



AEROMAGNETIC ANOMALIES OF INTRUSIVE ROCKS ASSOCIATED WITH MINERAL DEPOSITS IN SEDIMENTARY ENVIRONMENT OF THE NORTHEASTERN MEXICO

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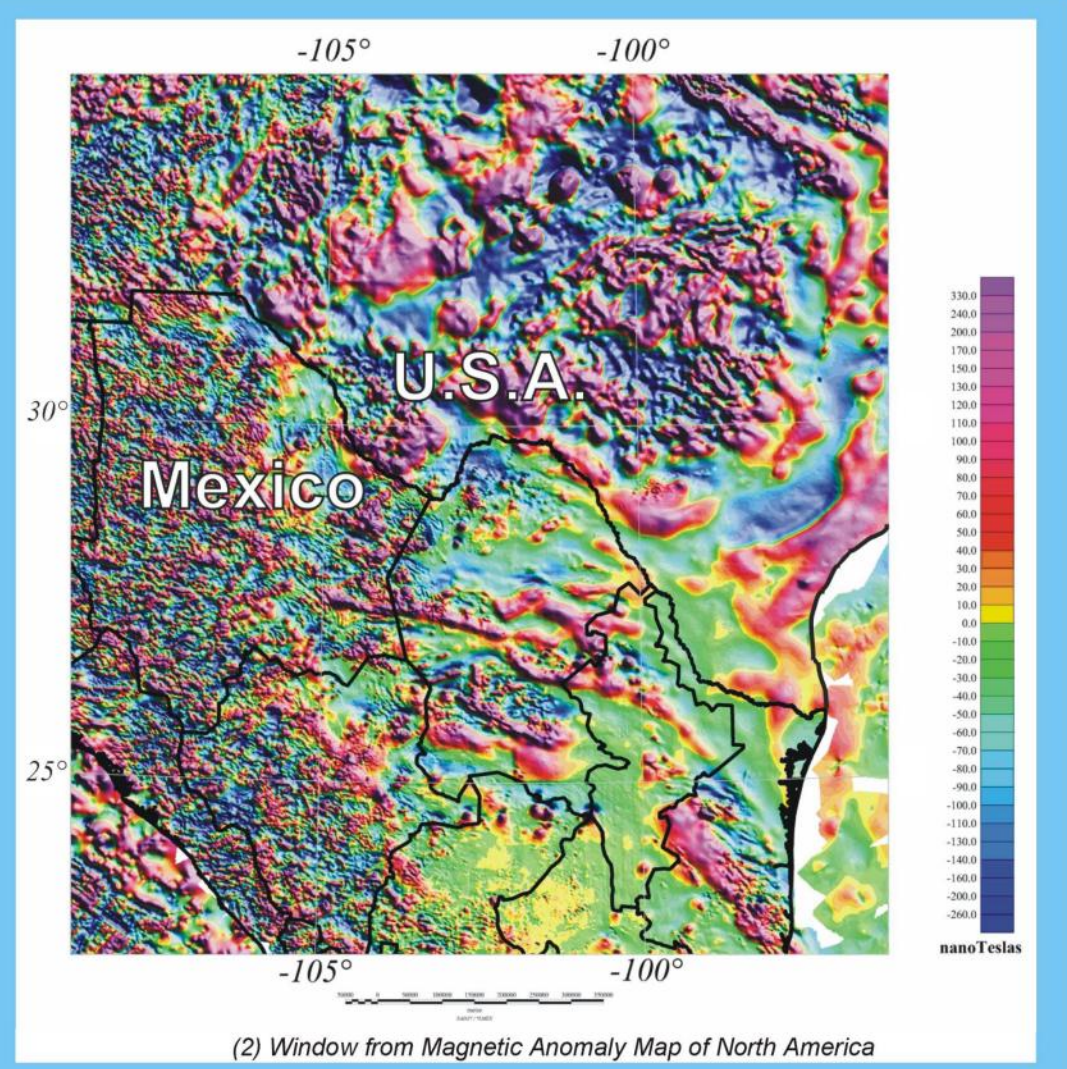


