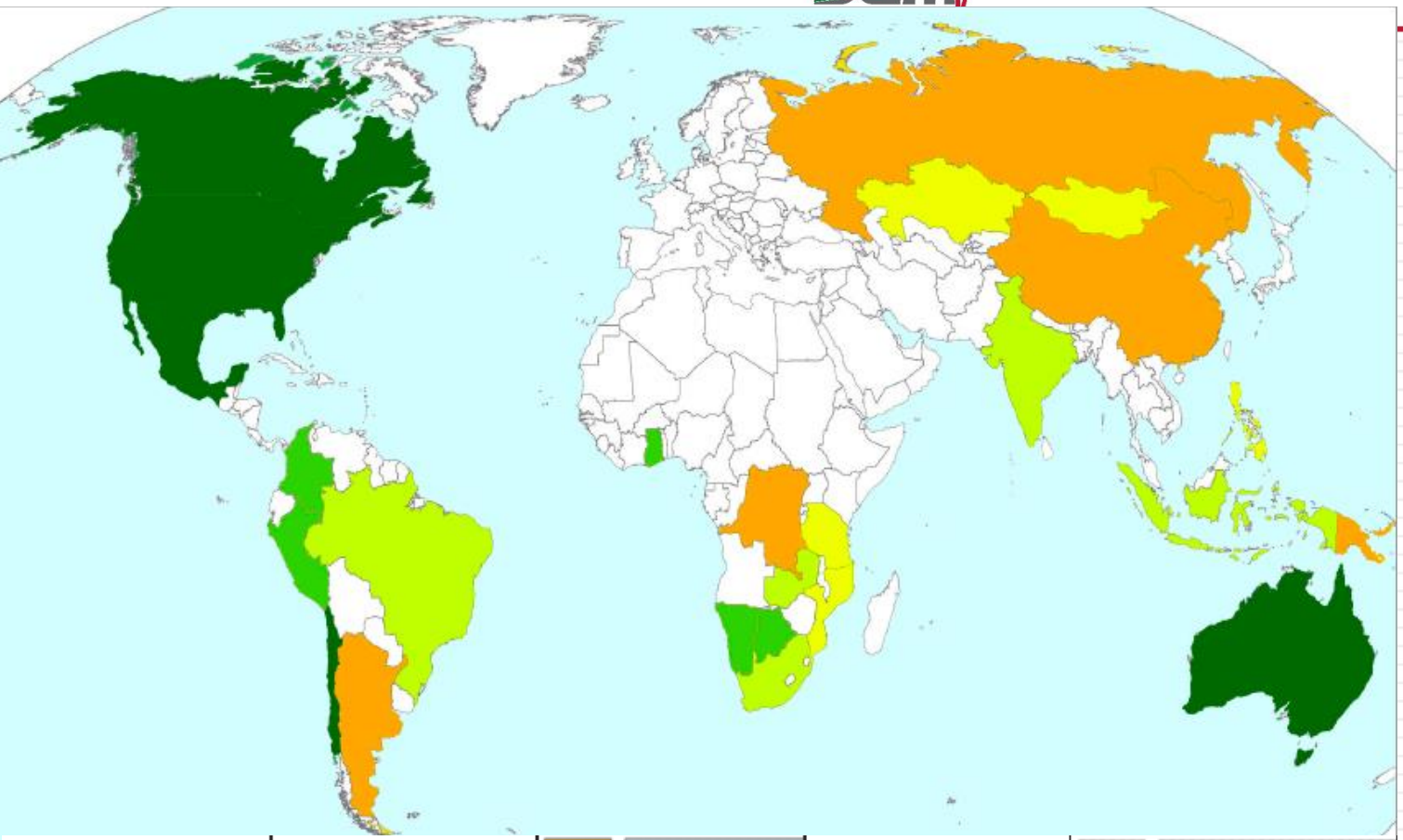
Objectives, activities and benefits of Mexican Geological Survey for the mining sector

CHINA MINING
中国国际矿业大会

September 22-25, 2016
Tianjin Meijiang Convention Center



1	Canada	6	Peru	11	Brazil	16	Philippines	21	China
2	Australia	7	Namibia	12	Zambia	17	Mozambique	22	Argentina
3	United States	8	Botswana	13	South Africa	18	Kazakhstan	23	Russia
4	Chile	9	Colombia	14	India	19	Mongolia	24	Papua New Guinea
5	Mexico	10	Ghana	15	Indonesia	20	Tanzania	25	D.R. Congo

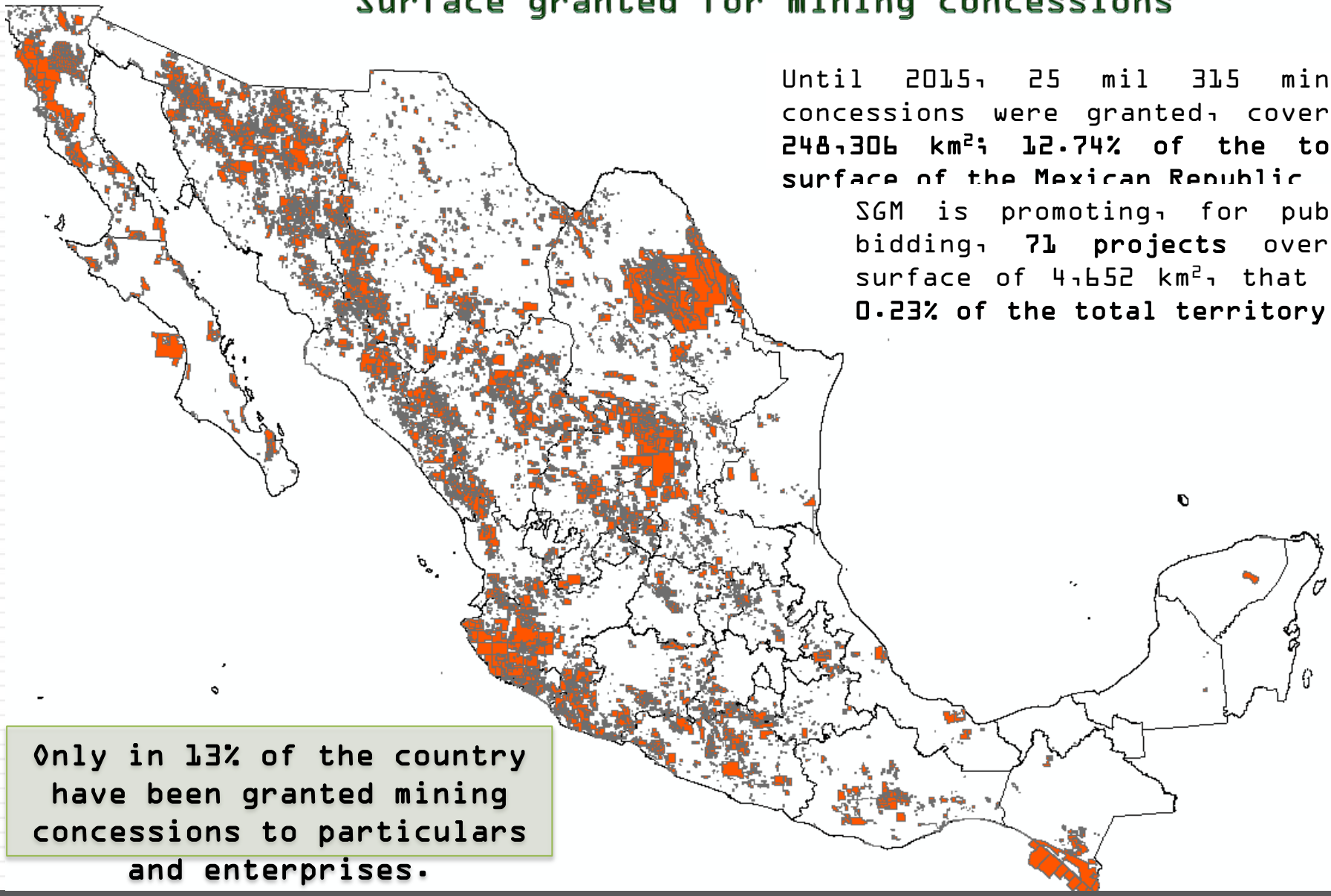
Where to invest

2015

BEHRE DOLBEAR GROUP

Ranking of countries for mining investment

Surface granted for mining concessions



Until 2015, 25 mil 315 mining concessions were granted, covering **248,306 km²; 12.74% of the total surface of the Mexican Republic**

SGM is promoting, for public bidding, **71 projects** over a surface of 4,652 km², that is, **0.23% of the total territory**

Only in 13% of the country have been granted mining concessions to particulars and enterprises.

