American Mineralogist
Vol. 57, pp. 615–619 (1972)

PRESENTATION OF THE ROEBLING MEDAL OF THE MINERALOGICAL SOCIETY OF AMERICA FOR 1971 TO J. D. H. DONNAY

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President Goldsmith, members and guests of the Mineralogical Society of America:

Joseph Désiré Hubert Donnay was born in Grandville, Belgium, on June 6, 1902. He received the degree Ingénieur civil des Mines from the University of Liège in 1925. In the same year he went to Stanford University which at that time had close relations with his native land as an aftermath of Hoover's wartime activity in behalf of Belgium. In the summer of 1926 he had to go back to Belgium for his military service. He returned to Stanford in December 1927.

Having come to the University of California in 1925, by the spring of 1928 I was substituting there for Professor Eakle in mineralogy. That year the meetings of the Cordilleran Section of the GSA were held in Berkeley and I recall vividly several events during those meetings. Howel Williams received the prize for the best paper by a young man for his work on the Marysville Buttes. Now, 43 years later, Willie is still concerned with the Marysville Buttes. J. D. H. Donnay presented the first of his many papers to be recorded in the Bibliography of North American Geology. The abstract of it appears in the Bulletin of the GSA for 1929 under the title "Cleavage versus parajointing". It was a criticism of terminology. José did not like "fracture cleavage" and proposed the term "parajointing". Apparently it was not generally adopted, for it is not listed in either the AGI Glossary or the USBM Dictionary. However, this paper gave an indication of one of its author's outstanding traits, his interest in words.

Soon after the spring meeting of the Cordilleran Section, Donnay came to see me in Professor Eakle's office and told me that he planned to make a study of the copper deposit at the Engels mine in Plumas County, California. I tried to dissuade him from such an undertaking. Charlie Anderson was then about to submit his Ph. D. thesis on the Engels mine after three years of study, and no less a person than Adolph Knopf was about to join him in further publication on the Engels mine copper deposit. But José was not to be dissuaded and the following year he received his Ph. D. from Stanford on the basis of a dissertation on this subject.

Following his first three years at Stanford, José was employed as an engineer and geologist in French Morocco for six months and in 1930 presented his report on the Engels mine at a congress held in Liège. The next academic year, 1930–31, was again spent at Stanford. The disguise of engineer and geologist was cast off, and the crystallographer and mineralogist emerged.

In 1931 Professor Rogers published a paper on "Castanite, a basic ferric sulfate from Knoxville, California". This involved some calculations which seemed a bit arduous to even such an experienced crystal lographer as Austin F. Rogers. He wrote "From these five measured angles the—geometrical constants were calculated by spherical trigonometry" and added in a footnote "I am indebted to my assistant, Dr. J. D. H. Donnay, for a careful checking of the computations." Years later Donnay published a little book, Spherical Trigonometry after the Cesàro Method, which is still carried on the Polycrystal list of books.

Following his year as Rogers' assistant, José went to Johns Hopkins where he stayed for eight years, until 1939. During all this period he published widely on crystallographic subjects, many of the papers appearing in Belgium or elsewhere and so tending to be hidden from his American colleagues. A number of these papers dealt with form birefringence and spherulite optics, subjects sadly neglected by nearly all American teachers of crystal optics. This work had been begun at Stanford together with H. W. Morse in 1930, major papers on the subject appearing in the American Journal of Science in 1932 and in the American Mineralogist in 1936, but even in recent years the subject has been pursued together with his wife Gabrielle (Gai) Donnay in work on the bastnaesite-vaterite series (1961) and on the water content of spherulitic vaterite (1967).

During his first Johns Hopkins period, Donnay began his long series of studies on the relations between morphology and structure of crystals, leading to the famous Donnay-Harker paper in the Palache number of the American Mineralogist, "A new law of crystal morphology extending the law of Bravais". This was followed over the years by a number of papers by Donnay and his students. In favorable cases it seemed possible to determine space groups by morphological analysis. Where a discrepancy occurred there might be reference to the morphological space group as contrasted with the structural space group. In 1961 Donnay and Donnay again took up some of the cases first considered twenty years earlier and, in a group of papers in the Comptes Rendus, presented the "Second generalisation of the

law of Bravais", a phrase which, unfortunately, does not appear in the titles of any of these papers.

In 1939 José was appointed professor at the Université Laval in Quebec. I met him at the Austin, Texas, meeting of MSA the following year. He was pleased with his new position and bubbling over with crystallographic ideas. He discoursed on these earnestly as we walked along the main street of Austin one evening, suddenly reproaching me with the remark "you are not listening" as my attention was distracted by the sights and sounds of the city about us. He stayed at Laval only three years, coming back to the United States for war work as a research chemist with the Hercules Powder Company in 1942, and in 1945 he returned to Johns Hopkins, this time as a professor. However, throughout his years in the United States José had maintained close relations with his homeland and in 1946 he went back to Liège as a professor. Fortunately for us he stayed there only a year and we soon had him with us again at Johns Hopkins.

