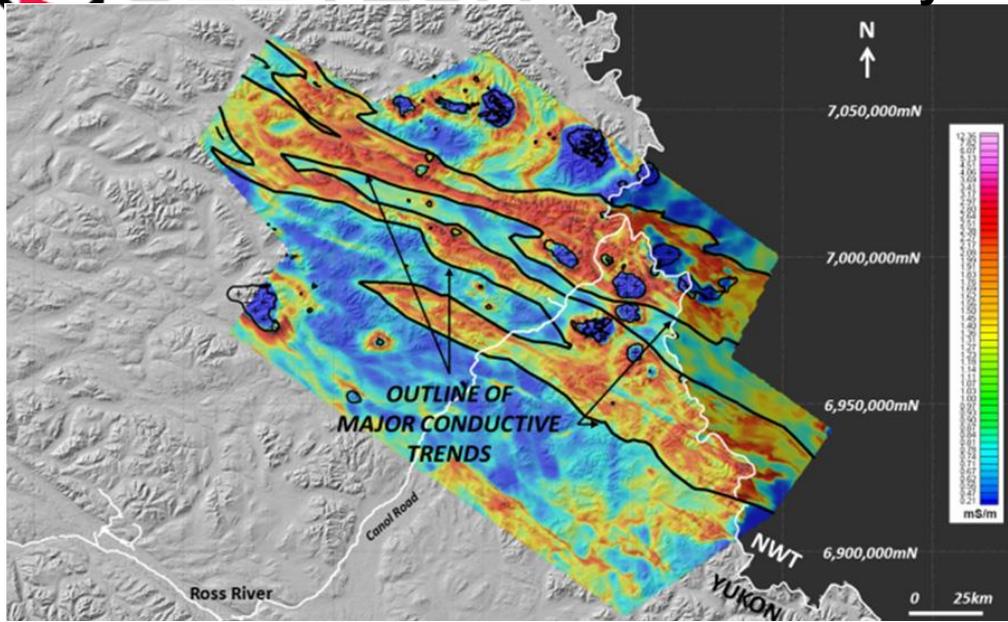


- SEDEX (эксгальционно-осадочные месторождения) Zn-Pb-Ag (Au, Cu) 12 известных месторождений включая Howards Pass 180 Mt indicated (Kirkham et al., 2012) и Faro, Vangorda, Grum.

