Pallas' geological map of the Ural Mountains (1773)

CHAPTER VII

PALLAS' GEOLOGICAL MAP OF THE URAL MOUNTAINS (1773)

Pallas' map entitled "Karte des Uralischen Berg und Hüten-Reviers vom Ursprung der Bjelaja bis an die Soswa" was published as an illustration in Part II, Book I, p. 368 of his *Reise durch verschiedene Provinzen...* (1771-1776).

Its scale is approximately 1: 1,400,000. The origin of its topographic background is not given. The map is plagued by numerous distortions and has neither grid nor latitudes and longitudes. It emphasizes streams as well as lakes and marshes which are both the arteries of penetration of this difficult and covered terrane and its pitfalls. Location names are strongly emphasized toward mining sites. All mountains, without barometric elevation, are systematically represented by the symbol of a conical hill, and only along the watershed line do these symbols carry a cross on top.

On this rather rudimentary background, Pallas superposed the results of his field observations with a combination of punctual symbols used at his time which may be designated as "mineralogical" and "structural" (See F. Ellenberger, 1985 for an exhaustive discussion of the subject). The first group of seven symbols used by Pallas represents the major rock-types in part defined by their structural attitude. The second group of fifteen symbols are of economical interest including particular rock-types, minerals, metallic ores, mineralized springs combined with written designations on the map, such as marble, magnetite mountain, asbest mountain, and burning mountain (burning seeps of natural gas).

The first group of punctual symbols represents Pallas' primitive, secondary, and tertiary mountains (named mountains of first, second, and third order by Pallas) which form distinct bands (*Strich*) although the boundaries between the bands are not marked on the map by solid lines. As mentioned in Chapter II, Pallas' symbol for *Schiefer Ganggebürge* pertains both to shales and schists, namely highly inclined to vertical shales on the west side, including some schists, and metamorphic schists on the east side. This symbol has a variable orientation on the map to indicate the approximate observed dip of the schistosity at a given location.

The symbols of the first group (Fig. 4) are designated as follows:

Vitrescirendes Gebürge u. Quarz.: vitreous rocks (metamorphics, quartzites, and quartz veins). Primitive mountains.

Schiefer-Ganggebürge: highly inclined to vertical shales and some schists (west side) and metamorphic schists (east side). Primitive mountains.

Kalk Gebürge: inclined to folded limestone beds. Secondary mountains.

