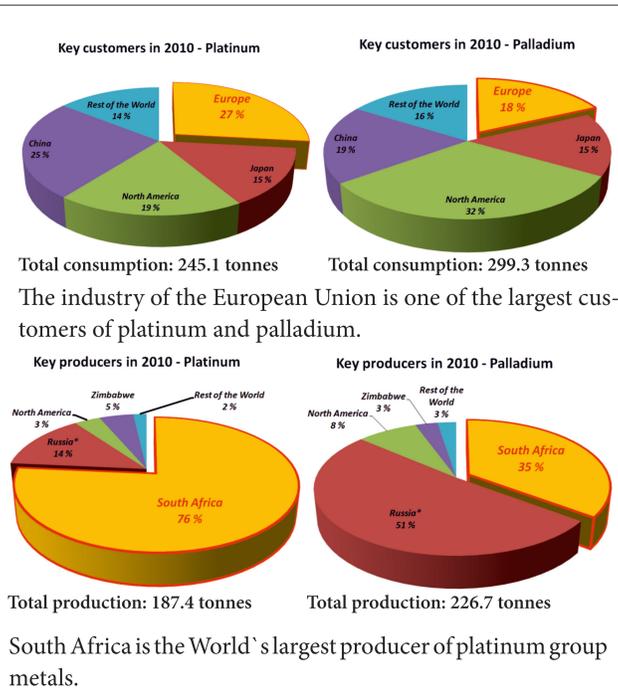


Ore Geology Research to Support Exploration for New Primary Resources of Platinum Group Metals in Magmatic Systems

Ferenc Molnár Geological Survey of Finland, Espoo, Bedrock Geology & Resources, Finland

Christoph Gauert University of the Free State, Bloemfontein, Economic Geology & Exploration Geochemistry, South Africa

Economic Importance of Platinum Group Metals: Production and Consumption

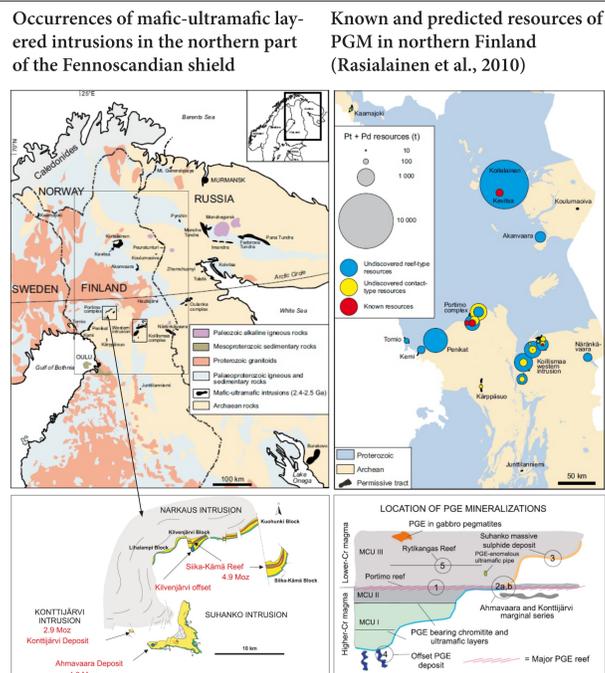


Key Scientific Problems Targeted by the Proposed Collaborative Ore Geology Research

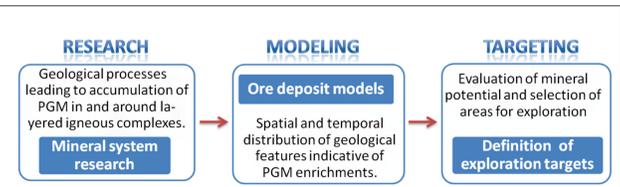
Layered igneous complexes and their ores are results of dynamic magma chamber processes which are often highly influenced by the magma-country rock interactions. Better understanding of these processes is needed for the development of new efficient exploration models and tools. The major aspects of the proposed comparative ore geology research, which is based on the proper combination of traditional analytical methods with new cutting edge analytical techniques, are as follows:

- key processes in dynamic magmatic systems leading to formation of PGM enriched reefs.
- role of the magma/country rock interaction in localization of high concentrations of PGM ores.
- the effect of the syn- and post-magmatic fluids in formation of high PGM concentrations in and around layered complexes
- application of transitional metal stable isotopes paired with sulphur isotope studies for achieving deeper insight into processes leading to the formation of PGE enriched ores
- definition of geological vectors pointing towards to the zones of PGM enrichments and applicable in mineral exploration

Occurrences of PGM in Finland and Assessment of Undiscovered Deposits



The expected number of undiscovered contact- and reef-type PGM deposits is 29 and 23, respectively. Offset type deposits are also known and some of them are economic around other layered igneous complexes in North America (Molnár, 2013). Finland has a great potential to increase known resources of PGM and for becoming an important supporter of the European industry. Achieving this goal requires exploration for new resources on the basis of new geological concepts and models.



Layered magmatic complexes are the most important primary resources of PGM and they are also economically important sources of nickel, copper, cobalt, chromium, titanium and vanadium. Comparative studies between the world class PGM producing magmatic complexes of South Africa and layered complexes in Finland provides a unique opportunity for development new geological concepts and models applicable to the exploration for primary resources of these metals.

