

## PROFESSOR AKIHIKO YAMAGISHI

2012 RECIPIENT OF THE MARILYN AND STURGES W. BAILEY  
DISTINGUISHED MEMBER AWARD

PROFESSOR ROBERT SCHOONHEYDT



To introduce Professor Akihiko Yamagishi as the recipient of the 2012 Marilyn and Sturges W. Bailey Distinguished Member Award of The Clay Minerals Society is a distinct honor. The Bailey Award is the highest award bestowed by the Society and is based on scientific eminence in clay mineralogy in the broadest sense as shown by published original research papers and their impact on clays and clay-mineral sciences.

Professor Yamagishi obtained his PhD at the University of Tokyo in 1975. He was a postdoc with Prof. M. Szwarc at the State University of New York in Syracuse in 1976–1978 and a research associate at Hokkaido University from 1978 until 1985. He then became associate professor at the University of Tokyo (1985–1991) and full professor at Hokkaido University in 1991. In 2001 he was appointed full professor at the University of Tokyo, from where he retired in 2006. He

remains active in clay mineral research as a visiting professor at Ochanomizu University (2006–2009) and at Toho University (2009–present).

Professor Yamagishi (born in 1943) is a brilliant scientist with research activities in eight research fields, ranging from clay-mineral science to chiral metal complexes, liquid crystals, and chiral gels to biological chemistry. He has published 213 papers and five patents in these fields, supervised 20 PhD students and 30 postdocs, and had several collaborations both in Japan and abroad. However, clay minerals and chirality have been the leading themes throughout his scientific career.

His successful research activities are based on creativity and multidisciplinary. Professor Yamagishi has combined synthesis of chiral amphiphilic transition-metal ion complexes, such as bipyridine and phenanthro-

line complexes, with their ion exchange on smectite surfaces and detailed spectroscopic and quantum-chemical studies of their organization at the smectite surfaces. He was the first to show that the racemic and chiral forms of these complexes bind differently in the interlayer space of clay minerals. He predicted correctly that the difference in binding capacity was determined by differences in packing efficiency in the interlayer space. Thus, chiral clays were prepared with applications in separation of racemic mixtures in their optically pure components, in chiral catalysis, in clay-modified electrodes, and in the development of non-linear optical materials.

Professor Yamagishi was first to introduce the Langmuir-Blodgett technique in clay science. By spreading amphiphilic cations at the air-water interface of a dilute aqueous dispersion of smectite, hybrid films of clay-mineral layers and amphiphilic cations were obtained at the interface. These films, when transferred onto a substrate, can be studied in detail by a range of spectroscopic techniques and by Atomic Force Microscopy. More importantly, the films form the basis for the preparation of a new range of optical materials and of new sensors. Yamagishi and his students introduced the clay science community to Langmuir-Blodgett films which exhibited two-photon absorption, second harmonic generation, and fluorescence resonance energy transfer.

These studies of single clay-mineral layers led to fundamental studies of clay mineral layers, as shown by his papers on the flexibility of a single clay mineral layer, the elastic constants of kaolinite, polytypes of 1:1 dioctahedral phyllosilicates, and stacking of pyrophyllite. The work also led to studies of other types of layered materials, such as hydrotalcite, layered niobate, brucite, and layered titanium oxide.

During his career Professor Yamagishi has emphasized materials-science research of clay minerals. He taught graduate classes on 'Structure and Properties of Inorganic Layered Materials' and on 'Spectroscopic Applications in Mineral Sciences.' His students have emulated the basic tenets of Professor Yamagishi's research, *i.e.* that it be fundamental and multidisciplinary.

Examples are Prof. H. Sato, who performs quantum chemistry on clay minerals at Ehime University; Prof. Y. Umemura, who has established the Langmuir-Blodgett technique at the National Defense Academy of Japan; and Prof. J. Kawamata, who is a specialist in the non-linear optical properties of hybrid clay materials at Yamaguchi University.

During his career, Professor Yamagishi consistently took an international view and established several successful collaborations. He was instrumental in the development of the Langmuir-Blodgett technique at the Center of Surface Chemistry and Catalysis (Prof. R.A. Schoonheydt) at the KULeuven; he sent to his collaborators amphiphilic chiral ruthenium complexes for the preparation of hybrid clay-mineral films with non-linear optical properties. With C.T. Johnston (Purdue University) he performed theoretical studies on the elastic structure of kaolinite and with G. Villemure (University of New Brunswick) on clay-modified electrodes.

Professor Yamagishi has been very active in the clay-mineral research community at large, serving as president of the Clay Minerals Society of Japan (2002–2004).

He and his students organized two international clay mineral conferences: (1) the Sapporo Conference on the Chemistry of Clays and Clay Minerals at Hokkaido University was held in 1996. The proceedings of this conference were published as *The Latest Frontiers of the Clay Chemistry* (edited by A. Yamagishi, A. Aramata, and M. Taniguchi); (2) An international workshop on the chemistry of clay minerals on the occasion of Yamagishi's 60th birthday in Tokyo in 2003.

I met Prof. Yamagishi for the first time in 1985 at the International Clay Conference in Denver. Standing at his poster we discussed the adsorption of tris(bipyridine) and tris(phenanthroline) complexes on smectites. I recall his eye for detail, his determination to obtain a fundamental understanding, but most importantly, his willingness to share his results with other scientists.

In Prof. Yamagishi, The Clay Minerals Society honors an eminent clay-mineral scientist and an exceptionally talented scholar of international renown.