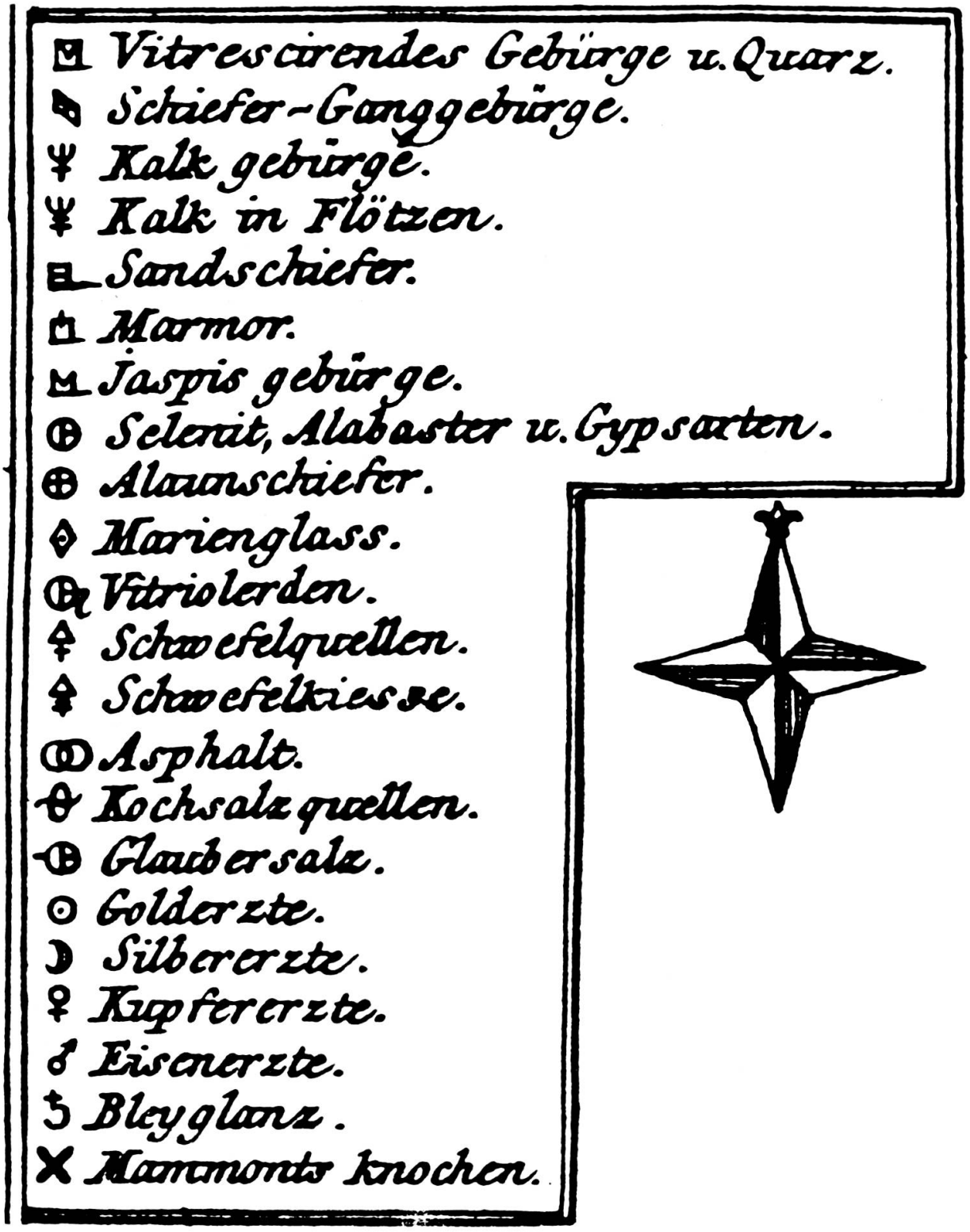

FIG. 4.

Legend of punctual symbols of Pallas' geological map (1773).

Kalk in Flötzen: horizontal limestone beds. Secondary mountains.

Sandschiefer: alternations of sandstones, shales, and marls. Tertiary mountains.

Marmor: marbles intercalated in the metamorphic schists of the east side. Primitive mountains.

Jaspis Gebürge: jasper (radiolarites) intercalated in the metamorphic schists of the east side. Primitive mountains.

The symbols of the second group (Fig. 4) deal essentially with materials of economic interest and are as follows:

Selenit, Alabaster u. Gypsarten: selenite, alabaster, and various forms of gypsum.

Alaunschiefer: alunite shales or schists; alunite or alumnstone. $KAl_3(OH)_6(SO_4)_2$, basic potassium aluminum sulfate, used in medicine as astringent, in dyeing, in tanning, and many other industrial uses.

Marienglass: selenite or transparent gypsum in large platy crystals found in veins from which are extracted large slabs used for windows. The term *Marienglass* (also called *Fraueneiss* or *Frauenglass*) is a symbol for purity of the Virgin Mary.

Vitriolerden: any kind of sulfate-bearing shales, probably copper sulfates.

Schwefelquellen: sulfurous water springs.

Asphalt: natural seeps of oxidized petroleum (tar pits).

Kochsalzquellen: salt water springs.

Glaubersalz: Glauber's salt (sodium sulfate).

Golderzte: gold ore.

Silbererzte: silver ore.

Kupfererzte: copper ore.

Eisenerzte: iron ore.

Bleyglanz: galena, lead ore.

Mammonts Knochen: Pleistocene mammoth bones.

For a comparison between Pallas' map and modern knowledge and to evaluate his understanding of the geology of the Urals, we have traced on his map, as accurately as possible, the boundaries between areas of similar punctual symbols of the major rock-types, thus changing his map into one with bands (Figs 5, 6, 7, zones A-I).

REFERENCES

ELLENBERGER, F. (1985). "Recherches et réflexions sur la naissance de la cartographie géologique, en Europe et particulièrement en France": *Histoire et Nature,* No. 22-23, 1983, p. 3-54.