México, main producer of 16 minerals

1 Silver

2 Fluorite

3 Bismuth, Wollastonite

5 Lead, Cadmium, Barite, Molybdenum

6 Zinc, Salt, Graphite

7 Gold, Diatomite

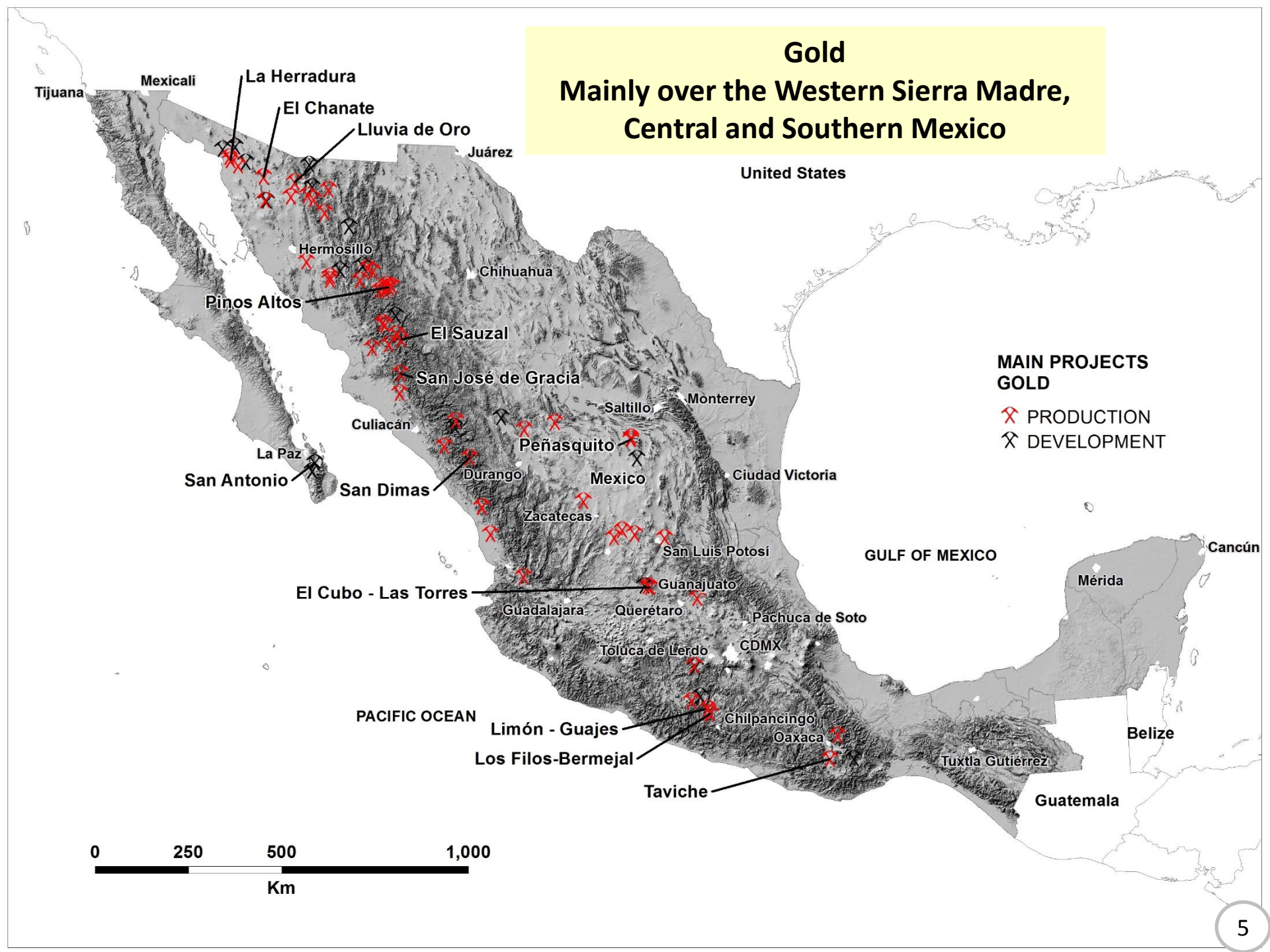
8 Gypsum

9 Manganese

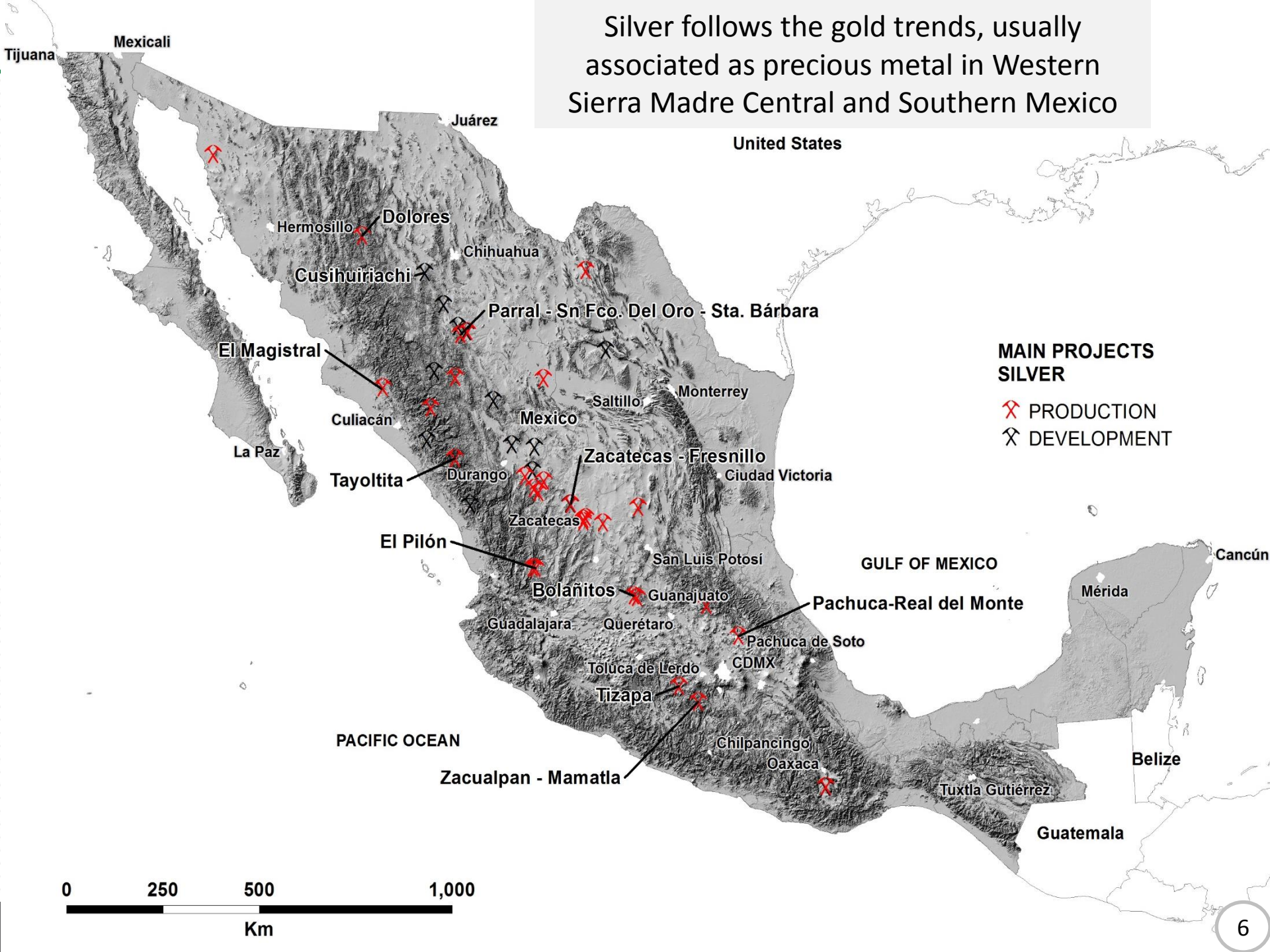
10 Copper

Source: USGS, 2015

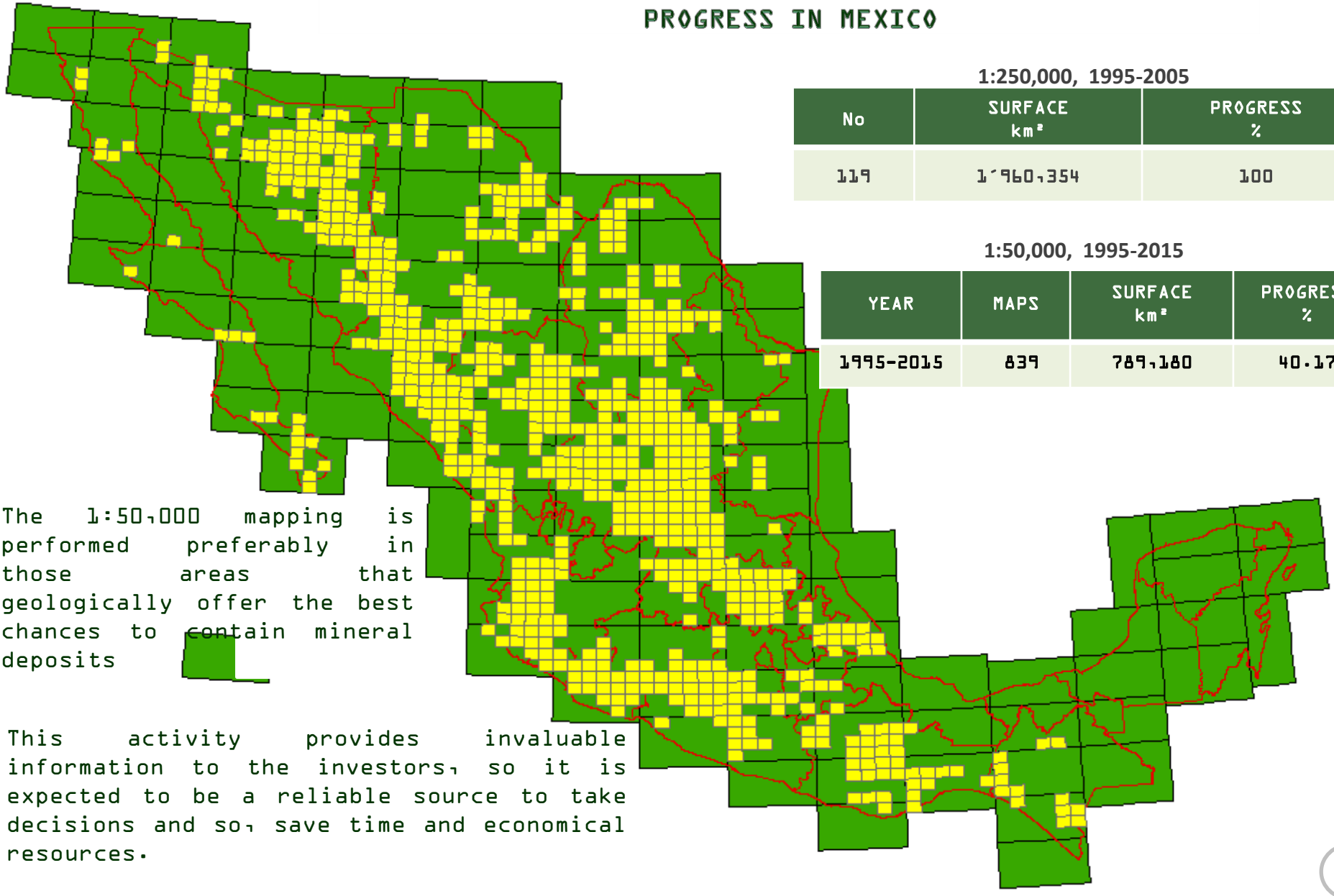
Gold
Mainly over the Western Sierra Madre, Central and Southern Mexico



Silver follows the gold trends, usually associated as precious metal in Western Sierra Madre Central and Southern Mexico



