



PAUL NIGGLI

1888—1953

Paul Niggli, Professor of Mineralogy, Crystallography and Petrography at the Eidgenössische Technische Hochschule and at the University of Zurich, died unexpectedly in Zurich on 13 January 1953. Shortly after holding his morning class he had a heart attack and was taken to the hospital, where he seemed to recover. Later in the day, however, in the midst of a pleasant conversation with his relatives, he suffered a fatal recurrence.

With Niggli Science loses one of its great figures, a man of encompassing knowledge, great vision and untiring will to work; a man who passionately devoted his life to a broad ideal, namely that of uniting, for his part, the exact and the descriptive sciences which converge in mineralogy and petrography. The integration he achieved ranges from pure geometrical studies over

crystal structure and chemistry to mineral formation, petrography and to applied geology and protection against avalanches. Important as the details of this work may be, Niggli himself repeatedly stressed as his ultimate aim the incorporation of this whole field of Earth Sciences into a single unit, in which the divergent tendency of methods would be eliminated between the experimental approach with its isolation of causes and the descriptive approach with its acceptance of a bewildering multiplicity of causes. His own field of work was to him a proving ground for testing the degree of integration attainable, so as to indicate to other sciences, like biology, how the trend towards ever increasing specialization might be balanced by a return to a wider perspective.

Niggli's great influence on contemporary science

stems from this attitude rather than from the details of his work. Crystallographers will remember him as the author of *Geometrische Kristallographie des Diskontinuums* (1919) in which he transformed the theory of space groups from the mathematical skeleton left by Schoenflies (1891), Fedorov (1891) and Hilton (1903), to a helpful friend and adviser of the modern crystallographer. This first of Niggli's books testifies well his aim of achieving convergence of previously separate fields. Once this was accomplished, he stopped; he never made an all-out attempt at structure determination, the details of which he may have felt to divert him from his main course. He kept, however, a profound interest in extending morphological methods to account for the inner structure of crystals.

His two papers 'Atombau und Kristallstruktur' (1921) contain a detailed survey of atomic and ionic volumes in the solid state throughout the periodic system and discuss the importance of similarity of volumes on the crystallographic properties of salts. His book *Kristallographische und Strukturtheoretische Grundbegriffe* (1928) is an attempt to arrive at a more refined classification of the translation lattices of structures and to connect to it the external morphology of the crystals. Papers 'Topologische Struktur-analyse' and 'Stereochemie der Kristallverbindungen' (1928-33) serve as preliminary studies for his book *Grundlagen der Stereochemie* (1945), which, by its treatment of the internal morphology of crystals, is a counterpart to his textbook *Spezielle Mineralogie* (1924). Niggli's urge for unifying, condensing and classifying knowledge so as to make it applicable to ever wider fields also stands out in his papers on 'Charakterentafeln' (1950-51) in which a method is developed for symbolizing each space group so as to make any further reference to tables unnecessary.

Even in view of the infiltration of detailed wave-mechanical bond theory into the realm of crystallography Niggli remained convinced of the lasting power of morphological methods. Morphology was the central theme of his interest and philosophy and his last larger book *Probleme der Naturwissenschaften erläutert am*

Begriffe der Mineralart (1949) is, in this sense, his testament.

The same fidelity of purpose reappears in Niggli's other activities, as an inspiring, if exacting, teacher of his students and assistants, an efficient and, in times of political strife, incorruptible Rector of his academic institutions, the Hochschule and the University, a representative on and chairman of important committees of his country, and an organizer of his science throughout the world. His twenty years of editing the *Zeitschrift für Kristallographie*, as a worthy successor to its founder P. v. Groth, saw the expansion of the *Zeitschrift* to a truly international journal. The labour Niggli devoted to the *Zeitschrift*, including an abstracting service under his supervision, can be assessed only by his co-editors and co-workers. But the fact will be appreciated by all crystallographers that through his effort a certain unity of crystallographic publication throughout the crucial first decades of X-ray crystal analysis was preserved.

Niggli's approach to the problems of crystallography and the sense of obligation and reverence which made him look on himself as a faithful servant of Truth cannot be more fittingly rendered than by quoting the concluding paragraph of his last paper 'Vom Wachstum der Kristalle' which appeared on 31 December 1952: 'Das Staunen über das Wunder der Kristallgestaltung und die Neugierde, zu erfahren, wie die Eigenschaften kristalliner Materie von ihrer Bildungsweise abhängen, haben eine Wissenschaft entstehen lassen, die in irgendeiner Abwandlung in sich fast die ganze Fülle der Fragestellungen enthält, die den um Erkenntnis ringenden Geist beim Anpacken irgendeines Problems beschäftigen. So vermag in ihrer Einordnung in das Ganze auch diese Fachdisziplin anderen Wissenszweigen Anregungen zu vermitteln und Analogien in Ergebnissen und Methodik aufzuzeigen. Sie lässt in ihrem kleinen Bereich erahnen, dass der Gedanke der Universitas lebendig ist. In einer von vielen Facetten spiegelt sich auch in ihr die Struktur des menschlichen Geistes in seinen Bemühungen und seinen Fähigkeiten, das Sein in Bildern zu gestalten, die der inneren Wahrhaftigkeit verpflichtet sind.'

P. P. EWALD.