FIG. 5.

Partial reproduction of Pallas' geological map of the central Urals (1773) with punctual symbols, showing the bend against the Ufa foreland.

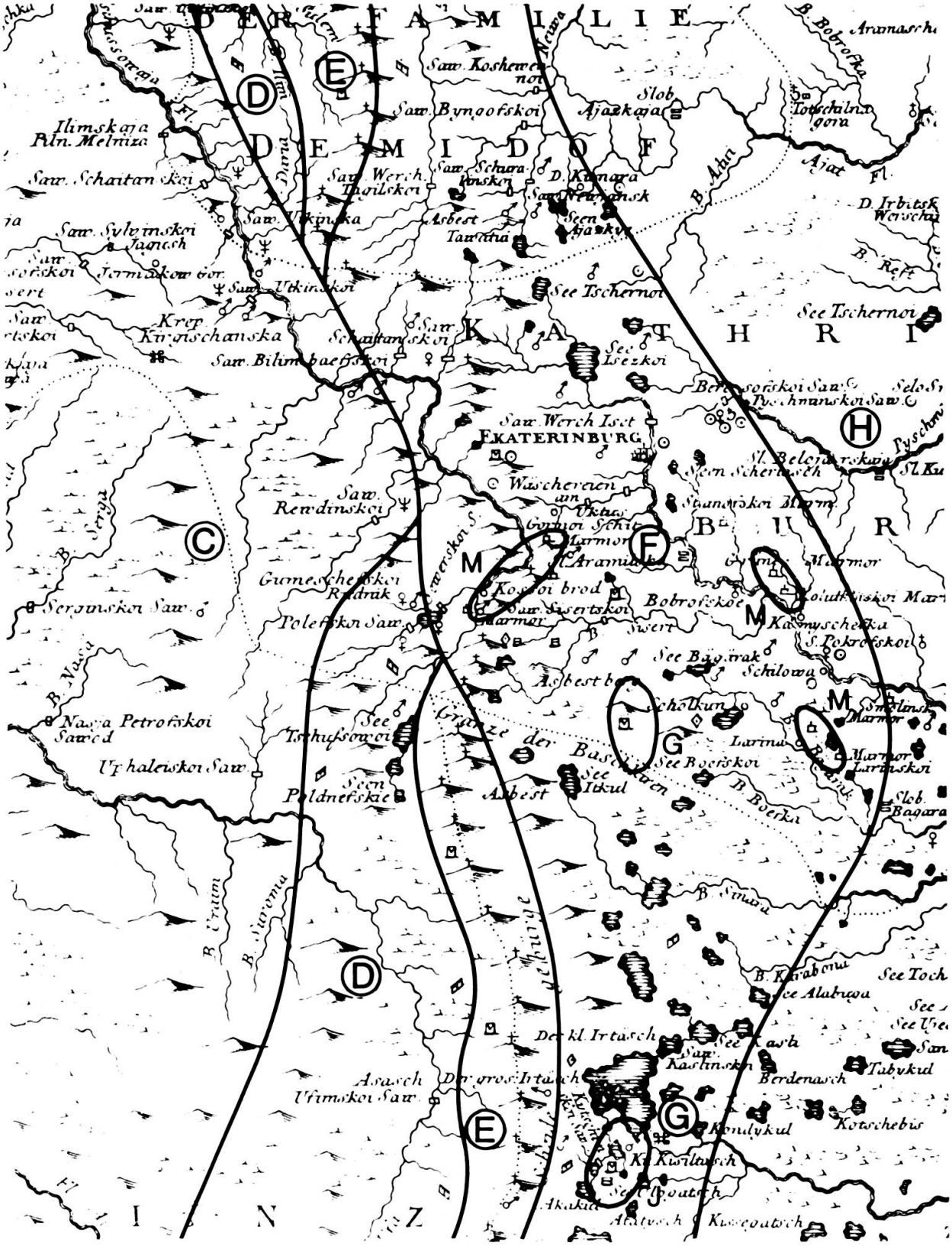

FIG. 6.

Example of transformation of the portion of Pallas' geological map with punctual symbols of Fig. 5 into a map with bands. For the meaning of the letter symbols, see legend of Fig. 7.