MAP SHOWING GEOLOGICAL-MINING AND GEOCHEMICAL MAPPING PROGRESS IN MEXICO



1:250,000, 1995-2005

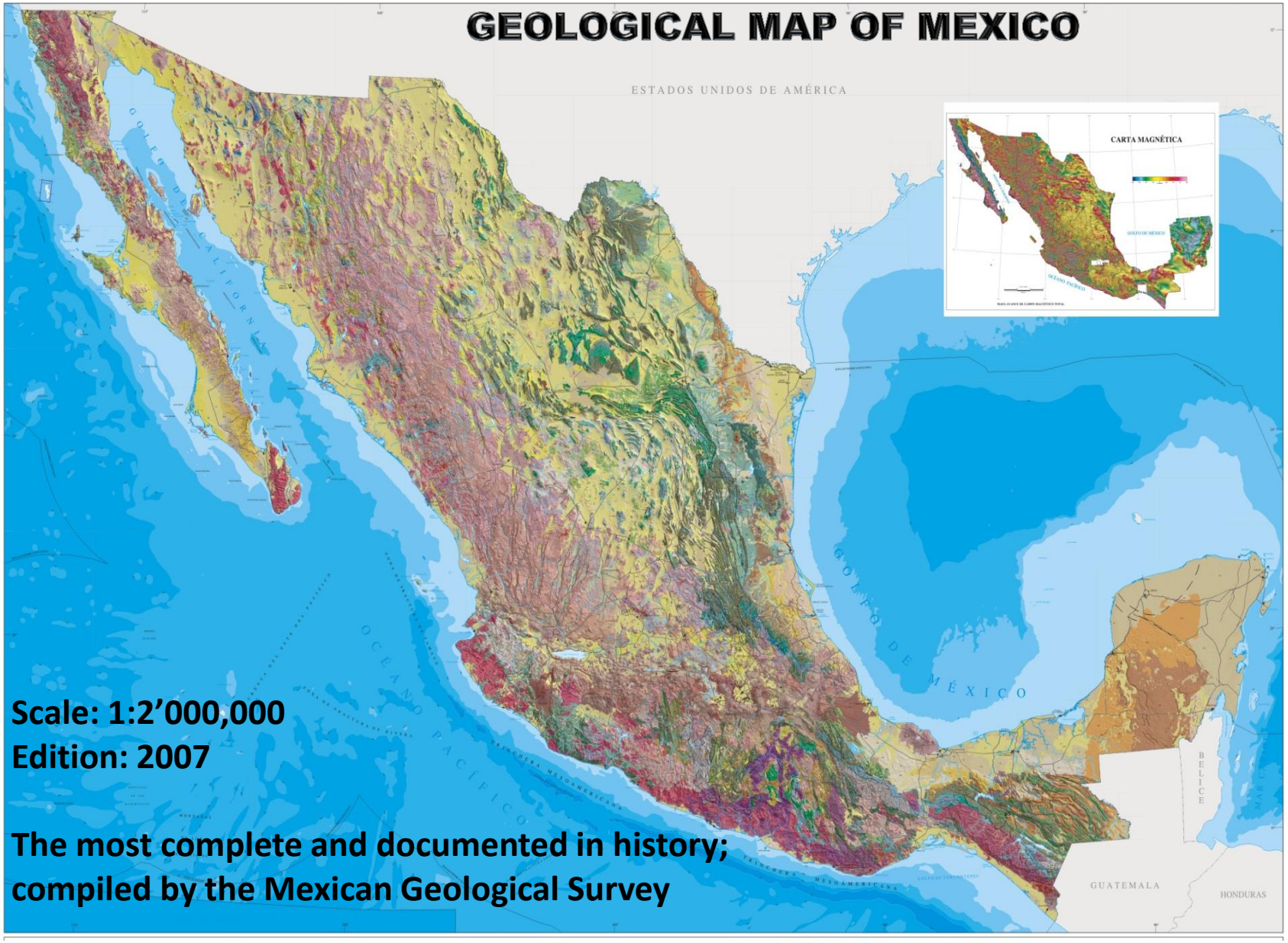
No	SURFACE km²	PROGRESS %
119	1´960,354	100

1:50,000, 1995-2015

YEAR	MAPS	SURFACE km²	PROGRESS %
1995-2015	839	789,180	40.17

The 1:50,000 mapping is performed preferably in those areas that geologically offer the best chances to contain mineral deposits

This activity provides invaluable information to the investors, so it is expected to be a reliable source to take decisions and so, save time and economical resources.

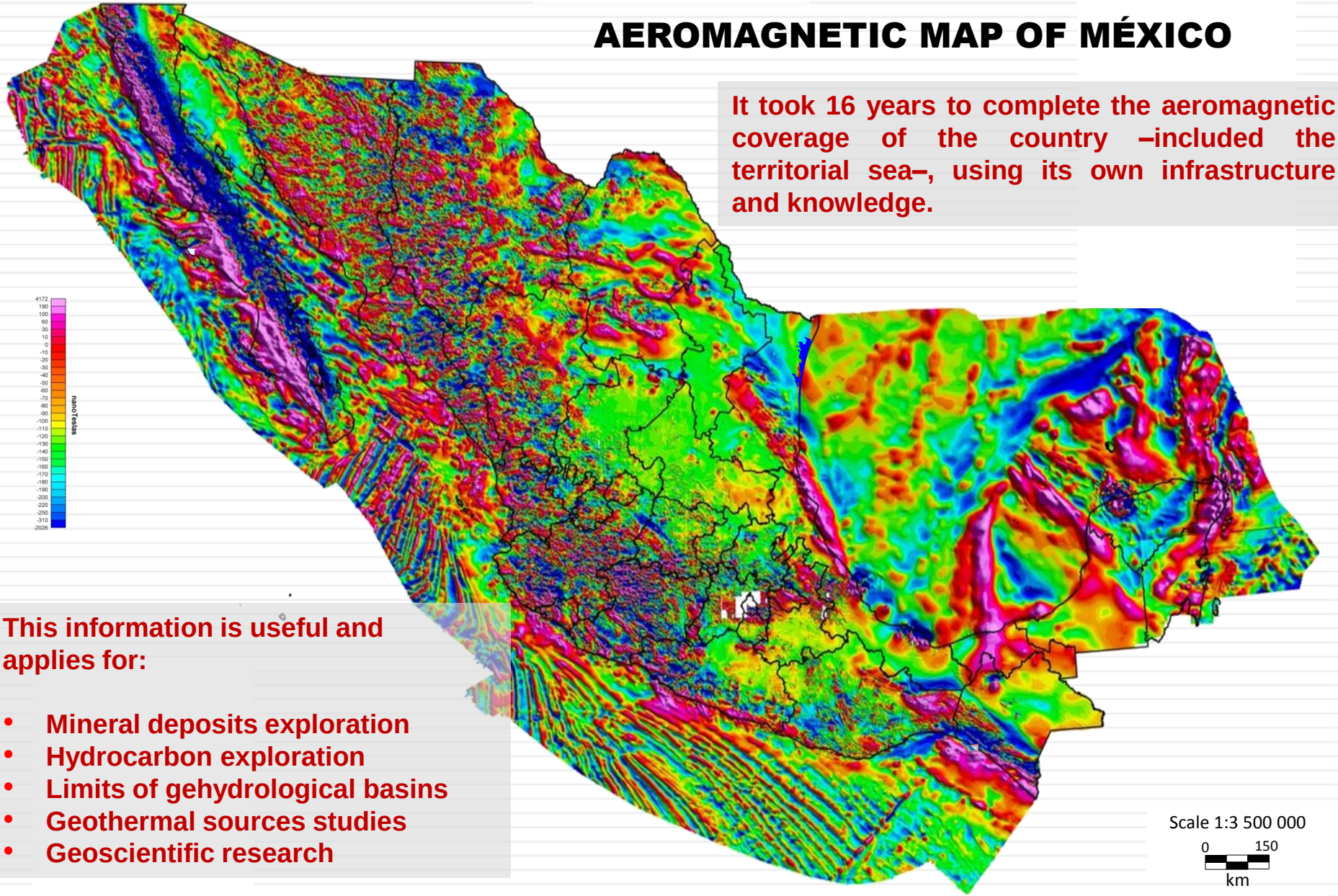


Scale: 1:2’000,000
Edition: 2007

The most complete and documented in history; compiled by the Mexican Geological Survey

AEROMAGNETIC MAP OF MÉXICO

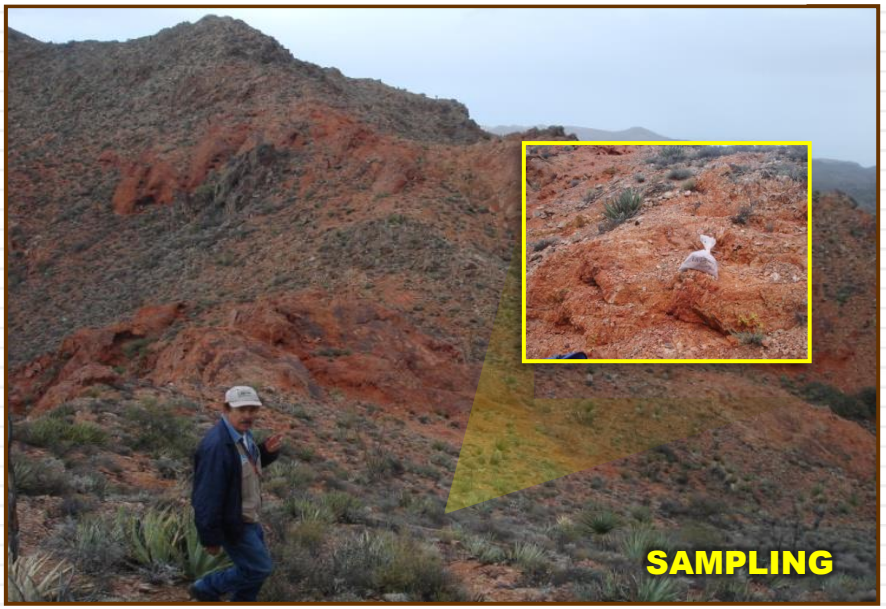
It took 16 years to complete the aeromagnetic coverage of the country –included the territorial sea–, using its own infrastructure and knowledge.

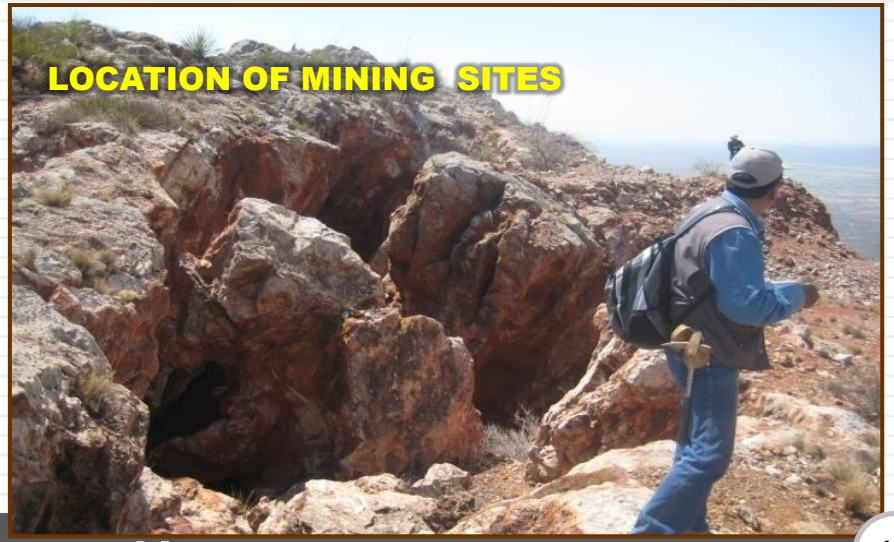


This information is useful and applies for:

- Mineral deposits exploration
- Hydrocarbon exploration
- Limits of gehydrological basins
- Geothermal sources studies
- Geoscientific research

