The Molecular Structures of Bis-(o-dimethylarsinophenyl)methylarsinecopper–Manganese Pentacarbonyl, Triphenylgermanium–Manganese Pentacarbonyl, and Triphenylphosphinegold–Cobalt Tetracarbonyl

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THE recent syntheses of many compounds containing bonds between different metal atoms,[1] which are not joined in any other way *e.g.* by bridging groups, has shown the need for direct

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[1] E. Coffey, J. Lewis, and R. S. Nyholm, *J. Chem. Soc.*, **1964**, **1741**; A. S. Kasenally, J. Lewis, A. R. Manning, J. R. Miller, R. S. Nyholm, and M. B. Stiddard, *J. Chem. Soc.*, **1965**, **3407**; A. S. Kasenally, R. S. Nyholm, and M. H. B. Stiddard, *J. Amer. Chem. Soc.*, **1964**, **86**, 1884.

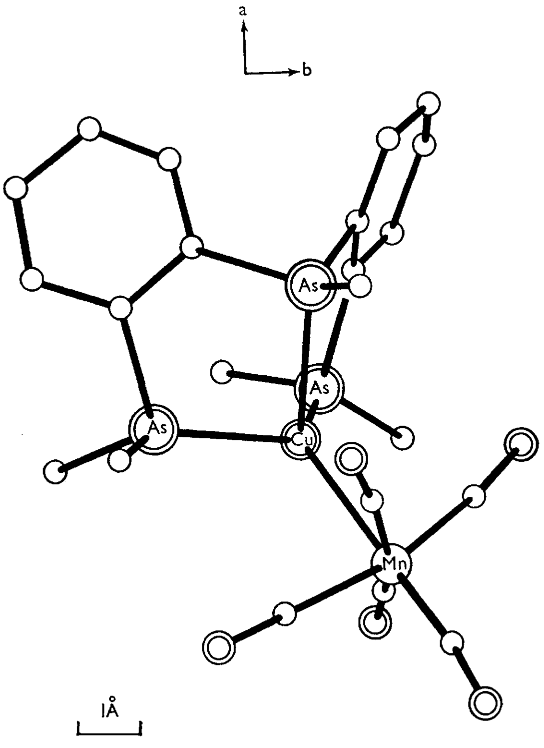
structural information about these compounds. Accordingly the three compounds described in the title have been crystallographically examined and their structures solved by Patterson and electron-density maps, and refined by the least-squares method.

The tritertiary arsine ligand, bis(*o*-dimethylarsinophenyl)methylarsine (TTAs)[2] forms a complex with copper(I) bromide which will react with sodium pentacarbonylmanganate to form TTAs–copper-manganese pentacarbonyl.[3] This compound crystallizes in the space group $P2_1/c$ with $a = 11{\cdot}19$, $b = 18{\cdot}90$, $c = 12{\cdot}38$ Å, $\beta = 92{\cdot}8°$, $Z = 4$. The present R-value for the 1300 photographically observed reflections is 10·7% (refinement with anisotropic parameters).

The figure shows one molecule viewed down the *c*-axis. The distorted tetrahedral configuration about the central copper atom is evident as is also the displacement of the four carbonyls out of the equatorial plane around the manganese atom and towards the copper atom. The bonding of the triarsine to the copper is such that the arsenic atom linking the two benzene rings is about 0·1 Å further from the copper atom than the other two arsenics. The distances are 2·46 ± 0·01 Å for the long bond, and 2·33 and 2·36 ± 0·01 for the other two bonds. The copper–manganese distance is 2·56 ± 0·01 Å.

Triphenylgermanium-manganese pentacarbonyl, prepared[4] as described by Seyferth,[5] crystallizes in the space group $P\bar{1}$ with $a = 11{\cdot}38$, $b = 11{\cdot}66$, $c = 17{\cdot}17$ Å, $\alpha = 105{\cdot}0°$, $\beta = 97{\cdot}8°$, $\gamma = 91{\cdot}2°$, $Z = 4$. The present R-value, for approximately 3000 observed reflections, is 12% (refinement with isotropic thermal parameters). The two crystallographically distinct germanium–manganese bonds have lengths of 2·54 and 2·53 ± 0·02 Å.

Triphenylphosphinegold-cobalt tetracarbonyl[1] also crystallizes in the space group $P\bar{1}$, with $a = 9{\cdot}76$, $b = 13{\cdot}10$, $c = 10{\cdot}82$ Å, $\alpha = 108{\cdot}9°$, $\beta = 110{\cdot}0°$, $\gamma = 62{\cdot}9°$, $Z = 2$. The present R-value for the 1760 observed reflections is 12·4%. The cobalt atom is five co-ordinate with a trigonal bipyramidal arrangement of ligands, the three equatorial carbonyls being displaced out of the equatorial plane and towards the gold atom. The gold–cobalt distance is 2·50 ± 0·02 Å.



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[2] R. G. Cunninghame, R. S. Nyholm, and M. L. Tobe, *J. Chem. Soc.*, 1964, 5800.

[3] A. S. Kasenally and R. S. Nyholm, personal communication.

[4] E. Coffey and R. S. Nyholm, personal communication.

[5] D. Seyferth, H. Hofmann, R. Burton, and J. Helling, *Inorg. Chem.*, 1962, **1**, 227.