

BRUNO SANDER †

On September 5, 1979, at the age of 95, Emeritus Professor for Mineralogy and Petrography at Innsbruck University, the geologist Bruno SANDER, passed away in his native Innsbruck (Austria), in good mental and physical health. He was a man whose lifework has found application in the education and professional work of nearly all geologists and rock mechanics engineers of today, whose name has, nevertheless, become known mainly to experts with an intense involvement in research work. With SANDER we have lost a scientist who had been so far ahead of his time that his revolutionary methods and findings had been understood, appreciated and taken up only over a period of several decades, so that in most cases the present active generation of geologists had become aware of his work only from secondary literature.

Nowadays it is a matter of course for every geologist, all the more for every engineering geologist, to include Structural Geology in his work, to watch carefully grain fabrics, to describe the qualities of the elements of the fabrics, to survey quantitatively their spatial data, to evaluate them statistically and to draw conclusions from these factors with regard to the behaviour of solid rock masses, of their strength, deformability and watertightness as well as of the anisotropy concerning these properties. Rock mechanics experts and rock engineers consider such exact quantitative representations of the grain and plane fabrics to be the bases of their computations and model tests, e.g. for the calculation and design of dam abutments which they aim to undertake. However, all these achievements have become so self-evident that only a few geologists know the origin of these methods: namely that they are only a part of a much more comprehensive science of fabrics, embracing several fields including mineralogy, petrography and tectonics, as a particular science which has fertilized even remote fields, e.g. metallography and the chemistry of material. Still less is known to many experts of the true pioneer of this science of fabrics, who had already between 1915 and 1922 proved rules of fabrics as an effect of mechanical deformation by comparing field and laboratory studies using the universal stage microscope (1930 also by the first X-ray investigations on rocks). Together with his friend Walter SCHMIDT, Leoben, SANDER had systematically extended these findings, so that he was able to present in 1930 his textbook "Science of Fabrics of Rocks" ("Gefügekunde der Gesteine").

It had been a great and new idea – only discovered contemporarily by Hans CLOOS – to derive mechanical stress fields analytically from symmetrical patterns of the rock structure, which CLOOS called "stiffened movements". It had also been a very important step in the development of the whole of geo-science in the direction of quantitative statement and exactness.

SANDER's and SCHMIDT's studies emanated from grain fabrics regularities, which reflected the deformation process in the large-scale area of a fold, flexure or fracture-tectonic unit as a result of acts of deformation in the micro-range. But the science of fabrics soon proved to be a method for the most general documentation and interpretation of geometrical spatial data (and their variations), suitable also for plane fabrics, especially for the fabrics of separation planes, also for sedimentation planes in grain sediments and for fracture structures. This enabled the introduction of a kinematic, not stationary, system of fabric coordinates which allowed the inclusion also of large and the largest areas of the Earth's crust, and helped also to distinguish between repeatedly re-worked fabrics.

Personally Bruno SANDER was characterized above all others by two attributes: by an outstanding modesty, which is often the mark of truly great men, and the rigour of thought typical for a scientist in idealistic times. An uncompromising rigour against himself as well as against his students – which, however, did not restrain the influx of visitors to his university, especially from northern and American countries – forced him again and again critically to call in question his own findings. His nearly fanatic impulse for exactness and accuracy of expression induced him to create scientific terms of the highest clarity, which he delimited carefully with regard to extent and content. Neither hydromechanics nor rheology, nor the mechanics of material and the theory of plasticity are provided with such a clear and uncontradictable definition, as e.g. regarding the process of flow. They all mingle the geometric phenomenon with mechanical causes. SANDER, however, with his keen-edged logic, insisted to the utmost on a clear distinction between the description (by means of geometry) and every genetic, e.g. mechanic, "explanation". In this respect SANDER's terms of the considered range of dimension, the range of homogeneity, of isotropy and anisotropy with regard to mechanical, optical and thermal properties and to the behaviour against water, stand alone; also the completely new ideas of internal and external rotation. In this respect, many scientists could learn a lot from SANDER's science of fabrics.

This inconvenient rigorous logic, as far as I know scarcely reached in another field of science, had unfortunately in the first instance impeded the propagation of his work; it demanded not only intense study by the reader, but it also made translation into other languages difficult, so that except one translation into English, his original wealth of ideas has become known more from secondary literature than from the original version. Also in the same way, his extreme modesty – similar to that of STINI –, always masking his own person behind the object, led to SANDER becoming far less well known in the world than he and his work deserved, the more so as he almost completely refrained from lecture tours. But those who had the good luck to become acquainted with SANDER as a human being – distinguished men such as Prof. Konrad, Leitgeb, Terzaghi, Ludwig v. Ficker had been his friends – were deeply impressed by the uprightness of his character and his high demands on his own personality, by his unconditional and unlimited veracity. This veracity resulted in his attaching only low importance to being read and understood by those who take in his ideas superficially, but – as he often expressed – led him to write only for a limited number of men.

The same can be said of his second field, in which he left important thoughts and which testifies the uncommon amplitude of his human life: It became obvious only at the end of his life that (completely separated from his scientific life-work) SANDER left behind him a nearly equally large volume of artistic literary performances, a series of collections of poems, written during lonesome mountain tours and published under the pen name "Anton Santer": without exception poems that bear witness of the same way of thinking of a seeker of truth, inexorably austere against himself, looking deep into all things, as known from his scientific publications. He also admitted to having written these poems only for a few, and also in these woodcut-hard lines, in which he climbs like a cragsman on the rock, handhold by handhold of ideas, up to toilsome summits, he did not make it easy for his readers; he did not bait them with cheap linguistic complaisances, on the contrary he kept away those whose lacking will to reflect and to search with him kept them in any case from access.

Distinguished by his affiliation to the Vienna Academy of Sciences and the "Leopoldina" at Halle, with two honorary doctorates, many badges of honour and honorary memberships (which he always accepted calmly), Bruno SANDER stands before us in lively remembrance as a monolith of mental life; we have strong motives to emulate him and to thank him for the body of work he left, which has become the daily bread of our work.

SANDER is one of the stars of first magnitude in the sky of science. That in spite of this fact his name has become less known in the world than the far-radiating influence of his work, cannot burden those who know that it is not important in the mental world that the work be linked to the name, but that it is plainly a symptom of genuine mental efficacy that the act, the idea – detached from the name of their originator – continue to exist and to have effect.

Leopold Müller-Salzburg