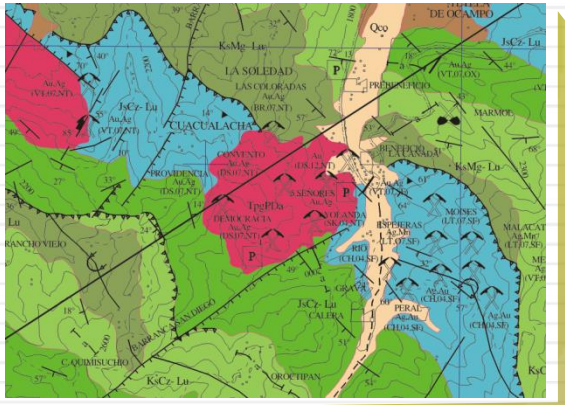
GEOLOGICAL MAPPING SUPERVISION, PROGRESS CONTROL, PROSPECTIVE LOCALITIES

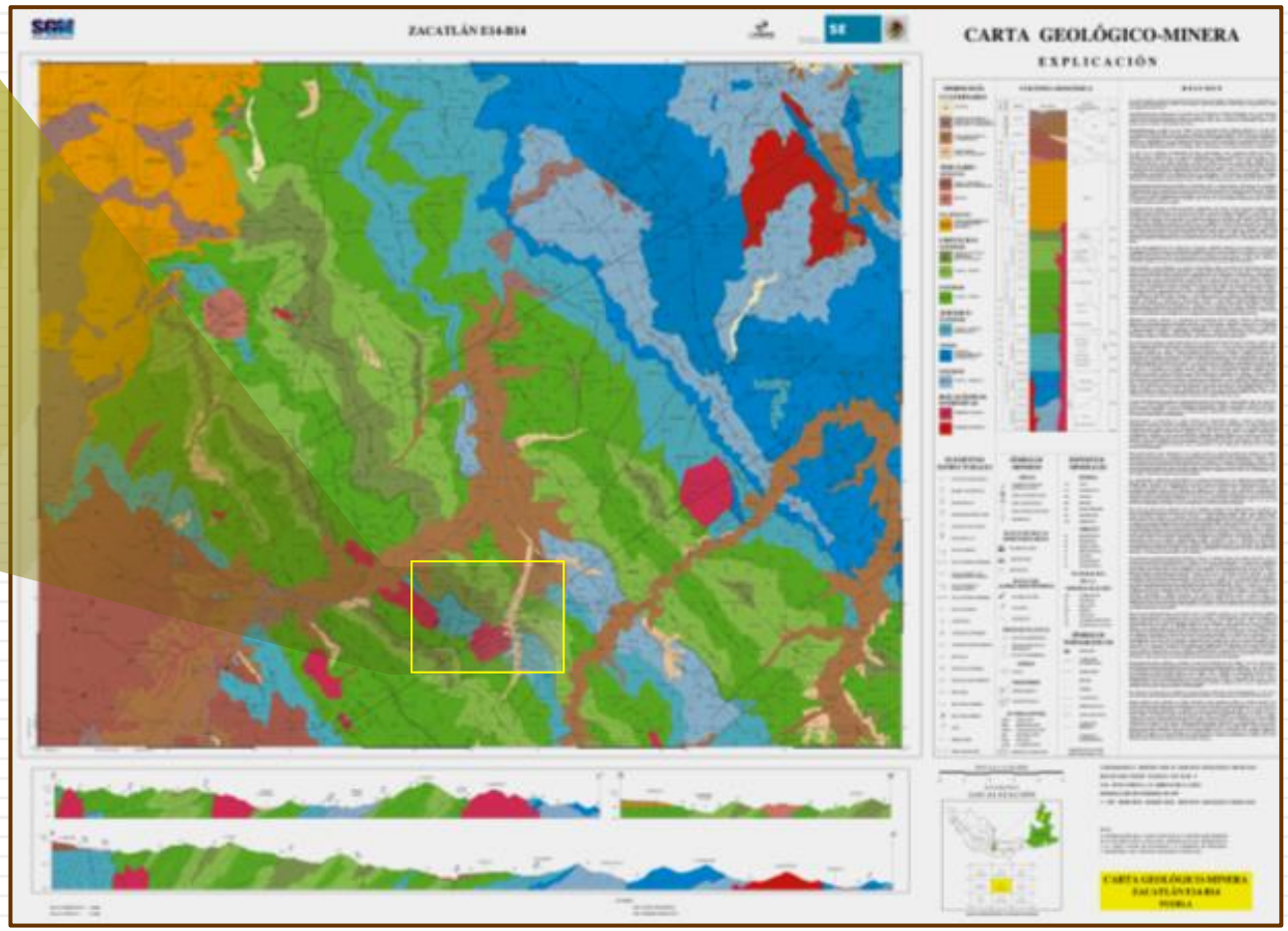




1:50,000 scale map (Example)

As an outcome, a verified graphic representation of rock types and structures and their relationship with the mineral deposits is obtained





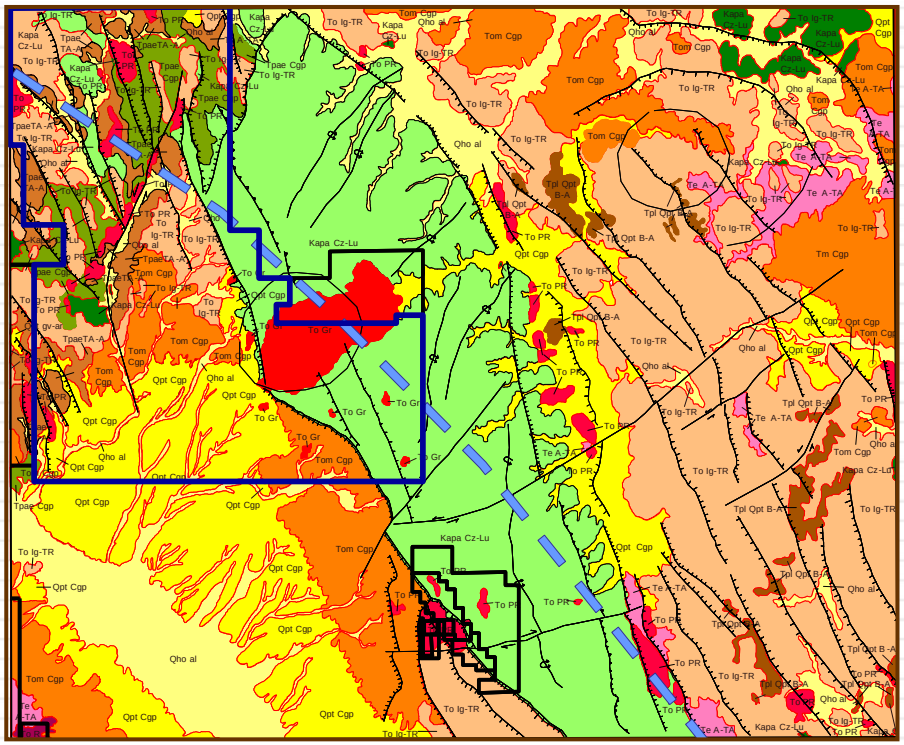
Levels of information

- Lithology
- Structural arrange
- Sampling
- Metallic and non metallic mineral deposits
- Cross sections
- Stratigraphy
- Abstract and final report

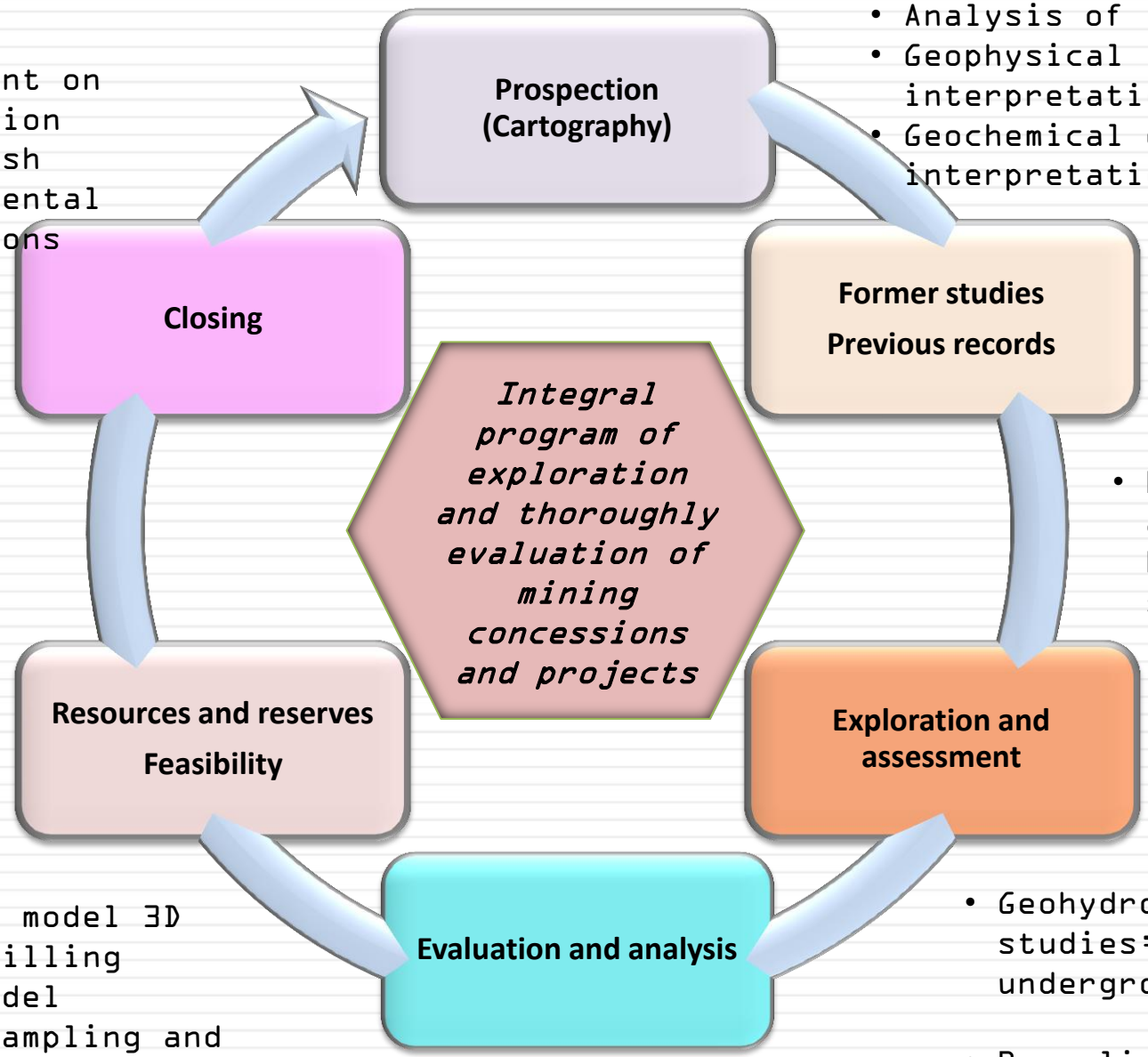
PROSPECTIVE LOCALITIES

Geological, geochemistry and geophysical interpretation are used to identify new **prospective areas** aimed for detailed exploration. Most of the actual mines started as a single prospect.

More than 700 localities were suggested between 2007 and 2015. From those, more than 80 became a government exploration target and, eventually, an allotment.