Consejo de Recursos Minerales



(1) Location Map

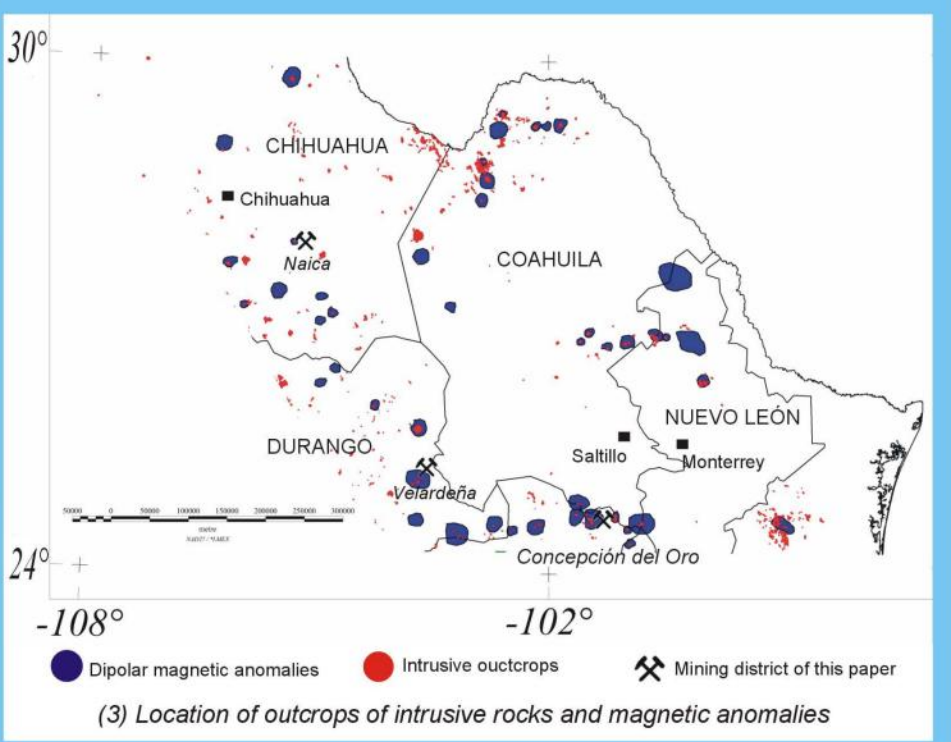
The Geological Survey of Canada, United States Geological Survey and Consejo de Recursos Minerales concluded the integration of the digital magnetic anomaly into a database for the North American continent, which is useful for many geological applications; one of this is the investigation of the mining resources associated with intrusive igneous rocks in sedimentary environment of the Mesozoic geological provinces.



(2) Window from Magnetic Anomaly Map of North America

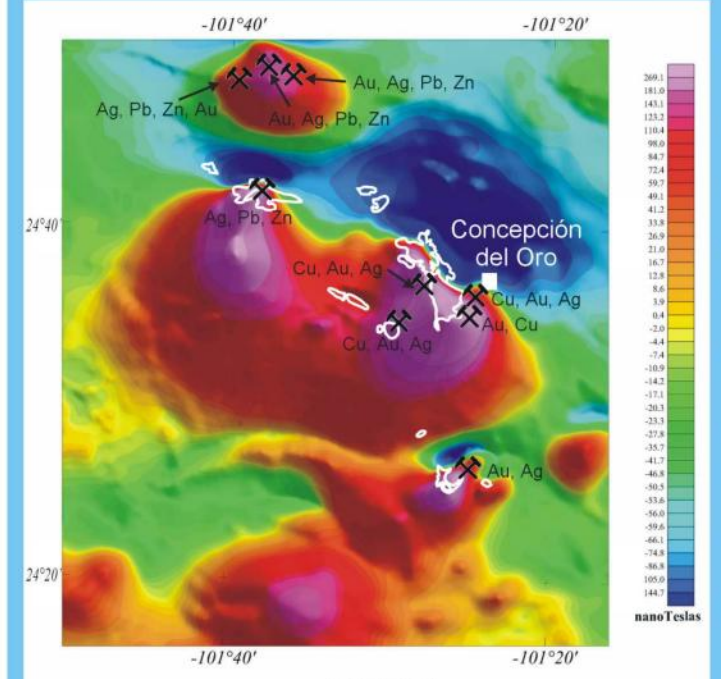
The area of this work is located to the northeast Mexico where a sedimentary marine environment of Jurassic - Cretaceous age mainly exist; a close correlation is observed among intrusive igneous rock outcrops and dipolar magnetic anomalies; some examples of these are the dipolar magnetic anomalies at Concepcion del Oro Zac., Velardeña Dgo. and Naica Chih. mining districts with skarn type ore deposits containing Pb, Zn, Cu, Ag, and Au in the contact zone (Megaw, et al, 1988).

