MEMORIAL OF PAUL NIGGLI

ROBERT L. PARKER, *Swiss Federal Institute of Technology, Zürich, Switzerland.*

With the death on January 13, 1953, of Paul Niggli, since 1920 Professor of mineralogy and petrography in the Swiss Federal Institute of Technology at Zürich, the Earth Sciences have lost one of their most notable exponents and his co-workers an inspiring leader.

The main biographical details of his life are simple. Born on June 26, 1888, in the little Swiss town of Zofingen, he made preliminary contacts with the science that was later to become his domain while still a boy at school at Aarau. Coached by Professor Mühlberg, a well-known Swiss geologist who was his science teacher, he started to study and map the geological features of his native canton. By 1907, when he matriculated as a student at the Institute of Technology in Zürich, these investigations had furnished him with the material for a report that was published in due course by the Geological Commission of Switzerland. To the experience and pleasure in field work thus gained in his early days may be ascribed the value attached by him to observations in situ and the mastery in the art of unfolding to the participants in his field trips the subtle implications of the geological scene before them. Though the Geological Institute in Zürich was at the time of his entry in the hands of Professor Albert Heim, it was not this eminent teacher and scientist who modelled Niggli's ultimate career. For at that stage of his development fossils, sedimentary rocks, and tectonics offered Niggli too little scope for the application of physics and chemistry to be wholly satisfying objects of study. Minerals, igneous rocks and metamorphics which were included in the syllabus of the adjoining Institute under Professor Ulrich Grubenmann presented, on the contrary, a field entirely to his taste. It was thus in the main as a pupil of Grubenmann that Niggli presented himself in 1912 for the Ph.D. examination at the University of Zürich. His study on the chloritoid-bearing schists of the north-eastern Gotthard Massif submitted to the faculty as his dissertation reveals the interesting fact that many problems that were to remain life-long preoccupations were already foremost in his mind. After a year spent in the Geophysical Institution of Washington, Niggli returned to Zürich and became lecturer (Privatdozent) in Zürich University. In 1914 he was, however, called to the University of Leipzig as extraordinary, and thereafter (1918) to Tübingen as ordinary Professor of Mineralogy. When in 1920 Professor Grubenmann resigned from the chair of mineralogy and petrography in Zürich, Niggli was elected to be his successor and in spite

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of calls that came to him from abroad, did not again leave the Institute at which he himself had studied.

To call Niggli a mineralogist, petrographer, or geochemist, would be doing him less than justice. He was, in fact, all these things in a measure rarely attained by a single individual. The work carried out by him during his thirty-three years at Zürich can only be described as amazing, and a glance at the list of his scientific publications suffices to prove the aptness of this adjective. For the bibliography shows that during this time he published over 15, mostly voluminous, books as well as some two to three hundred papers, essays, etc., in various periodicals. These works

are in the main devoted to matters of petrography, mineralogy, crystallography, and crystal structure, but also include such bearing on questions of general scientific principles and methods, education, politics, history, philosophy, etc. It must be remembered, however, that only a limited part of his time could be devoted to scientific work. For beside a very full programme of lectures during term time and the hours devoted to his students, an interminable series of examinations as well as much administrative work both within the Institute and in the innumerable commissions and committees to which he belonged remained to be dealt with. He was for some years (1921 to 1940) editor of the "*Zeitschrift für Kristallographie,*" but resigned from that post when political conditions in Germany took a turn that he disliked intensely.

Niggli had the satisfaction of receiving a very full measure of appreciation for his labours. He was awarded honorary academic degrees by the Institutes of Technology at Stuttgart and Karlsruhe and by the Universities of Geneva, Budapest, Sofia, and Liège. From America honours came to him from the Mineralogical Society (Correspondent in 1931 and Roebling Medallist 1947), the Geological Society (Correspondent 1935), the N. Y. Academy of Sciences (honorary life-member 1944), and the Academy of Natural Sciences of Philadelphia (Hayden Memorial Geological Award 1947). Beside these distinctions he was correspondent, honorary member, foreign member, etc., of learned societies in Austria, Belgium (3), Brazil, Finland (2), France (2), Germany (5), Great Britain (3), Holland, India (2), Italy (4), Poland, Roumania, Spain, Sweden, and U.R.S.S., and of half a dozen or more Societies in his own country.

For those who were closely associated with Niggli and have witnessed the gradual building up of his life's work, it is interesting to compare his early publications with those of later years. Two books published before coming to Zürich come clearly from the *investigator* Niggli. Thus his treatise on the volatile constituents in the magma (1918) is an enquiry into the physical chemistry of magmatic systems and reveals him as a master of his subject. The "Geometrische Kristallographie des Diskontinuums" (1919), too, was Niggli's fundamental contribution to a branch of science then still in its infancy. His volume (written with P. J. Beger) on rock and mineral provinces (1923) which contains the first catalogue of magma types based on molecular (so-called "Niggli") values and the treatise on rock metamorphism (1924) with Grubenmann as co-author are further products of a period during which he was actively concerned with practical research. If it was the *teacher*, Niggli who was largely responsible for many of the later works, this was, perhaps, due to the great success that attended his "Lehrbuch der Mineralogie" published in 1920. The freshness and originality of his treatment of the fundamental aspects

of crystallography, crystal chemistry, and crystal physics (with which was coupled a rather detailed account of the occurrence and deposits of minerals and rocks in the earth's crust) constituted a complete breakaway from the general trend of German textbooks at that time and was very enthusiastically received by readers of widely different status. It henceforth became his ambition to keep this work abreast of the rapid development of the science and the repeated calls for new editions were responded to by several complete recastings and amplifications of the work, involving an ever broadening scope in the matter treated. The didactic approach to his subject can clearly be discerned in much of his later writing and led to his last great publication, the "Gesteine und Minerallagerstätten," the third volume of which remained unfinished at the time of his death.

Niggli's treatment of the "Earth Sciences" was conceived on a generous, indeed monumental, scale. Not only did he include in it every ingredient of the crust from igneous rocks to snow crystals, but all their manifestations as well, from the atomic assemblage to world distribution. His genius is attested by the fact that the universality of his interests was matched by the versatility of his ideas.

Bibliography

Dr. Niggli's bibliography is so extensive that only a summary under the various headings will be recorded here. A complete list of publications has been prepared by *J. Marquard* and *J. Schroeter* and will be found in *Schweiz. Min. Petr. Mitt.*, *Band* **33**, pp. 9–20, 1953.

Kristallstruktur- und Symmetrielehre: 3 books; 61 papers.
Allgemeine und Spezielle Mineralogie: 7 books; 25 papers.
Minerallagerstätten: 1 book; 14 papers.
Allgemeine Petrographie und ihre Physikalisch-Chemischen Grundlagen: 7 books; 63 papers.
Regionale Petrographie und Geologie: 4 books; 30 papers.
Beziehungen von Mineralogie und Petrographie zu Praktischen Fragen: 19 papers.
Schneeforschung: 4 papers.
Allgemeines zu den Mineralogischen Wissenschaften: 1 book; 12 papers.
Allgemeine Forschungs- und Unterrichtsfragen der Wissenschaften: 1 book; 24 papers.
Biographische Artikel: 5 papers.