23.1–1 MODERN MINERAL CLASSIFICATIONS. A HISTORICAL REVIEW. By H. Strunz, Institute of Mineralogy, Techn.University, D-1000 Berlin 12.

1. Chemical-Morphological Classifications.
It is rather unknown, that Haüy (1801) has given a fairly modern mineral classification, based on chemical principles, following the cationic part of mineral composition. Berzelius (1824) preferred the anionic part of composition, and Gustav Rose (1852) combined this with principles of morphological symmetry and isomorphism, and following the natural periodicity which was later discovered in the periodic system of chemical elements (1869). Dana (1854-92) used the same classification, but Groth (1882-1921) and others inverted the positions of the halides and oxides.

2. Chemical-Structural Classifications.
Important theories on crystal structures from about 1611 (Kepler) to 1890 (Fedorov, Schoenflies), and the wellknown idea of Max von Laue (1912) provided the basis for the determination of many important crystal structure types from 1913 (Bragg) to about 1941, and the recognition of their relationships. This gave the possibility of a modern mineral classification, based on chemical-structural (crystallo-chemical) principles, and which were used in Mineralogische Tabellen (1941). Following classifications are registered (Dana 1944-62, Betekhtin 1950, Grigoriev & Smolianinov 1953, Kostov 1968, Chukhrov 1960-81, Kudriashova 1983); special arrangements are considered (Hey 1950-75, Machatschki 1953, Lima-de-Faria & Figueiredo 1976, Povarennykh 1972, for oxides Keller 1971-82, phosphates Moore 1981, silicates Belov 1960, Liebau 1962-82, etc.).

3. Genetic-Geochemical Classifications.
The principles of paragenesis (Breithaupt 1849), of minerogenesis (Lindgren 1911, etc.), and of geochemistry (V.M.Goldschmidt 1911/24, Fersman, etc.), open quite another aspect of classifying minerals. But, such a genetic-geochemical classification (Machatschki 1953) gives many repetitions and no strong system: For instance, the genesis of calcite is magmatic in the carbonatites, hydrothermal in the ore veins, sedimentary in the limestones, and metamorphic in the marbles; that would involve for one species four positions in a genetic system. Regarding the class of silicates, many chemical-structural close related species, as the mica and clay minerals, had to be classified in different genetic classes.
In the chemical-structural classification, developed by a 180 years work of scientists in mineralogy and crystallography, in chemistry and physics, minerals are now divided into twelve classes: I. Elements, alloys, carbides, nitrides, phosphides, silicides. II. Sulfides, selenides, tellurides, arsenides, antimonides, bismuthides, sulfosalts. III. Halides. IV. Oxides, hydroxides. V. Arsenites, selenites, tellurites, iodates. VI. Nitrates. VII. Carbonates. VIII. Borates. IX. Sulfates, selenates, tellurates, chromates, molybdates, tungstates. X. Phosphates, arsenates, vanadates. XI. Silicates. XII. Organic Compounds. The classifying principles and mineral sequence are unchanged since 1941. The system is open for refinements. It is a basis for further studies of chemical, structural, physical and genetic relationships, also for students, mineral collectors, and museum curators. - Full text in IUGS Proceedings 1984.

23.1–2 SYMMETRY PRINCIPLE IN CRYSTALLOGRAPHY AND CRYSTAL PHYSICS. ORIGIN AND DEVELOPMENT. By V.A.Koptsik, Moscow University, Moscow, USSR

Symmetry principle states: in each material object and in a set of its motion states there exists a symmetrical structure level or hierarhy of different symmetrical structure levels. Symmetry methods play a leading part in the formation of the contemporary physical theories. These methods were developed in algebra, geometry and crystallography in connection with the problems of solution of algebraic equations, of searching for invariants of the geometrical transformation groups and of describing crystal structures. They were used by a number of outstanding scientists for solving some concrete physical problems. The methodological principle of connection between the symmetry of geometrical structure and physics was gradually formed on the basis of these results. Pierre Curie was the first to formulate this principle as the symmetry aspect of causality principle. He derived (I880) the possible piezoelectric groups as the solutions of the equation $G_{ph} \geq G_0 \cap G_a$ which defines the system symmetry consistent with the characteristic symmetry of phenomenon G_{ph} as the intersection of symmetry groups of the object G_0 and external action G_a. Then (I894) he generalized this equation into the connection between the symmetry of causes and the symmetry of consequences, $G_{con} \geq G_{cau}$. The modern formulation of this principle given by Shubnikov and Koptsik (I972) postulates the isomorphism between the symmetry groups of complete system of causes and that of consequences, $G_{cS\,con} \leftrightarrow G_{cS\,cau}$, the symmetry group of system being derived as intersection of symmetry groups of its structural parts multiplied by some simmetrizer, $G_{system} = G_{parts} \times G_{symmetrizer}$. This formulation expresses the abstract symmetry conservation principle for isolated physical systems. It offers in principle the way of symmetry paradoxes solving when the symmetry of particular consequences isn't consistent with the symmetry of the adopted system of causes, $G_{conj} \not\geq G_{conj} \times G_{symmetrizer} \leftrightarrow G_{CScau}$. For instrance Curie principle isn't broken for piezoelectric effect in the group 432 but the linear approximation to the phenomenon is inadequate.