Yan Bottinga (1932-2021)

Pascal Richet and Marc Javoy, Institut de Physique du Globe de Paris

Yan at his desk at home in 1986, an issue of *Geochimica et Cosmochimica Acta* next to his hand, one of the journals in which he published the most.

Yan Bottinga, one of the most eminent geochemists of his generation, died on July 12 at the age of 88 in Bry-sur-Marne, near Paris. He is survived by his wife, Gertie, a daughter, Janneke, a son, Casper-Yan, their spouses, and five grand children.

In the diversity of the topics tackled by Yan, stable isotope geochemistry and magma physics have particularly benefited from his innovative approaches to the point that his publications still constitute undisputed references. In his work, Yan consistently displayed an independent mind by staying away from fashions and by not taking his inspiration in congresses. He innovated with rigorous approaches using resources that
he sought out himself and by taking advantage of the new computer means that became available in the 1960s.

His character showed the same rigor. He did not tolerate boasting or pretentiousness, but was just as demanding of himself as he was of others, and sometimes appeared curtly, which was in fact the counterpart of a certain shyness. As for his fidelity in friendship, it is illustrated by the fact that this biographical note has been written by Pascal Richet and Marc Javoy, the two people with whom he had the longest collaboration.

Born in Dokkum, Friesland, Yan lived as a child through the difficult period of the German occupation of the Netherlands, which ended in a particularly difficult period. He started his professional career by traveling to Asia to import mother-of-pearl for the company of one of his uncles. Soon, however, he decided to turn to a less lucrative but intellectually more rewarding and stimulating career.

In 1957, Yan left for Canada to pursue a higher education while working to support himself. His search for a job was unsuccessful until luck led him to meet with Dick Williams, a geological student who was working for a Geophysical Exploration company. Doing summer fieldwork in the Quebec wilderness, he managed to get Yan hired to work with him under spartan conditions such that both had for instance to share a tent and be supplied once a week by helicopter. Yan was then able to tell Gertie to join him. When they married shortly thereafter, the ties already established with Dick made him Yan’s best man, and gave birth to a friendship that has never ended.

Yan received a bachelor's degree in geology in Toronto in 1961, which was his goal when coming to Canada, and then moved to Vancouver to pursue a master's degree in physics. Under the impulse given in 1947 by the physicist Harold Urey (1893-1941), isotopic geochemistry opened up new fields of study by providing in particular precious paleo-thermometric tools. With his dual physical and geological skills, Yan understood the great interest of this field. In 1963, he went to work for a PhD at the Scripps Institution, in California, under the supervision of Harmon Craig (1926-2003), one of Urey’s main disciples. Yan’s initial focus was on measuring oxygen splitting factors between water and its vapor. However, he was more interested in theoretical than experimental aspects. His dissertation ultimately consisted mainly of calculations of the fractionation factors of hydrogen, carbon and oxygen between important chemical species. The series of papers he produced from his statistical mechanics calculations of partition functions met such needs that they were immediately successful and have been published to this day.

After his PhD, Yan joined the petrology laboratory of Daniel F. Weill (1932-2020) in Eugene, Oregon. It was there that he became interested in the physical chemistry of molten silicates and understood the immense interest for petrologists in predicting the physical and chemical properties of magmas as a function of temperature and chemical composition. Yan found enough data in the glass, ceramic and metallurgical literature to establish such predictive models for density and viscosity. We are now so used to such models that it is hard to imagine what a novelty they were at the time. And it is no
exaggeration to say that it was Yan's two publications on these issues that prompted geochemists to start measuring and modeling the physical chemistry of magmas.

During his PhD, Yan at work soldering glass to build an oxygen analysis line after attack of the sample with BrF₅ (a substance he experienced himself to be highly explosive).

At the invitation of Claude Allègre, Yan then came in 1970 to the IPGP where he obtained a position as a physicist before moving quickly to CNRS research positions. With the exception of a spell in 1977-78 as a visiting professor at Harvard University and Lamont Doherty Geological Observatory, followed by a period of seven years at the University of Nice, he remained at IPGP until the end of his career and continued his activities there for a decade after his retirement. In Paris, Yan immediately put his theoretical inclinations at the service of fruitful collaborations with Claude Allègre on the thermal aspects of the new plate tectonics, and also with doctoral students of the time such as Francis Albarède or Ariel Provost on various petrological problems. In an informal way, he was also following closely the work of young newcomers as Claude Jaupart or Patrick Allard reminded us.

At the same time, Yan naturally found his way to collaborate with Marc Javoy who had created the stable isotope geochemistry laboratory at IPGP. This collaboration manifested itself in particular in the interpretation of isotopic fractionations between major minerals of igneous and metamorphic rocks. Important results were the determination of the formation temperatures of these rocks and their cooling rates in various metamorphic and igneous contexts. Other advances were obtained in the
interpretation of isotopic measurements made on samples from oceanic ridges, in particular those rich in gas vesicles (popping rocks), for which evolutionary models were constructed.

It was within this framework that Marc proposed to Pascal to prepare a thesis under their joint direction to establish a set of fractionation factors as complete as possible for the gaseous molecules of geochemical interest. Yan, for his part, set out to establish a thermodynamic model of molten silicates able of predicting crystallization equilibria in magmas. The sheer magnitude of the task led him to propose Pascal to participate. One of the difficulties encountered was that, unlike for minerals, the thermodynamic properties of molten silicates were so poorly known that they had to be considered as adjustable parameters. To remedy this situation, an extensive measurement program was undertaken, to which Yan naturally devoted much attention. His interest in viscosity had not waned as evidenced by the analyses he continued to devote to various theoretical facets of this property of fundamental importance in magmatology.

It should also be noted that Yan was actively involved in the life of IPGP life as well as in the geosciences community. For instance he chaired from 1978 to 1984 a successful Silicate melt working group of the Interdisciplinary Program for the Survey and Prediction of Volcanic Eruptions set up after the Soufrière of Guadeloupe crisis of 1976, and another of Geothermal energy at the Earth Sciences branch of CNRS. Between 1985 and 1987, he was vice-president and then president of the European Association of Geochemistry. He directed the computing center of IPGP from 1987 to 1993, and the National Center for Parallel Computing in Earth Sciences from 1990 to 1993. He also had an important activity as a reviewer in his numerous fields of expertise. By the way, he preferred small colloquiums to large conferences, bringing together the participants in a closed place in order to promote in-depth informal discussions and contacts. These were the forerunners of the Silicate Melt Workshops, which have been held every four years since 1991 and are published in a special issue of the journal Chemical Geology.

Finally, this brief portrait would be incomplete if other facets of Yan's intellectual curiosity were not mentioned. Along with Gertie, whose family was active in music, he was a regular concertgoer, enjoying baroque as well as jazz and contemporary ensembles. A great reader, he was also very interested in modern sculpture and architecture, and had a particular penchant for Romanesque churches; he could even have written a catalog raisonné of them, illustrated with the thousands of photos he had taken during his travels.

Select references


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