EL REFUGIO AREA



- Analysis of information
- Geophysical interpretation
- Geochemical data interpretation

- Environmental Requirements

- Geohydrological studies; underground water
- Base line considerations

- Geological model 3D
- Diamond drilling
- Deposit model
- Logging, sampling and spectrometry

- Assessment on restitution
- Accomplish environmental regulations

EXPLORATION TECHNOLOGY

- *Geoinfomex* database
- Hyperspectral images

- Aerial and ground geophysics

- *FRX analysis*
- Digital collector (*Mapamóvil*)
- Spectral Field lectures

- Aerial support

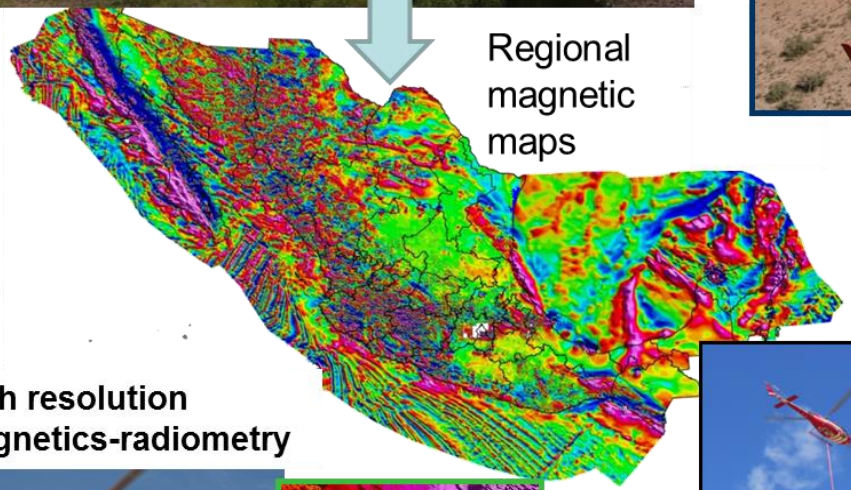
- Isotopic data
- *Well logging (16 probes)*

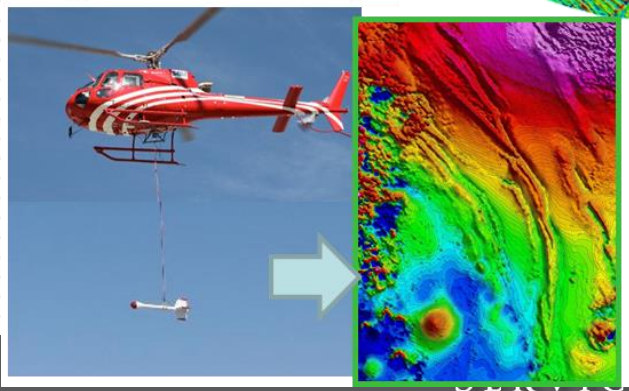
- *Electronic microscope and probe*
- *Information and technology support*

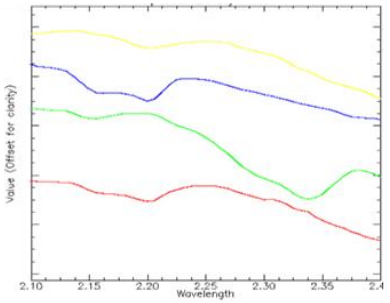
- *Modeling software for evaluation of mineral deposits*
- *3D imagery*

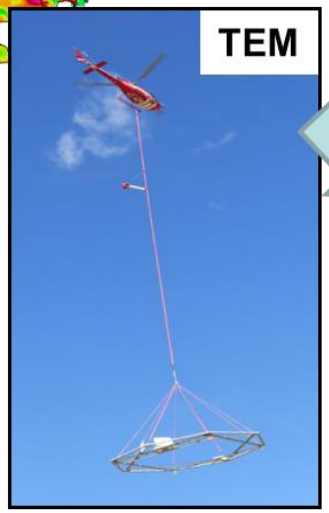
- *Organic petrography*
- Metallurgical testing

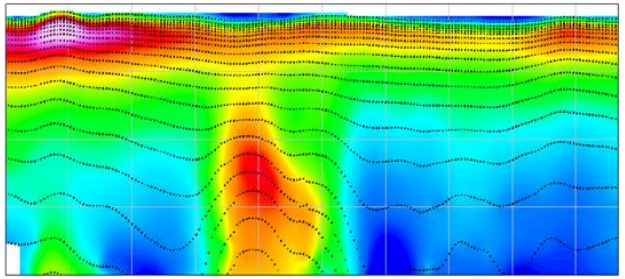
Indirect methods: airborne geophysical surveys



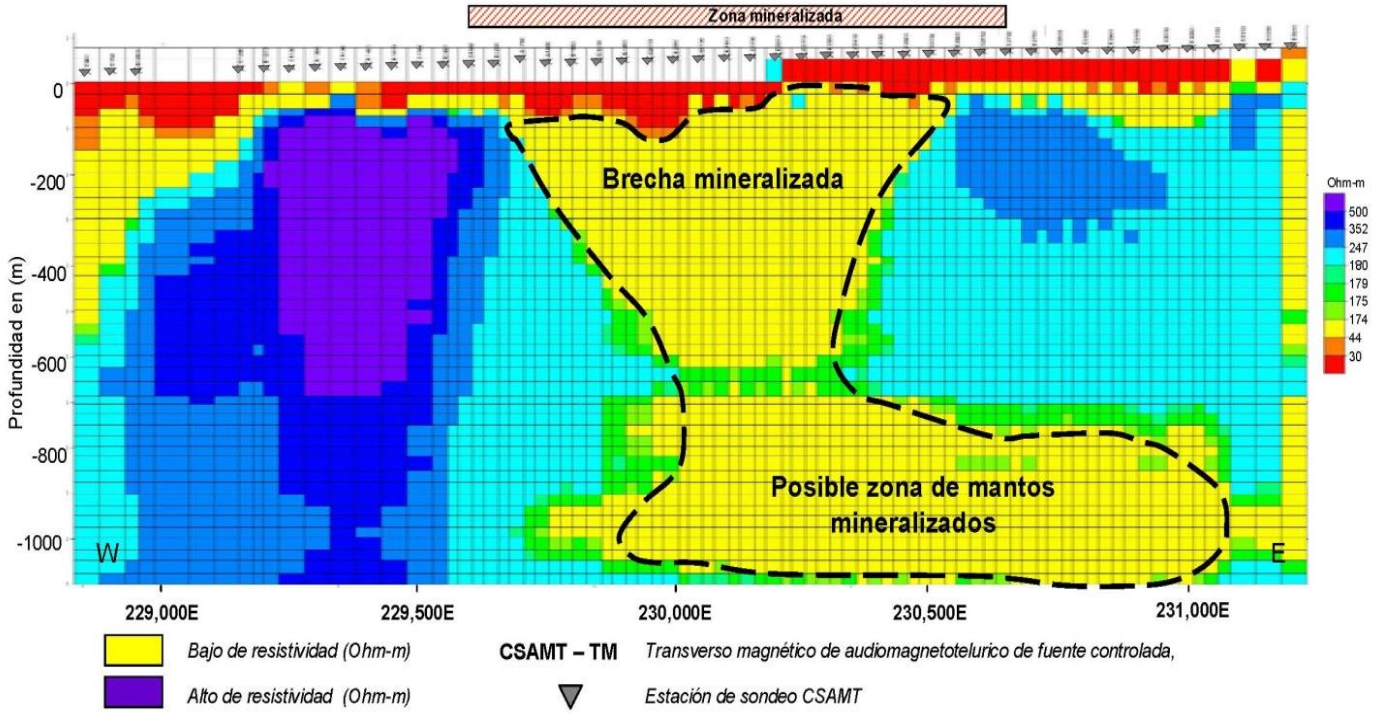








GEOPHYSICAL RESPONSES, GROUND



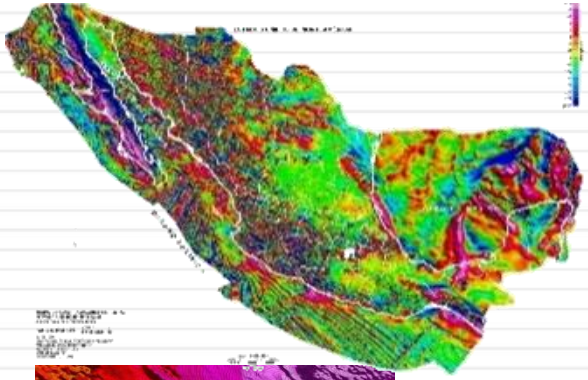
Gamma ray spectrometer BGO

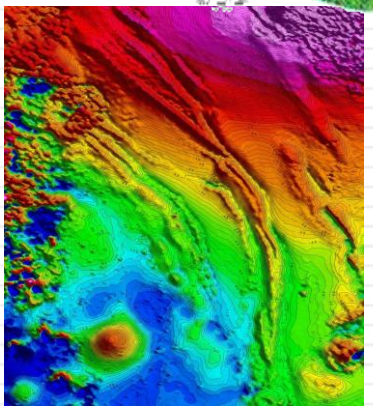
IP receptor

Gravimeter CG_5

GEOTHERMAL SOURCES

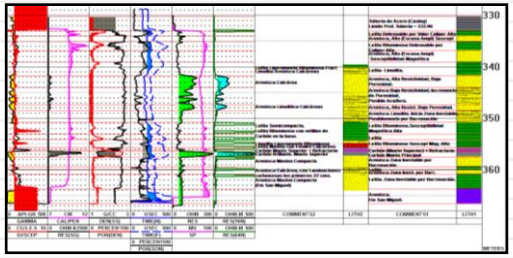
PROJECTS IN MEXICO	METHODS	SURFACE
Acoculco, Puebla	Ground TEM	780 km
	AMT Search	780 km
Los Negritos, Michoacán	Magnetic, airborne (Ground TEM& ATM)	6,000 km
El Molote, Nayarit		7,234 km
Caldera de la Reforma, B.C.S.		5,000 km
Cerro Prieto, B.C.		2,903 km
Los Azufres, Michoacán		2,330 km
Los Humeros, Puebla		2,713 km



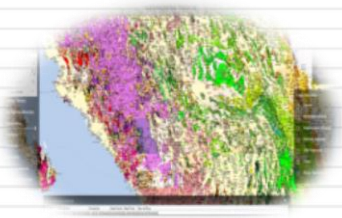


GEOTHERMAL PROJECTS

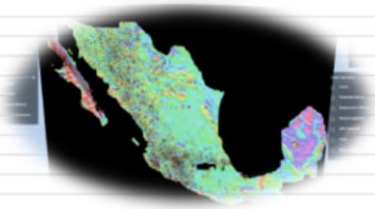
- To keep supporting exploration with electromagnetically search TEM and ATM, extending operation to areas such like *Chichonal*, state of Chiapas .



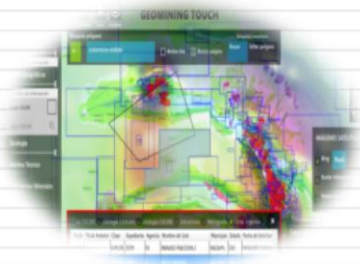
WELL LOGGING



GEOLOGY, GEOCHEMISTRY



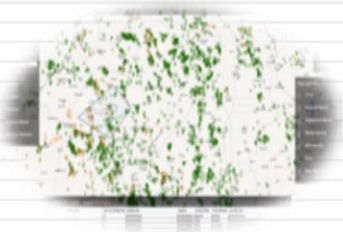
GEOPHYSICS



GRANTED CONCESSIONS DGRM

ENVIRONMENTALLY PROTECTED AREAS

Geo InfoMEX®



MINING OPERATIONS

TECHNICAL REPORTS

SATELLITE IMAGERY

LAND TENURE

GEOINFOMEX IS THE SGM'S GEOLOGICAL SCIENCES DATABASE ALLOWING TO SEARCH ON THE RICHNESS AND *GREAT EXPECTATIONS* OF THE NATURAL RESOURCES WITHIN MEXICAN TERRITORY..