The group of Mesozoic and Tertiary granitic intrusive rocks of the northeastern Mexico are emplaced surrounding the Coahuila basement block (Lehmann, et al, 1999). As show in the figure 3, there is a gap of intrusive rocks in the central portion of the Coahuila state, the aeromagnetic anomalies probably are due to the igneous - metamorphic rock of the basement of the Coahuila block (Gilmer, et al, 1988)



(3) Location of outcrops of intrusive rocks and magnetic anomalies

CONCEPCION DEL ORO DISTRICT



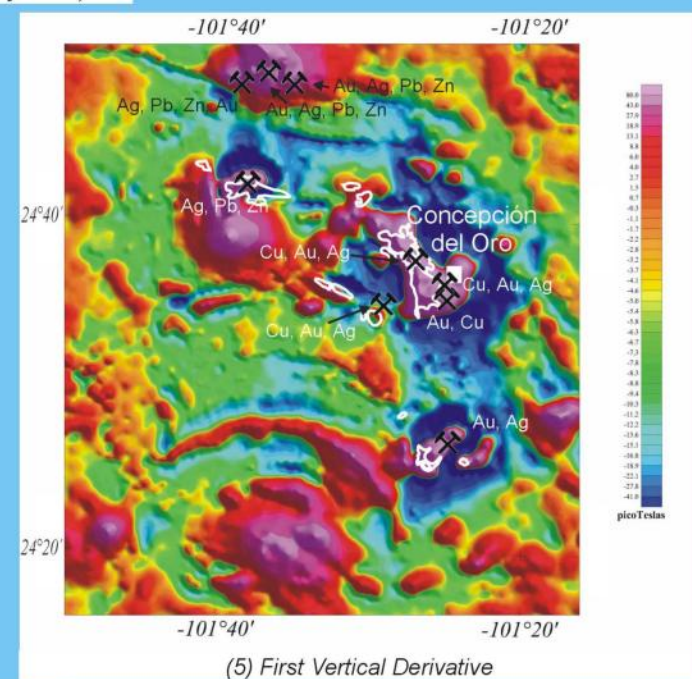
(4) Total magnetic field anomaly (white lines show contacts of intrusive - sedimentary rocks)

The Concepcion del Oro mining district in the northeast of Zacatecas state is an example of the application of the digital magnetic database in the exploration of high temperature skarn type ore deposits through the identification of the response of the granitic intrusives.

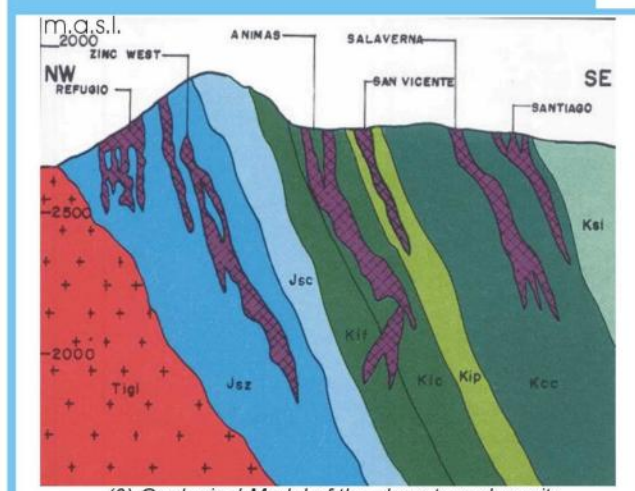
The total magnetic field anomaly show a dipolar normal anomaly which is due to the presence of intrusive rocks under surface.

(Figure 4)

When we separated the magnetic response due to shallow bodies from the deeper bodies, applying a first vertical derivative we can see a good correlation among the magnetic highs and the intrusive outcrops. (Figure 5)



