

As expected from the above results if R" is a carboxyl group, basic tertiary amines bring about a catalytic reaction (10). For example, 5-phenyl-2,4-pentadienoic acid is obtained in over 90 per cent yield from bromobenzene and 2,4-pentadienoic acid as given in **D**, page 62.

Vinyllic halides also react with dienes but in the absence of nitrile or carboxyl substituents, secondary amines are required which produce tertiary allylic amines and cause catalytic reac-

tions. Terpene derivatives have been produced by this reaction (11). An example is given in **E** on the previous page.

These few examples illustrate the extraordinary ability of palladium to produce carbon-carbon bonds selectively. Since these reactions often cannot be achieved as easily in other ways, palladium catalysis should become a useful addition to the synthetic methods available to the organic chemist.

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Catalyst Availability

The following five U.S. Patents have been granted on various aspects of the technology outlined in this article by Professor Richard F. Heck: 3,922,299; 1975, 3,960,932; 1976, 3,988,358; 1976, 4,128,554; 1978 and 4,175,187; 1979

Licensing is available through Johnson Matthey Inc. For further information and experimental samples of catalysts contact Dr. Ernest Gore, Johnson Matthey Incorporated, 1401 King Road,

West Chester, PA 19380, U.S.A. (Telephone 215/648-8000). Quotations for commercial size quantities are available.

In addition to the reactions described above, compounds of the type Pd(PR₃)₂Cl₂ have many other catalytic uses, for example, hydrosilylation, synthesis of long chain carboxylic acids and esters, and the addition of alkyl and aryl halides to alkynes. Further information is available on request.

A Possible New Mining Area for Rustenburg

The major commercial platinum metals deposits in South Africa occur in the enormous geological formation known as the Bushveld Igneous Complex. Since their discovery in the 1920's these deposits have become increasingly important and they now form the principal source of platinum metals for the Western World. In addition these are the only deposits primarily worked for platinum, thus the mines located on them are able to respond most rapidly to an increase in demand for the metal.

Continuing its exploration of the Bushveld Igneous Complex as part of its evaluation of possible future mining areas, Rustenburg

Platinum Mines reports that particular emphasis is being placed on the so-called Merensky Platereef of the Potgietersrust district that was originally mined in the 1920's. Prospecting results to date indicate that this area has the potential for supporting a major new platinum, nickel and copper mine.

Indications are that this wide ore-body might be exploitable by open-cast methods at working costs below those of conventional underground mining, but much work remains to be done in evaluating this deposit, particularly as its metallurgical characteristics differ from those of the deposits mined in current operations.