AN IDEAL ASSISTANT TO VISUALIZE INTERACTIVELY GREAT AMOUNTS OF DATA WITH A SOLELY TOOL.

SHALL INVESTORS AND RESEARCHERS COUNT WITH IT TO TAKE IMPORTANT DECISIONS.

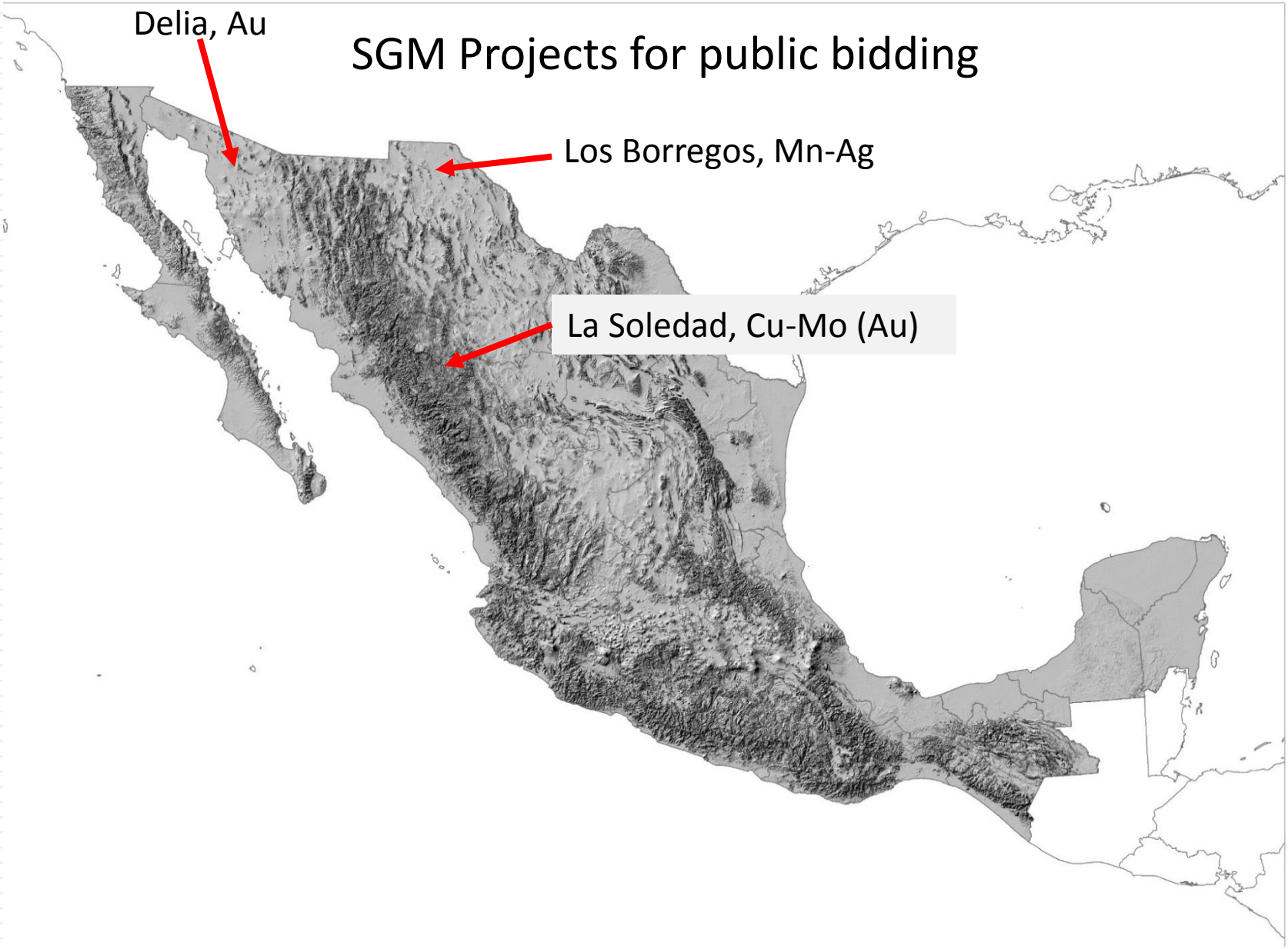
MAYBE THE MOST IMPORTANT DECISIONS OF THEIR LIVES, WHO KNOWS…

BENEFITS

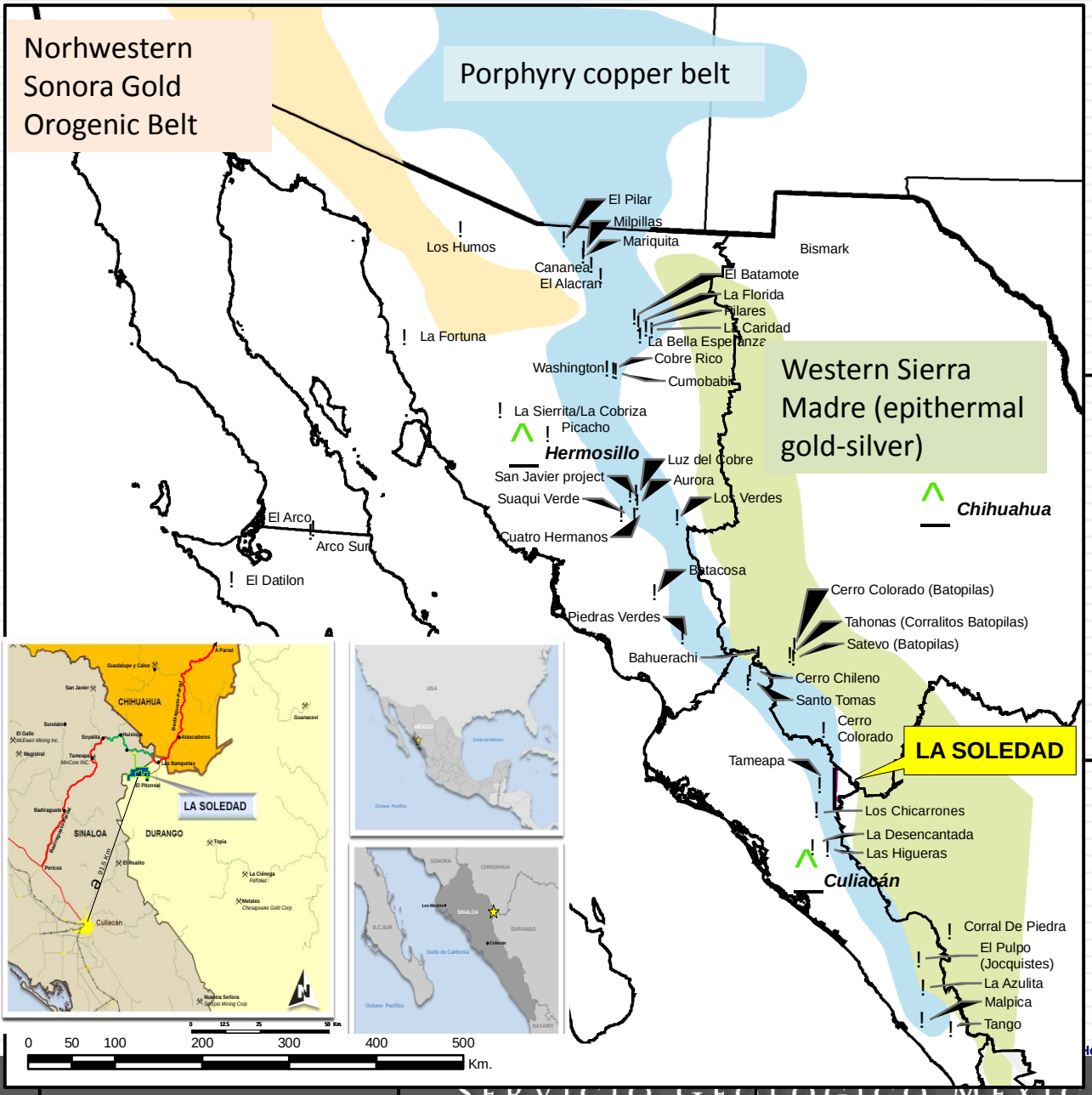
- AVAILABILITY OF DATA
- SPEED QUERY
- SAVE TIME AND MONEY
- MAKES LIFE EASIER

GEOINFOMEX ®
A BANK THAT MANAGES NOT MONEY BUT INFORMATION, VERY VALUABLE INFORMATION INDEED

SGM Projects for public bidding



La Soledad (6,059, hectares)



La Soledad is located within a belt of porphyry copper type deposits as in the blue strip. West and 33 km of the *Tameapa* Prospect where *MinCore* has estimated 3.6 billion pounds of equivalent copper.

