



GEOFFREY E. COATES

Geoffrey Edward Coates: an Appreciation

Geoffrey Coates was born in London on the 14th May 1917, and, unusually, both of his parents were chemists. When 3 years old he moved to Swansea where his father, J.E. Coates was for many years Professor of Chemistry. Geoffrey was educated at Clifton College, Bristol, and in 1935 he was awarded a scholarship to Queen's College, Oxford where he graduated with First Class Honours in Chemistry in 1939. His first research was with Dr. L.E. Sutton at Oxford and was concerned with thermochemistry and dipole moment studies on aromatic organic compounds.

The onset of the war resulted in his abandoning research work at Oxford and up to 1945 he was attached to the research department of the Magnesium Metal Corporation in Swansea. There he developed an interest in electrochemistry, and his early papers included a determination of the standard electrode potential of magnesium and studies on the acid and alkaline corrosion of magnesium and its alloys.

At the end of the war he was appointed to a lectureship in inorganic chemistry at the University of Bristol (1945–1953), and it was at this stage, possibly influenced by earlier contact with N.V. Sidgewick, that he turned to organometallic and coordination chemistry. This was about the time that ideas on the electron deficient bonding of pre-transition metal alkyls were being formulated and the role of ligands, such as phosphenes, capable of accepting π -electrons in back-bonding in conferring stability on transition metal–carbon σ -bonds were being investigated. It was also the period in which the structure of ferrocene was put forward and Hein's mysterious chromium polyphenyls were interpreted in terms of sandwich structures. Thus for most metals it seemed that their organo derivatives posed exciting problems for accepted theories of structure and bonding, and in many cases there was the additional challenge that chemical studies required considerable experimental finesse, using techniques developed by Stock and Schlenk among others. This combination of structural novelty and refined experimentation was, I believe, the reason for Geoffrey Coates's lifelong interest and dedication to organometallic-type chemistry. Others have been smitten in the same way and for the same reason.

At Bristol his work was largely concerned with organo derivatives of beryllium and gallium, but it also included some transition metal complex chemistry. Perhaps one might single out his work on dimethylberyllium which Rundle, in one of the earliest X-ray crystal structures of an organometallic compound, had shown to be an infinite 2-dimensional polymer and which Coates demonstrated could be broken down into small molecular units by reaction with a variety of Lewis bases. Among the weaker Lewis bases studied was the foul-smelling dimethyltellurium, which even contaminated the typescript of the paper submitted to the Chemical Society to such an extent that it was rapidly returned with the comment that "it stinks". Exposure

of the pages to bromine vapour cured the smell and the paper was duly published.

Between 1953 and 1968 Geoffrey Coates was Departmental Chairman and Professor of Chemistry at the University of Durham; this must be counted the most creative and productive part of his career. When he was appointed the chemistry department had few facilities for research (other than in radiochemistry) and very poor teaching laboratories. Before he left it had, largely thanks to his personal endeavours, one of the best designed chemistry departments in the country, incorporating many features that might with advantage have been more widely copied elsewhere. As Head of chemistry his attitude towards younger staff was to give them help and support without inhibiting their independent scientific development. Perhaps he acquired this enlightened attitude to running a department from Professor W.E. Garner when he was at Bristol. In this way he built up a diversified and highly productive department at Durham.

This was the period in which physical methods for studying structure became increasingly available and Coates's work benefited immensely from a close collaboration with the late H.M.M. Shearer. It is a matter of some regret that reports of crystal structures were not incorporated into the papers or published soon after. This situation has now been remedied by Dr. N.A. Bell who has worked systematically through the thesis material by Dr. Shearer's students, so that most of the crystal structures on compounds prepared by Coates and his collaborators have been published during the past 3-5 years. Some of the most interesting chemistry was concerned with the formation and structural characterisation of coordination polymers formed by Cu-, Ag-, and Au-alkynyls and their Lewis base complexes. Other papers from this period were concerned with the chemistry of structurally interesting organo derivatives of magnesium, gallium, indium, and thallium and of zinc, cadmium and mercury; in particular one thinks of the cubane-type structures produced by compounds such as $(\text{MeZnOMe})_4$. However for most of us Coates will be thought of for his contributions to the organo and coordination chemistry of beryllium. One of the attractions of having such a light metal as beryllium in the molecule is that commonly it has proved possible to locate the positions of hydrogen atoms by X-ray crystallography. This chemistry has produced many unusual and sometimes unexpected structures, often resulting from the steric requirements of organo or other ligands present. His studies of neutral and anionic beryllium hydride complexes in which two Be-H-Be bridges are often present has been particularly productive. As an illustration of the interdependence of preparative and crystallographic work, the complex $[(\text{CH}_3\text{C}\equiv\text{C})_2\text{BeNMe}_3]_2$ was shown to contain two independent molecules, both centrosymmetric dimers with a 4-membered Be-C-Be-C ring. The structures imply that in one case the bridging $\text{CH}_3\text{C}\equiv\text{C}$ groups function as 1-electron donors and in the other they are closer to acting as 3-electron donors.

In 1968 Coates left Durham to become Head of the Chemistry Department of the University of Wyoming at Laramie and there his work was devoted exclusively to beryllium, both its organo and coordination chemistry. Here he discovered what appear to be examples of cyclometallation reactions between R_2Be and azomethanes of the type $\text{PhCH}=\text{NBu-t}$, and the formation of a cubane-type molecule as the product of the reaction between RbOBu-t and BeEt_2 . In 1979 he took early retirement from the University of Wyoming owing to ill health, but it is pleasing to report that the latter proved to be a passing phase.

Throughout his career Coates devoted much time to the affairs of the Chemical Society and to writing review articles, but he will be most remembered for the three versions of his textbook on Organometallic Chemistry. The original was published in 1956 with an extensive revision in 1960. In 1967 it appeared as a highly authoritative two volume work with M.L.H. Green and K. Wade. Although now due for further revision it remained the prime textbook on organometallic chemistry for some 20 years, and was translated into a number of languages.

Geoffrey Coates has a distinctive manner that sometimes conceals the warmth of his personality. Among his many virtues is his great breadth and depth of knowledge of chemistry quite outside his own research interests, and his willing and enthusiastic discussions of other peoples' research problems. As a lecturer he was outstanding and entertaining, especially when performing experiments in front of a class.

An appreciation of a colleague would not be complete without some reference to other aspects of his life. Geoffrey Coates married Jean Hobbs while she was a medical student at Bristol, and their daughter Helen was born just after her mother qualified. Their son Peter was born in Durham. The Coates family have always been well known for their hospitality and for the way in which they entertain students. There must be many who have long since put chemistry behind them who will recall congenial evenings spent in their company.

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