

gear shift linkage in the existing floor hump.

The vehicle was successfully operated over the 50,000 mile test and the particulate emissions were within the 0.2 grams per mile regulations, as determined by the Federal Test Procedure. A selection of the results obtained is given in Table II, and Figures 8 and 9. It will be observed that in addition to the marked reduction in particulate emission there was also a significant reduction in gaseous hydrocarbons, carbon monoxide and odour emissions throughout the test.

Work is now continuing to improve still further these catalytic filter systems.

The work described in this article formed the subject of a SAE Technical Paper, No. 820184, at the recent International Congress and Exposition of the Society of Automotive Engineers, Detroit, Michigan, February 22–26, 1982. The paper "Catalytic Control of Diesel Particulate" presented there by Bernard E. Enga, Miles F. Buchman and Ivan C. Lichtenstein was supported by references and contains much detailed test data.

## A Definitive Work on the Mineralogy of the Platinum Group Elements

**Platinum-Group Elements: Mineralogy, Geology, Recovery, CIM Special Volume 23.**  
EDITED BY L. J. CABRI, The Canadian Institute of Mining and Metallurgy, Montreal, 270 pages, \$40

A considerable amount of new information on the geochemistry and mineralogy of the platinum group elements has been presented in numerous articles published over the last ten to fifteen years. Now the first comprehensive reference source has been produced, based on data compiled up to 1981.

The essential aspects of thermodynamics and inorganic chemistry, and their relevance to an understanding of the geochemistry of the platinum group elements is given. A collection of information on the phase relationships of the platinum metals with those elements which are considered to be mineralogically significant, and their importance in acting as geochemical collectors are exemplified and discussed. Dr. Cabri has carried out an exacting task in identifying, characterising and collating nearly one hundred minerals, and he includes a critical assessment of the base metal minerals which are reported to contain minor quantities of platinum group elements. Of equal relevance to the platinum producers are the chapters devoted to sample preparation and analytical techniques.

The relative importance of the different types of ore, with respect to platinum group element production and resources, are discussed in some detail. The largest and most important deposits occur in the Bushveld Complex of Southern Africa. These consist of the Merensky Reef, the UG<sub>2</sub> chromitite layer and the Platreef, which together are estimated to contain total platinum group element resources

of some  $60 \times 10^6$  kg—sufficient to satisfy foreseeable needs for many years to come. Most of the current production comes from the Merensky Reef, where the platinum group metals are the major product. Despite the large variation in the mineralogy of the Reef the platinum : palladium ratio is consistent at 2.5, while mine head grades for total platinum group elements are 6 to 8 grams per tonne. The other major deposits are the Noril'sk-Talnakh combine in Siberia, U.S.S.R., and the Sudbury district of Canada. In both cases the platinum group elements are by-products from the copper-nickel sulphide mines and have much lower platinum : palladium ratios; at Noril'sk it is 0.4. Most of the information on the recovery of the platinum metals is concerned with beneficiation techniques and their relationship to the mineralogy of different ores.

Inevitably in a book of this nature there is some duplication of material, however the index is sufficiently detailed to enable readers with differing interests to locate appropriate information. References are given at the end of each chapter.

In addition to providing an excellent and much needed compilation of data on the geochemistry and mineralogy of the platinum group elements, which will be a definitive work for years to come, the volume also demonstrates that there is still considerable debate on the genetic relationships of the platinum group elements, and it helps to define areas for future research.

J.G.D.