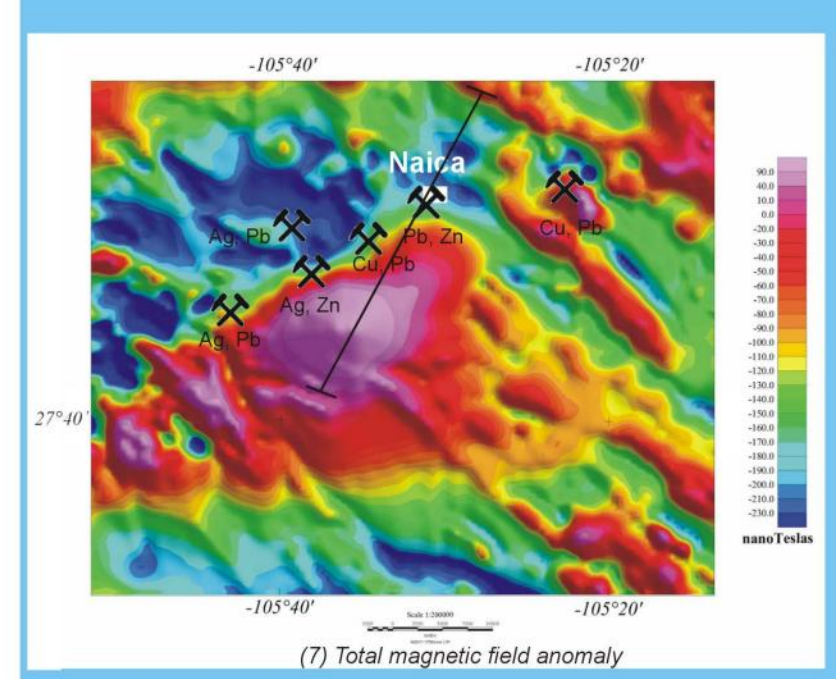
(5) First Vertical Derivative



(6) Geological Model of the skarn type deposits, Concepcion del Oro District.

Geological model at Concepcion del Oro district, show skarn type mineralization occurring in mantos, chimneys and veins of Cu, Pb, Zn, Ag, in the carbonate host rock close to the contact with the granodioritic intrusive.

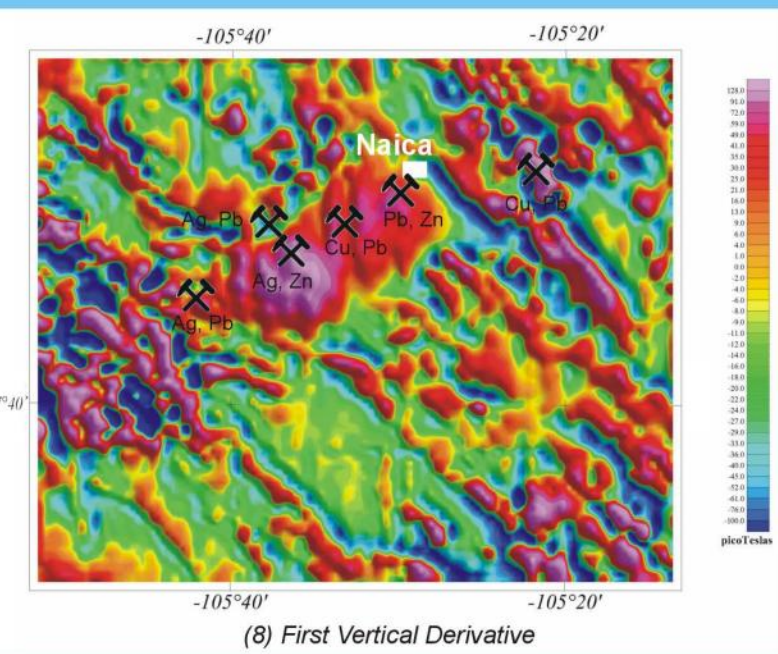
NAICA DISTRICT



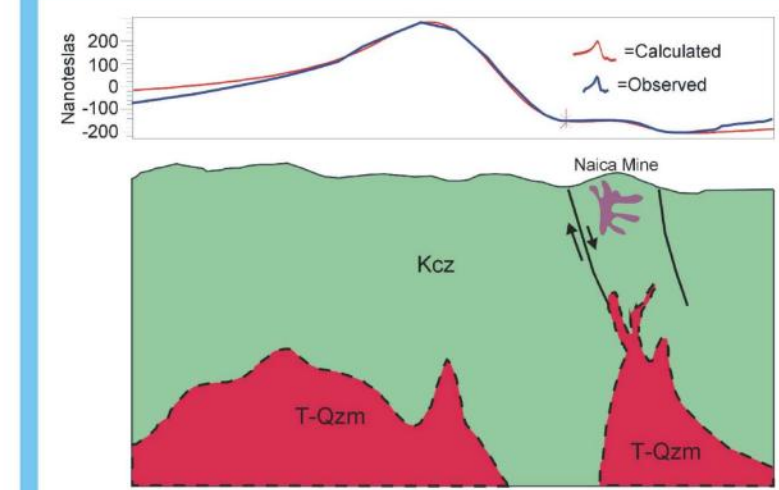
(7) Total magnetic field anomaly

This is other example of sulfide orebodies associated with intrusive rocks hidden under marine sedimentary rock. It is located at the boundary of the Coahuila basement block of Permian - Triassic age (Lehmann, et al, 1999). Here there is not evidence of intrusive outcrops, the total magnetic field anomaly show a typical response of an intrusive rock.