During the thirties Donnay had interested himself in T. V. Barker's system of identification of crystalline material from morphological observations, a development from Fedorov's crystallochemical analysis. In 1934 he joined Terpstra, Mélon, and van Weerden in a paper on this subject, while in a related paper with Tunell and Barth the work on the generalisation of the law of Bravais was foreshadowed. In the same year "Barker Tables" giving classification angles for 397 tetragonal substances were published by Donnay and Mélon in the series, Johns Hopkins Studies in Geology. The Barker Index of Crystals did not begin to appear until 1951 and was not completed until 1964. By that time it had been made obsolete by other developments mostly led by Donnay.

The key problem in devising a scheme for the geometrical identification of crystals, whether from X-ray observations or from morphology, is that of the standard or conventional setting. This problem had been approached in the work of the thirties and José addressed himself to it again in two papers published in 1943 while still with Hercules. This may be considered to have been preparation for the book, which in the case of most others would have been considered a life work, *Crystal Data,* published in 1954 as a GSA Memoir. *Crystal Data* included determinative tables based on cell dimensions for about 6000 substances. Though misunderstood by a few distinguished persons, the book was received with enthusiasm by most crystallographers and plans were soon made for a new edition. The greatly expanded second edition, prepared under Donnay's direction, covers about 13,000 sub-

stances and was published by the ACA in 1963. Its rules for "choice and orientation of the cell" include a few inconspicuous but significant changes from those given in the first edition, especially as regards triclinic crystals. This book alone would be enough to make Donnay known among crystallographers throughout the world.

But all the while José was making many other contributions in various sectors of crystallography. Twinning repeatedly engaged his attention. In this realm he applied the ideas of Friedel to albite twinning and to many other cases. Later with H. Curien he concerned himself with symbolization of "The symmetry of the complete twin" which involved the use of color point groups. Shubnikov groups were applied to the description of magnetic structures for which Donnay and Donnay tabulated all of the possibilities for one tetragonal point group. The paper by Donnay and Donnay on the high-temperature alkali-feldspar series, which appeared in the Bowen Volume nearly twenty years ago, is still one of the most widely cited papers in its field.

One could go on and on, it is difficult to choose subjects for mention when there is such a profusion of material. Along with his wide-ranging thoretical papers and crystallographic studies, José has helped us with many practical suggestions and devices: thinned polished sections, a simple crystal monochromator (with I. Fankuchen), a set of grids for the determination of non-opaque minerals, and (with Gai Donnay) charts for the interpretation of rotation and Weissenberg photographs marketed by N. P. Nies, the optical analyzer made by the Charles Supper Company, and many more. Throughout he has tried to persuade us to adopt his elegant methods and modes of expression from his early paper on the use of determinants in crystallography (1934) to his recent paper with Olga Kennard on condensed diffraction symbols (1964).

It might be expected that José would maintain close relations with his homeland and with Canada, but he is a true cosmopolite and has also worked and published together with colleagues in France, Germany, England, Japan, and Russia. In 1964, following a select international symposium at Kiel, he joined crystallographers from Switzerland and Germany in authoritative pronouncements on coordination polyhedra and on lattice complexes.

In his remarks of acceptance, a recent recipient of the Roebling Medal said "- - - far too few scientists of today realize that the English language is a very delicate precision instrument capable of the finest distinctions, and handle it like a sledge hammer." José is listed in Who's Who in America as a philologist by hobby, literally a lover

of words. He wields them with great dexterity, not only written words but also spoken words. In spontaneous discussion he gives a finished performance that puts most of us native Americans to shame. Though "parajointing" was not accepted, José has enriched mineralogical usage with many other terms. He has rescued *syntaxy* from obscurity and has given it new meaning, *aspect* has received a special significance, and he once wrote a paper on "The *superabundant* index in the hexagonal Bravais symbol". He is adept at putting in the engaging phrase or illustration. In Austin he spoke to us on "Interference figures in convergent light", beginning by saying he would put his remarks in a nutshell and his first slide showed a fine drawing of a *nutshell* complete with three axes, α, β, and γ. In New Haven he commented on "*Groping stages* in some organic crystal structure determinations" and at Los Angeles he referred to the recipient of the Day Medal whom he was introducing as "*instructor emeritus*". Donnay and Donnay have shown how to use the concept of the *one dimensional crystal* in making certain computations and lately they have acquainted us with *kenotetrahedral* magnetite.

Nearly 34 years ago the Geolaphical Society of America, better known as the Pick and Hammer Club, held a meeting in Washington. On page 13 of the program of that meeting one may find the following lines under the heading

Berryland

If import goods you most adore
Try Hopkins U in Baltimore;
You'll find a line at Bowman's store,
J. Hopkins U in Baltimore.
The best from Europe at your door,
When these wear out we'll order more—
Our native sons don't know the score
At Hopkins U in Baltimore.

As all can see, in 34 years there has been remarkably little wear. Mr. President, it is a great pleasure to present Joseph Désiré Hubert Donnay for the award of the 1971 Roebling Medal.