Using Airborne Gamma-Ray Spectrometry Exploration to Accelerate Geological Mapping in Greenfield Areas of Northern Canada

Volkan Tuncer, M.Sc., P.Geoph.
TerraNotes Ltd, Edmonton AB
Volkan.terranotes@gmail.com

Lei Sha, M.Sc., P. Geoph.
TerraNotes Ltd. Edmonton AB
lei.terranotes@gmail.com

Fatih Doğan, PhD. Physics
TerraNotes Ltd. Edmonton AB
fatih.terranotes@gmail.com

Julien Lambert, B.A.; GDM
Terranotes Ltd. Edmonton AB
terranotes@gmail.com

Summary

This study shows that ternary composite imaging from airborne gamma-ray spectrometry survey data can be used to prepare lithology maps with very little geological information.

Introduction

Airborne Gamma-Ray Spectrometry (AGRS) exploration measures the equivalent Uranium (eU), equivalent Thorium (eTh) and Potassium (K) content of the near surface. These are very common radioelements found in varying amounts in different type of rocks.

It has been shown that the composite images of the three AGRS radioelements are comparable to geological lithology maps in several geographical districts.

Theory/Method

In this study we researched and developed an approach to accelerate geological mapping in Greenfield Areas of Northern Canada using airborne AGRS. This approach consists of the combination of the following techniques:
1) an automatic technique without any priory information, and,
2) a hierarchical classification technique with priory information.

The first technique combines the three radioelements (eU, eTh, and K) in a statistical manner and defines the relative abundances of those radioelements at each data location. The results

of this technique are illustrated using composite ternary imaging procedures. We were able to distinguish felsic Quartz Feldspar Porphyry (QFP) areas from mafic areas.

The second technique's goal was to complement the visual interpretation of ternary maps with more quantitative measurements. We developed a quantitative method to establish the relationship between the rock samples and their radioactivity content acquired from the airborne system. Modeling was used to quantify the radiometry signatures and rock samples were used to classify the radiometry data.

Conclusion

This approach allowed us to extract a maximum of relevant information from the AGRS data and extend the primary geology maps beyond areas where the geology is not known.

Acknowledgements

TerraNotes and I would like to acknowledge the research and development contribution for this study from the following agencies:

1. National Research Council Canada (IRAP)
2. Alberta Ingenuity Fund (now Alberta Innovates Technology Futures)

And finally, we would like to thank to GeoScience 2010 for accepting our abstract and giving us the opportunity to share our study's findings with you.

References

Dickson B.L. and K.M. Scott, 1997, Interpretation of aerial gamma-ray surveys – adding geochemical factors, *AGSO Journal of Australian Geology & Geophysics*, 17, 187-200.

Duval J.S., 1983, Composite color images of aerial gamma-ray spectrometric data, *Geophysics*, 48, 722-735.

Martelet G., C. Truffert, B. Tourliere, P. Ledru and J. Perrin, Classifying airborne radiometry data with Agglomerative Hierarchical Clustering: A tool for geological mapping in context of rainforest (French Guiana), *International Journal of Applied Earth Observation and Geoinformation,* 8, 208-223.

Shives, R.B.K., Charbonneau, B.W., Ford, K.L., 1997, The detection of potassic alteration by gamma-ray spectrometry - recognition of alteration related to mineralization; in "Geophysics and Geochemistry at the Millenium", Proceedings of the Fourth Decennial International Conference on Mineral Exploration (Exploration 97), September, 1997.