

the great relief of South African Bushveld mining companies, no other area or example better typifies the statement that 'grade isn't everything'.

It is for these reasons that many papers presented at the conference focused on documentation of the platinum group mineralogy in a great many different settings. Dealing with grains, typically about 0.001 cm across, and present at grades of 2 g t<sup>-1</sup>, is an extremely challenging occupation. Academic studies presented on such minerals provide information on how the PGEs could be initially concentrated in the rocks, and by contrast, their counterparts in exploration are intent on getting them back out again!

## A Global Inventory

The section above indicates that there are unlikely to be any changes in worldwide PGE production in the short term. In an address at the meeting, the Director of the U.S. Geological Survey, Dr Charles G. Groat, had two themes. His first observation was aimed largely at those people who suggest that oil deposits are running out. He pointed out that commodities were not necessarily running out, it was simply that a global inventory was not available, but that with a global village mentality there would always be suppliers. Second, and arising from this view, was the decision that the U.S. Geological Survey would be conducting a cooperative international global programme to assess the undiscovered nonfuel mineral resources, and that platinum would be among the first group of commodities to be assessed. This plan is ambitious, and a comprehensive evaluation is expected to take seven to ten years.

This writer feels that the first conclusion should be applied with some caution to the platinum market. There is no other commodity in the world that remotely matches the PGEs for their uneven worldwide distribution. However quickly new targets are identified and brought to fruition, their contribution will be minor compared to the Bushveld Complex (2) and Noril'sk areas. No other commodity is so dominated by so few suppliers. Given the reserve and resource figures currently available, the Bushveld (mainly platinum) and Noril'sk (mainly palladium) areas will continue

to supply 80 to 90 per cent of the world's platinum and palladium for the foreseeable future.

The 10th symposium in this series is expected to take place in Finland in 2006. It will then be interesting to see how far towards viable commercial operation some of the sources mentioned at the 9th symposium will have come. The conference website is [www.platinumsymposium.org](http://www.platinumsymposium.org).

## References

- 1 R. P. Schouwstra, E. D. Kinloch and C. A. Lee, *Platinum Metals Rev.*, 2000, 44, (1), 33
- 2 R. G. Cawthorn, *S. Afr. J. Sci.*, 1999, 95, (11/12), 481

## Addendum

Geologically inclined readers may wish to obtain a recent summary of PGE deposits worldwide, "The Geology, Geochemistry, Mineralogy and Mineral Beneficiation of Platinum-Group Elements", edited by L. J. Cabri, (Special Volume 54), Canadian Institute of Mining, Metallurgy and Petroleum, Montreal, 2002; website: [www.cim.org](http://www.cim.org).

## The Author

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## Recyclable Ruthenium-BINAP Catalysts

Ryoji Noyori has been involved in asymmetric homogeneous hydrogenation for over thirty years. His work in this important area has resulted in catalysts with high selectivity and wide application (T. J. Colacot, *Platinum Metals Rev.*, 2002, 46, (2), 82–83). Among catalysts he has helped to develop is Ru-BINAP, (BINAP = 2,2'-bis(diphenylphosphino)-1,1'-binaphthyl) which, as Ru(II)-BINAP dihalide complexes, provides a versatile general asymmetric hydrogenation of functionalised ketones.

Now, scientists from China have synthesised dendritic Ru-BINAP catalysts that are peripherally alkyl-functionalised (G.-J. Deng, Q.-H. Fan, X.-M. Chen, D.-S. Liu and A. S. C. Chan, *Chem. Commun.*, 2002, (15), 1570–1571). These catalysts can be used for asymmetric hydrogenation in an ethanol/hexane reaction medium. Acids: 2-arylacrylic, 2-phenylacrylic and 2-[*p*-(2-methylpropyl)phenyl]acrylic used for model reactions had high catalytic activity and enantioselectivity. Phase separation was induced by adding a small amount of water. The hexane catalyst-containing layer can be removed for reuse.