When the first vertical derivative is applied, N-S trends cutting the main anomaly and regional NW-SE trends of magnetic anomalies are seen, probably due to faults or folding in the sedimentary rocks. The largest anomaly corresponds to the top of the granodioritic body under the anticline structure of the sedimentary rocks (figure 8).



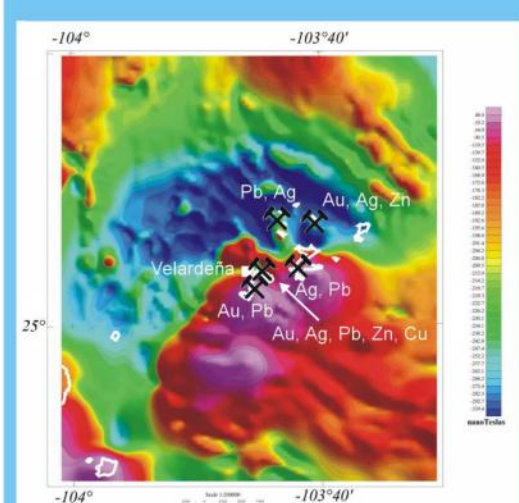
(8) First Vertical Derivative



(9) Geological - Geophysical Model of the skarn type deposits, Naica District

As geological - geophysical model show, the Naica district is a skarn type ore deposit mineralized, with structures like mantos, chimneys and veins; the skarn contain Pb, Zn, Cu, Ag and Au (Figure 9).

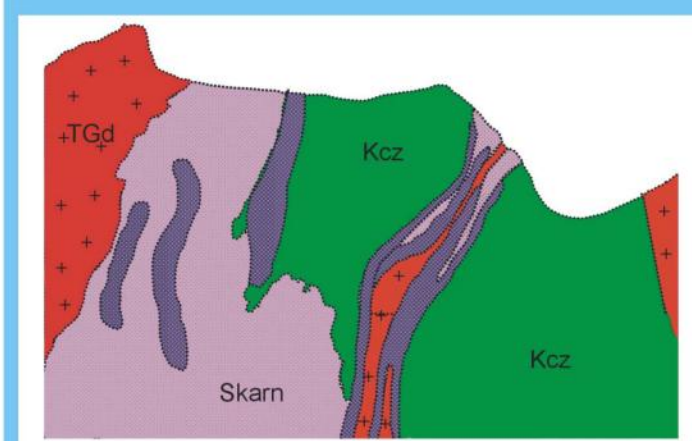
VELARDEÑA DISTRICT



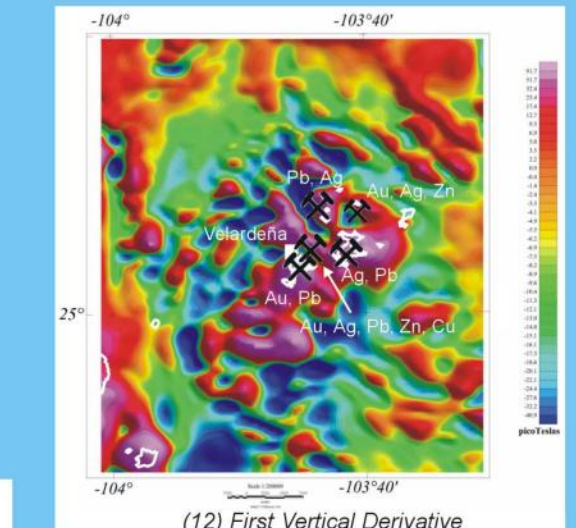
(10) Total magnetic field anomaly (white lines show contacts of intrusive - sedimentary rocks)

This is located in the northeastern portion of the Durango state at the Sierra Santa Maria. The total magnetic field anomaly similar to the others examples show a magnetic dipole, the size of this anomaly suggest the boundaries of the intrusive rock under surface. In the central portion of the anomaly there are some small outcrops of a granodioritic stock. (De Santiago, et al, 2000)

The first vertical derivative applied to this anomaly gives many magnetic high anomalies which some are located over intrusive rocks outcrops, others have not correlation and could be target for follow up works.



(11) Geological Model of the skarn type deposits, Velardeña District



(12) First Vertical Derivative

The mineralization occurs as pyrrhotite-sphalerite-calcopyrite skarn replacement in calcareous rocks proximal to the contact of the granodioritic stock with the carbonate rocks of cretaceous age.

CONCLUSION

Airborne magnetic database is a powerful tool in investigate carbonate - hosted mineral deposits in the contacts zone of intrusive igneous rocks with the Jurassic - Cretaceous sedimentary rock sequences, in the search for economic skarn, mantos and chimney type mineral deposits in the northeastern Mexico

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