

Polar Intermetallics, Clusters and Cluster Complexes

The Guest Editors from left to right, superimposed on Lake Laverne, a landmark of Iowa State University

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Imagine a fisherman, getting up early in the morning, deciding upon an area of the river to fish. The fisherman finds that cool place to search, it is quiet, and the water is turbid in some places. The fisherman is patient and perseverant, has no time limits (except for dinner time) and has ideas on the type of fish to catch. But then the fisherman discovers a new type of fish, a significant fish, or simply a beautiful fish and reports the findings to others. This stimulates others to fish in the same or other rivers. The fisherman will also carefully inspect and classify the fish and will be inspired to further explore other tranquil areas of the river.

Albeit sometimes impatient (“Lord, grant me patience, but hurry”), John D. Corbett is the ideal of a fisherman. It is the discovery of a novel type of fish that has been and is his motivating force for far more than half a century as a chemist. Mentally, his most important advice to the new fishermen is that it is hard, even impossible, to “imagine the unimaginable”. The conclusion drawn therefrom is to explore, is that synthesis comes first, aiming at a goal but without prejudice.

After earning a PhD in physical chemistry at Washington State University, John D. Corbett became associate chemist at Ames Laboratory and assistant professor at the Department of Chemistry at Iowa State University in 1952, at the age of 26. Thus, with the background of a molten-salt chemist, he entered an environment of pure metals, especially the rare-

earth metals, and intermetallics. This is the river with all its confluents in which Professor Corbett and his numerous students and postdocs catch new types of fish, often unimaginably beautiful fish. One of the first was the “eighth wonder of the rare-earth world”, gadolinium sesquichloride, Gd_2Cl_3 , a solid with the then unimaginable chain of edge-sharing gadolinium octahedra, surrounded by chloride, to be classified as an extended (polymeric) cluster complex. This catch inspired further fishing at the same cool place, by Corbett and others. But he moved on, searching for new sites to fish, catching new types of fish – naked clusters, for example, and in particular, Zintl anions as $\{\text{Ge}_9\}^{n-}$, $\{\text{Sn}_2\text{Bi}_2\}^{2-}$, or $\{\text{KSn}_9\}^{3-}$, crystallized as salts with cations encapsulated in cryptands as cations. A third confluent to Corbett’s river of scientific discovery are polar intermetallics. Early work (1988) on Zr_5Sb_3 was followed by hypoelectronic indium clusters as in K_8In_{11} or transition-metal centered indium clusters as in $\text{K}_{10}\{\text{NiIn}_{10}\}$, coined as carbon-free fullerenes in 1993. More recent beautiful and significant fish were caught in the confluents of metal-rich



John D. Corbett, Distinguished Professor of Science and Humanities, Iowa State University

tellurides, Lu_8Te or $\{\text{Os}_3\text{Sc}_{12}\}\text{Te}_8\text{Sc}_{2-x}$, quasi-crystals or approximants as in $\text{Mg}_2\text{Cu}_6\text{Ga}_5$, or the golden tetrahedral fish $\text{K}_3\text{Au}_5\text{In}$ and $\text{Rb}_2\text{Au}_3\text{Tl}$.

Dr. Corbett is a Distinguished Professor of Science and Humanities at Iowa State University, member of the National Academy of Sciences, fellow of the American Association for the Advancement of Science, recipient of numerous national and international awards, an author of, at present, 466 publications, and supervisor of 41 graduate students and 73 post-doctoral associates from all over the world. Most importantly, he has inspired his students and postdocs as well as quite a number of his colleagues to also fish in the rivers of knowledge. Some fished in the same or adjacent places, others found new tributaries or even new rivers.

The three undersigned guest editors of this special issue on "Polar Intermetallics, Clusters and Cluster Complexes" had the pleasure to catch fish with John, though not literally. As the photograph shows, he prefers catching real fish, e.g. in the tranquility of Snake River (Jackson Hole, Wyoming). Now, at the age of 85, John is still fishing, literally and figuratively, and we thought it appropriate to evaluate the rivers of polar intermetallics, clusters and cluster complexes. This issue contains an essay written by John D. Corbett and 36 papers from authors from across the world fishing in mentioned rivers and

confluents. Of course, we have not gotten all the fishers together, for one or other reason. But we think that a landscape of sites where fishing may be rewarding emerges from the knowledge presented in this issue.

This special issue covers a broad area of mostly solid-state chemistry in which metal–metal bonding plays an important role in assembling main-group and transition metals. Naked clusters like $\{\text{Ga}_5\}$ or $\{\text{Ge}_9\}^{2-}$ emerge embedded in an intermetallic compound or in solution, crystallized as a salt. The cluster may also be surrounded by ligands in cluster complexes as $[\{\text{Mo}_6\}\text{Cl}_{14}]^{2-}$. Clusters may encapsulate a main-group or transition-metal atom as $[\{\text{BZr}_6\}\text{Cl}_{12}(\text{CH}_3\text{CN})_6]^-$ or $\{\text{PW}_6\}\text{Cl}_{17}$. Most of the papers in this issue cover polar intermetallics, their synthesis, structures and properties. Polar intermetallics may obey the Zintl concept or, if not, the boundaries of this important concept are explored further.

The 4 microreviews, 2 communications and 30 full articles are all dedicated to Professor John D. Corbett on the occasion of his 85th birthday, which he celebrated in the midst of his present group of postdocs (and two visitors from abroad) on March 23, 2011, in good health and excellent spirits. John, may the Lord hurry to grant you patience and may the catch in the years to come be new, significant, even exhilarating.