Major PGM Deposits in South Africa

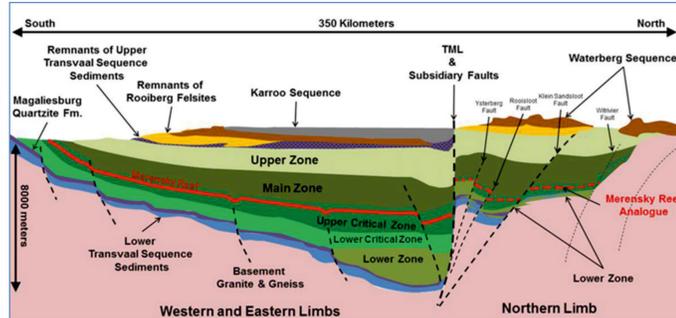
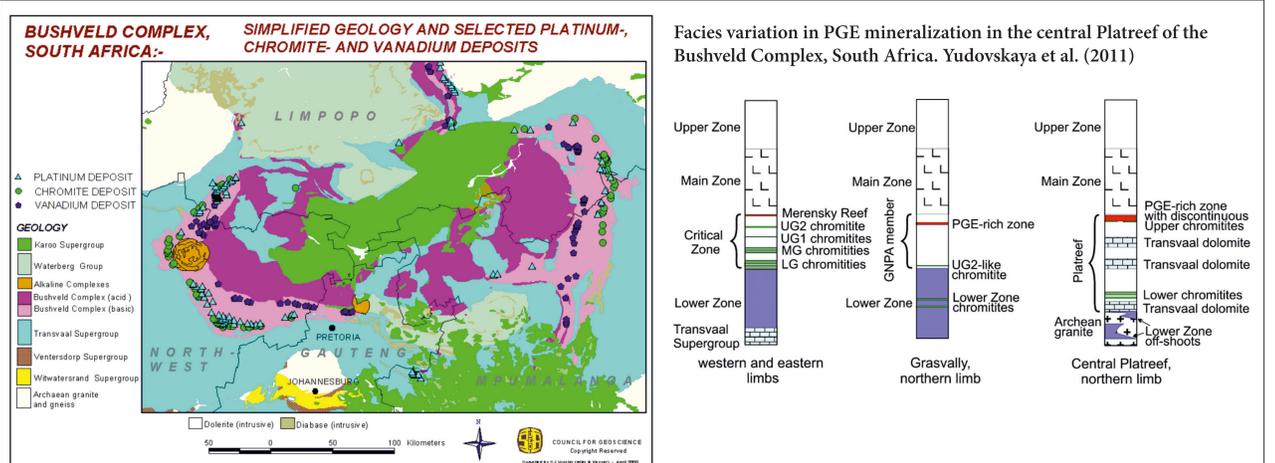
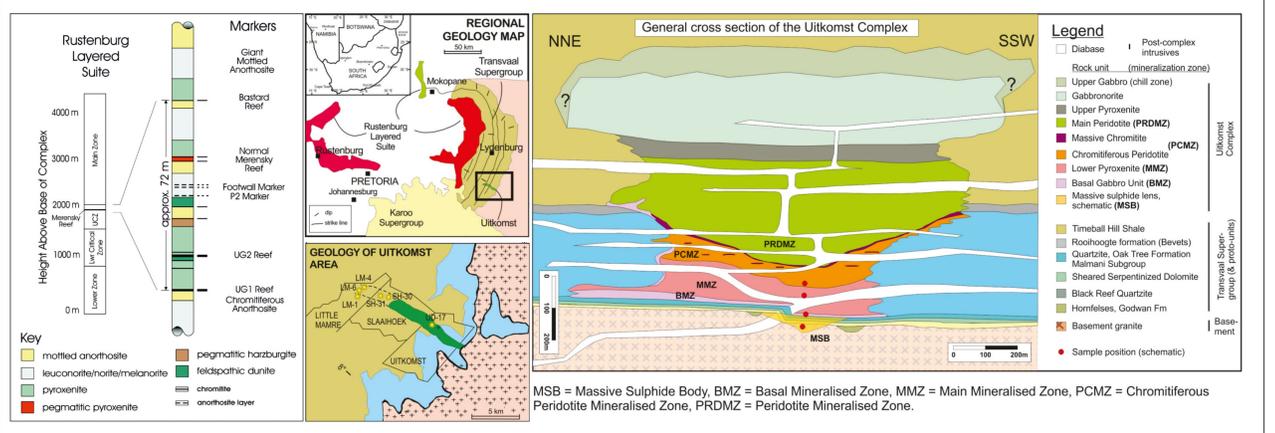


Figure courtesy Ivanhoe, 2012; modified after Kruger, 2005. Figure is schematic and not to scale. Section line illustrated is shown on Figure 7.1.

South Africa has still potential to increase known resources of PGM e.g. Platereef, fig. above) and will be the main supplier of PGE world-wide also in the future. To exploit this mineral wealth sustainably requires exploration for new resources on the basis of new geological concepts and models. Besides geometallurgical studies, metallogenic models have to be refined especially for the understanding of satellite complexes or for marginal situations of layered intrusions with country rock contamination.



References

- Ilijina, M., 2007, The Suhanko-PGE prospects and the Portimo layered intrusion. Geol. Surv. Finland, Guide 54, 27-44.
- Molnár, F., 2013, Pt-Pd-Au-rich sulphide ores in footwalls of layered mafic-ultramafic igneous complexes. Geol. Surv. Finland, Rep. Investtig. 198, 121-125
- Rasilainen, K., Eilu, P., Halkoaho, T., Ilijina, M., Karinen, T., 2010, Quantitative mineral resource assessment of platinum, palladium, gold, nickel and copper in undiscovered PGE deposits in mafic-ultramafic layered intrusions in Finland. Geol. Surv. Finland, Rep. Investtig., 180, 338 p.
- Yudovskaya M., Kinnaird J., Naldrett A.J., Mokhov A., McDonald I., Reinke C. 2011. Facies variability of PGE mineralization at the Central Platereef, Bushveld Complex. Canadian Mineralogist, 49, 1349-1384