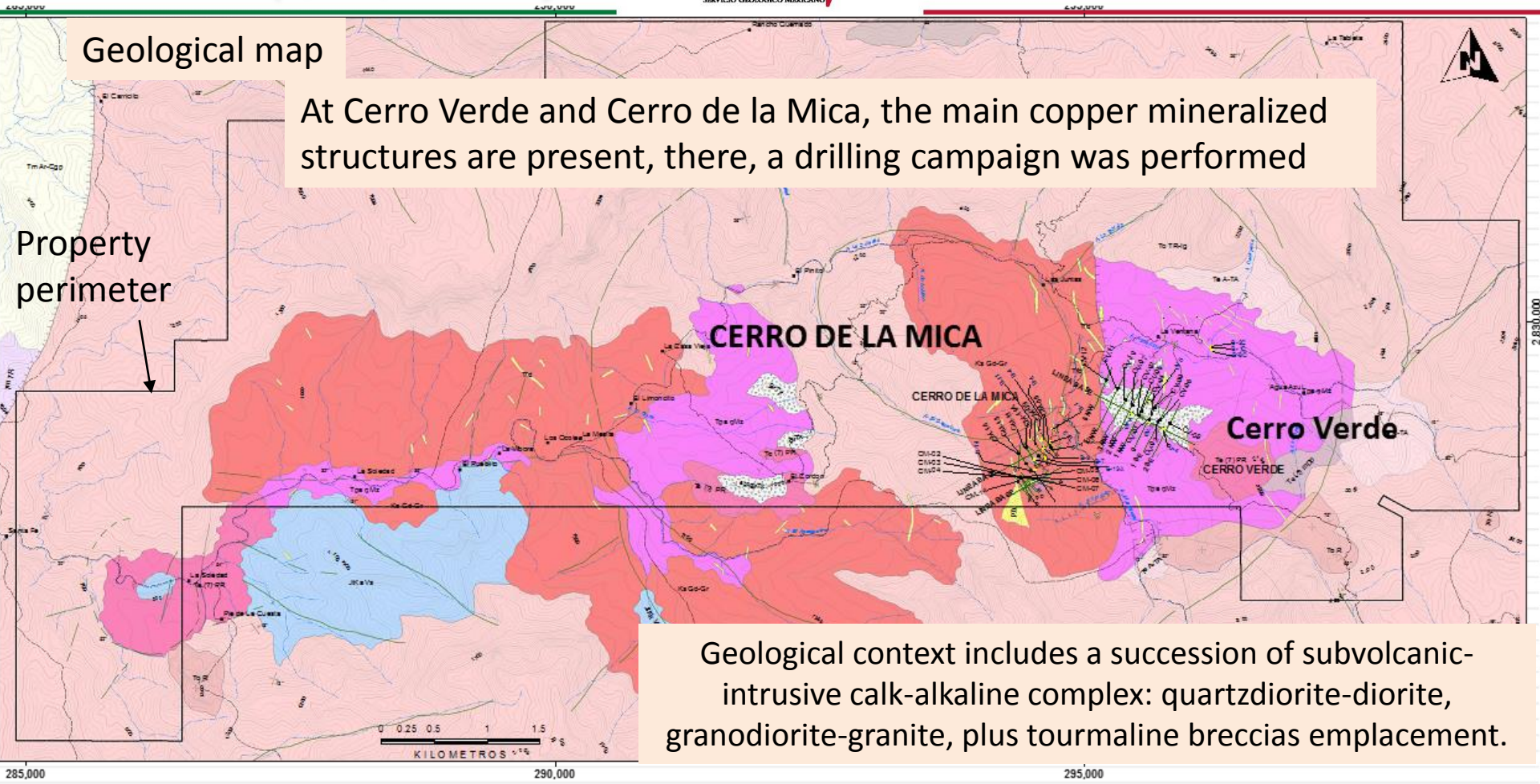
This copper belt runs from Arizona to Sonora and Sinaloa. It includes the next important copper deposits: Santo Tomas (Cuchicari), Los Chicharrones, Malpica, La Azulita, Piedras Verdes, Suaqui Verde, La Caridad, Cananea and Milpillas,

La Soledad (6,059, hectares)

Geological map

At Cerro Verde and Cerro de la Mica, the main copper mineralized structures are present, there, a drilling campaign was performed

Property perimeter



Geological context includes a succession of subvolcanic-intrusive calk-alkaline complex: quartzdiorite-diorite, granodiorite-granite, plus tourmaline breccias emplacement.

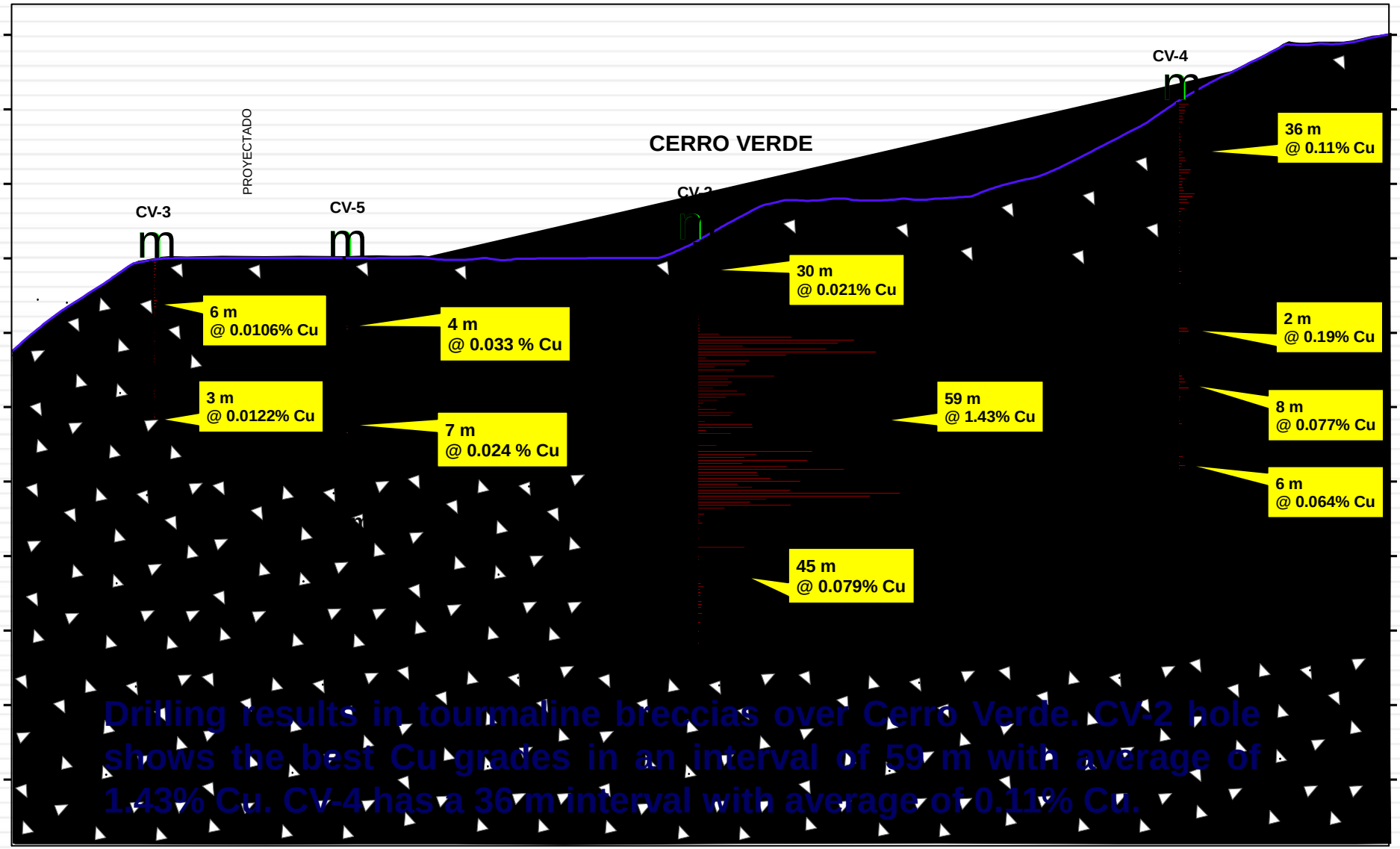
Cu-Mo Tourmaline breccias (270 million pounds of copper; 30 million pounds equivalent of molybdenum). In process for a next bidding.

Vertical flow in quartz diorite. Notice the copper staining along the fractures

Pegmatite basement at *Cocoyome Creek*

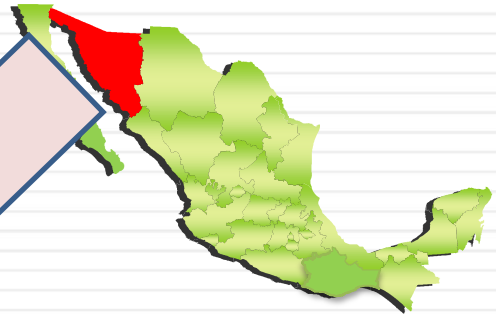
Detail of the pegmatite, old workings and Mo staining in *Cerro de la Mica*

La Soledad (6,059, hectares)



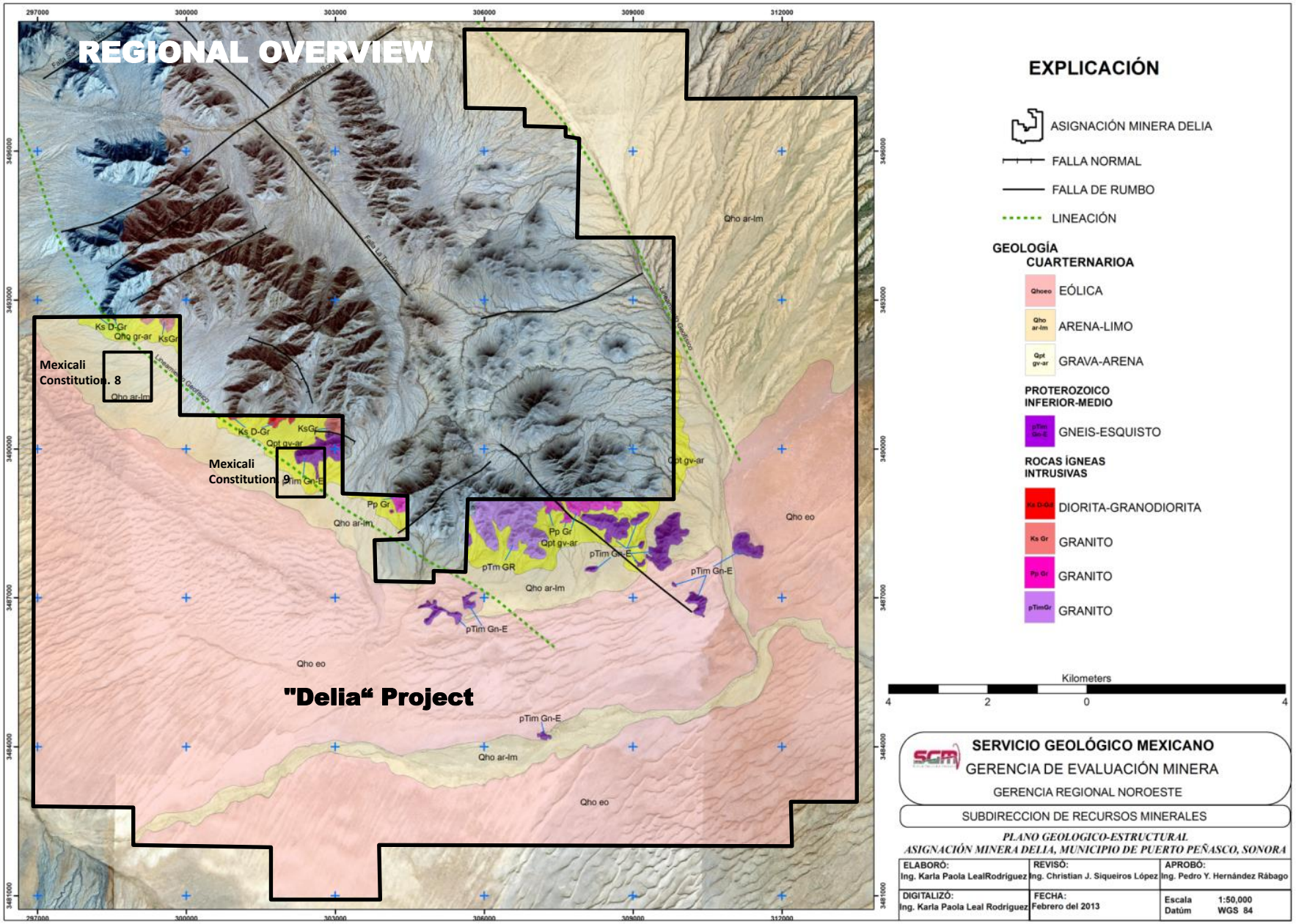
Drilling results in tourmaline breccias over Cerro Verde. CV-2 hole shows the best Cu grades in an interval of 59 m with average of 1.43% Cu. CV-4 has a 36 m interval with average of 0.11% Cu.