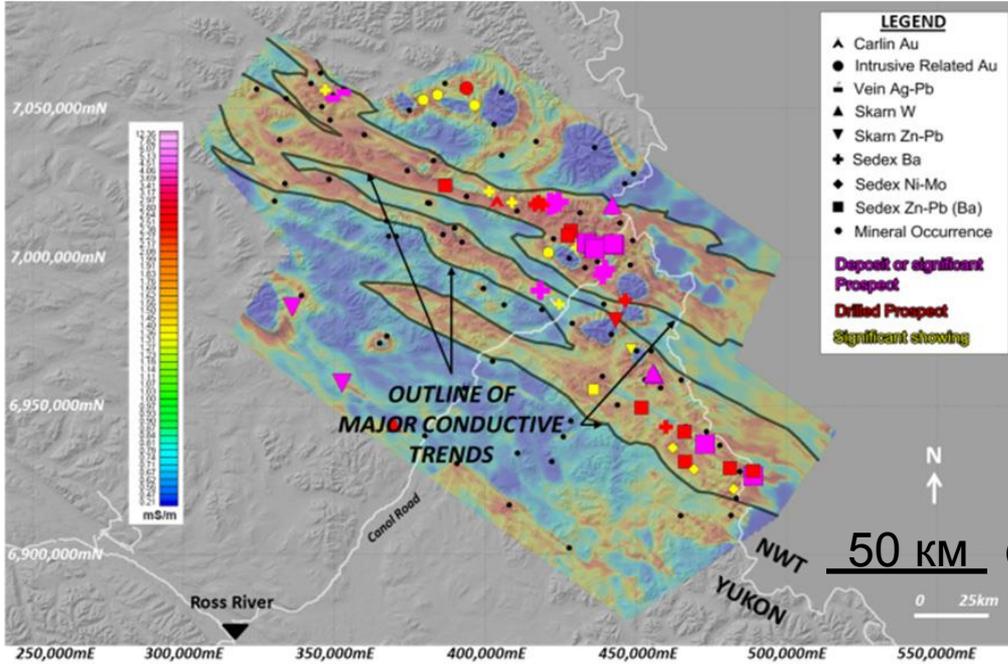
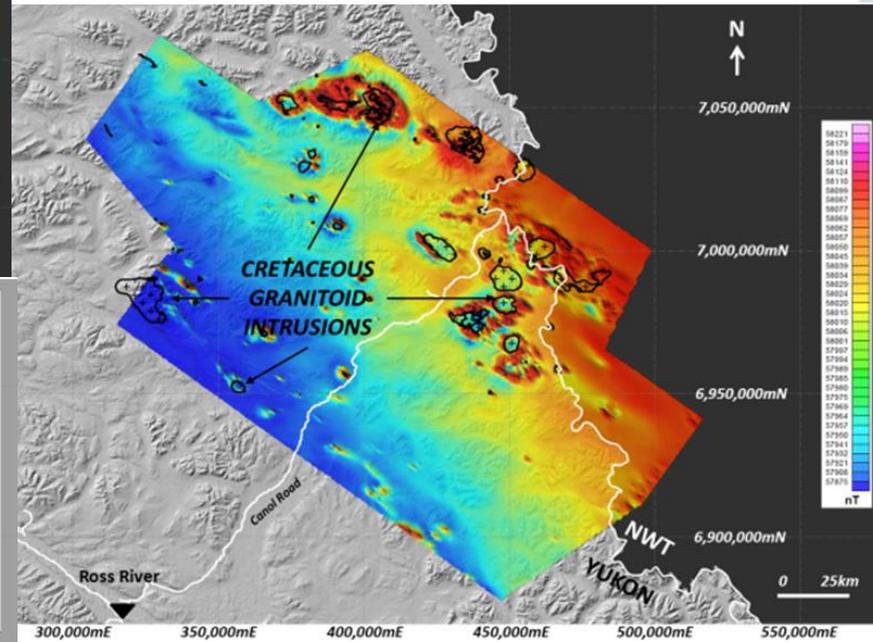
- Месторождения золота Карлинского типа
- Скарновые месторождения Zn, Pb, W



Карта ZTEM электропроводности 90Гц



Карта магнитного поля



Карта распределения МПИ с контурами ZTEM аномалий

50 км

- современные аэрогеофизические технологии являются залогом самой быстрой активизации геолого-разведочных работ, улучшения инвестиционного климата, подъема минерально-сырьевой базы районов, регионов и целых стран;

- последние разработки электромагнитных методов (VTEM, ZTEM) являются наиболее эффективными для поисков многих видов полезных ископаемых и в большинстве случаев не требуют последующих дополнительных наземных исследований для проектирования буровых работ;

- Принцип «Летай и Бури», относящийся в большей степени к вертолетным TDEM, устранила во многих случаях необходимость проведения дорогостоящих наземных исследований, что приводит к значительной экономии средств и времени.

- для активизации горнодобывающей промышленности и экономического развития регионов и целых стран рекомендуется планомерное внедрение зарекомендовавших уже себя на практике технологий и методов с учетом геологического строения и видов полезных ископаемых как в традиционных горно-рудных районах с развитой инфраструктурой так и в слабо изученных.

## Использованные материалы

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**Colin Burge, First Quantum**, PDAC, Toronto, CAN, March-2014)

**Jean M. Legault, Karl Kwan, and Alexander Prikhodko**. Airborne EM in Exploring for Epithermal Gold Deposits: Three Examples from the Great Basin and Western Cordillera. In: “New concepts for discoveries”, v.1. GSN Symposium, May 14-23, 2015. Reno, Nevada.

**СПАСИБО ЗА ВНИМАНИЕ**

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