Delia (15,170 hectares)

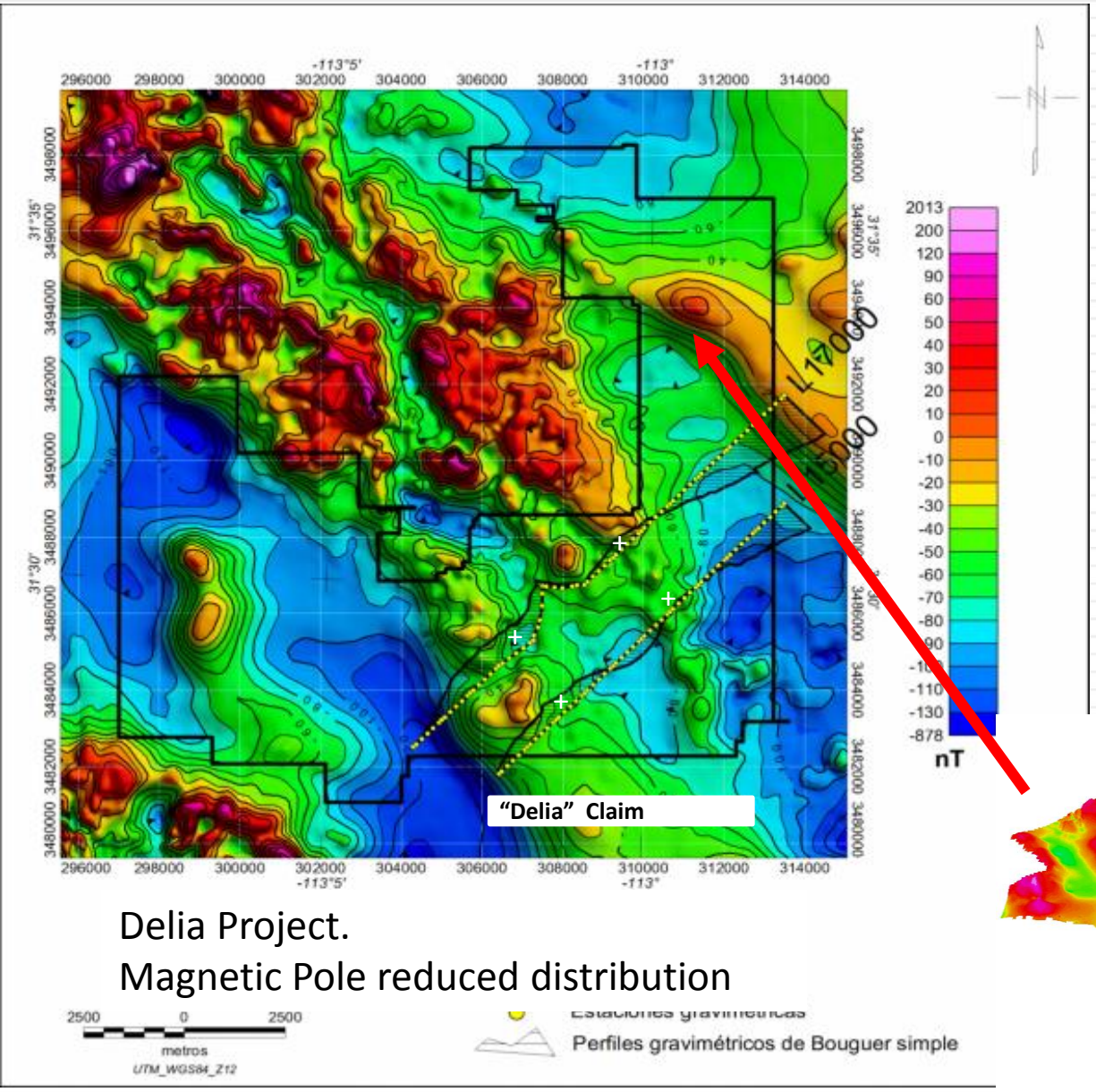


- Located at the NW portion of Sonora State, in the Municipality of Puerto Peñasco and General Plutarco Elías Calles.
- 328 km NW of Hermosillo City, and , 70 km NE of Puerto Peñasco, Sonora.
- Paved and unpaved roads in good conditions.
- The closest international airport locates at Hermosillo City.
- Located in the geological sheets Los Norteños H12-A23, Sierra Pinta H12-A33, 1:50,000 scale, and Puerto Peñasco H12-1:1:250,000 scale.

Delia (15,170 hectares)



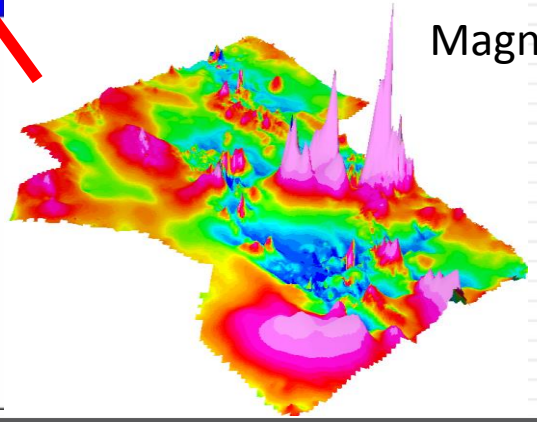
Delia (15,170 hectares)



Delia Project.
Magnetic Pole reduced distribution

Magnetic anomalies show NW-SE structural alignments of the intrusive and metamorphic magnetic rocks, both on surface and subsurface, particularly at the southeast of the Claim.

At northeast corner a clear elongated NW-SE magnetic high appears. The anomaly is related to schist-gneiss sequence interpreted underneath the alluvial deposits, similar to the one occurring *La Herradura* gold deposit.



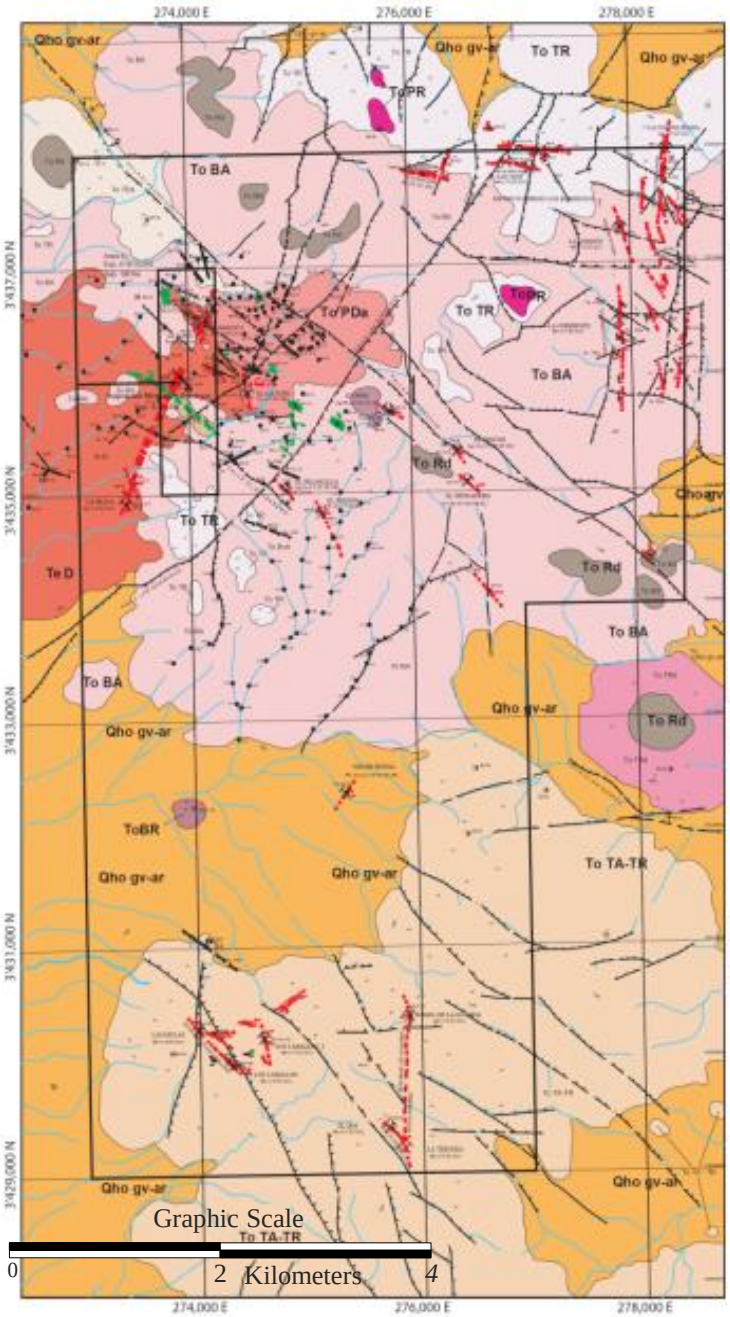
Magnetic profile

Los Borregos (4,100 hectares)

- Located in the state of Chihuahua, Northern Mexico.
- Away 294 km northwest of Chihuahua.
- It has an area of 4,100 hectares.
- Extreme dry climate with summer rains.

***La Consolidada* vein; brecciated material with fragments of manganese and some hematite**

Los Borregos (4,100 hectares)



QUATERNARY
HOLOCENE

Qho gv-ar	Gravel-Sand

TERTIARY
OLIGOCENE

To Rd	Rhyodacite
To RT	Rhyolite tuff
To RB	Rhyolite Breccia
To Rd T	Rhyodacite tuff
To AT-RT	Andes fe Tuff-Rhyolitic Tuff
To AB	Andesitic Breccia
To A	Andesite

EOCENE - OLIGOCENE

To RP	Rhyolite Porphyry
To DaP	Dac fe Porphyry
T e D	Diorite

Outcrops andesite and rhyolitic tuff; diorite and rhyodacite subvolcanic Oligocene-Miocene forming a volcanic field in which extensive parallel *en echelon* fault system oriented N-S and NW. probably Miocene or younger, hoist 77 Mn-Ag, Ba and Fe veins .

Into the area, 8 prospects were documented over an area of 7 km long per 5.5 km. Mineralization occurs as cryptomelane manganese oxides, psilomelane, hollandite, pyrolusite-associated with hematite, argentiferous galena, malachite and barite.

Manganese and iron oxides are primarily exposed in the zone of supergene enrichment, and may expect some sulphides of silver, lead, zinc and copper can begin to appear deep.

The district has been productive since World War I and II, with an average grade of 30% Mn; by 1959 and in the 70s, production declined and became intermittent, with average grades of 22% Mn. Old dumps reported from 4 to 37% Mn and from 8 to 109 g/t Ag, traces of molybdenum and up to 11% barite.

Thank you so much for your kind attention

It is everybody's responsibility to apply the very *best practices in mining* so the **equilibrium** persists in the planet we were assigned to live (and care…)

GEOLOGY SERVING MEXICO
(AND THE WORLD)