

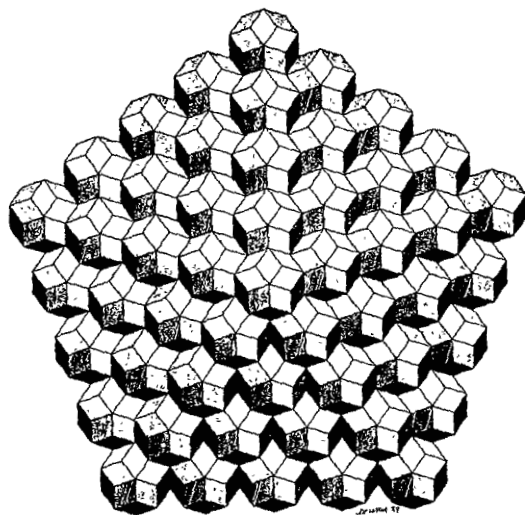
For

Symmetry of STRUCTURE

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Abstracts

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SYMMETRY OF THE EARTH SURFACE AND SOIL SPACE
STRUCTURES.

1. The aim of the present work was to carry out the cartographic analysis of the Earth surface and soil space structures using the symmetry theory. Accordingly, it was necessary to present the topographic map, a mathematic model of the Earth surface, which has a form of continuum of horizontal lines, as discontinuum. For this purpose the continuum of topographical map isohypses was transformed into the discontinuum of new relief plastics maps by means of additinal lines (morphoisographs). These lines were drawn according to Menier, they follow the normal and go to the horizontal lines, uniting the meanders of the same curvature. The identity of the original (isohypsic) and modified (morphoisographic) forms of the Earth surface is proved by the presence of invariants.

2. Indivisible systems consisting of two symmetric subsystems convexities and concavities are shown in the relief plastics map (Fig. 1). With convexities painted one can get a twocolour model of topographical or soil space having symmetry properties. These models possess interesting varieties of symmetry similar to those of antisymmetry.

3. The relief plastics maps have been compiled for the vast territories of the USSR including all the natural regions and zones. It allowed to find the differences in the symmetry of pattern structures in every significant geomorphological region, type and subtype of soils, as well as the peculiarities of their periodical recurrence. The soil and rock composition was not taken into account as

in crystallography while studying the symmetry of patterns. It is important to calculate the number of possible forms of the Earth surface which exist in nature, to determine their geometrical peculiarities and to find the symmetry of their spatial-temporal relationships as well. Thereafter it is possible to study the correlations of natural forms of the Earth surface taking into account the composition of rocks and soils. So, the correlations found allow to examine on the symmetry basis the properties of rocks and soils as well as a type of mineral deposits.

4. Polygonal, curvilinear and branching treelike structures are given in the relief plastics maps and soil maps (Fig. 2). Any relief is based on a treelike pattern appearing in the weakened (fatigued) zones of the Earth crust and having a morphological basis in the form of a hydrographical network. The treelike patterns are classified according to the symmetry of borders, they also have the forms of open and closed graphs (Fig. 2 D,E). Their rounded "crowns" form circles, ellipses, spirals. They are situated at the nodal points of the plane crystallographic lattice (Fig. 2 B) and their spatial arrangement has a lot of symmetrical, polygonal and other structures of various hierarchical levels (Fig. 2 C). The forms are inserted into each other thus forming the symmetry of similiarity.

The Earth surface is a complex spatial and temporal arrangement of symmetrical (and assymmetrical) forms (Fig. 2 A). The Earth crust block surfaces of different age are sometimes exposed at the day (apparent) surface and therefore their original relief as well as the weathering soils and crusts of the same time period can be studied structurally.

The relief of different age has specific patterns of symmetry. Long - term evolution of the planet resulted in topological changes

of the relief patterns. The direction of these changes can be found by analysing strange attractors. Soils, the youngest natural bodies of the Earth, follow the relief borders. This indicates that the soil space formation is going on still actively. If the time of origin of any soil series or relief is known, the arrangement of the Earth crust symmetrical forms of different age can be drawn on the map. The time when one form is transformed into another is indicated by dislocations manifested morphologically.

5. The analysis of the symmetry-dissymmetry of the Earth surface forms allows to conclude that the patterns of the relief and soil space can be characterized as dissipative structures during geologically long period of time: they change periodically their forms and spatial correlations between them depending on the quantity and quality of energy obtained. The relief patterns like living beings increase and decrease their dimensions, are divided or merged, forming rectilinear or curvilinear lines in different directions. These changes are not casual and are likely to be purposeful.

Probably, as a result of fighting against entropy the Earth has developed a special mechanism for receiving, accumulation, transformation and redistribution of energy due to topological adaptation of the most mobile structures of the relief and soil space to economically more profitable energy consuming forms, e.g. spirals.

CONCLUSIONS. It is suggested to construct cartographic models of topographic and soil surfaces on the mathematic basis instead of ordinary maps depicting relief and soil peculiarities. These models based on the symmetry theory can be applied to establish the regularities of systematic-structural correlations.

FIGURE LEGENDS.

Fig. 1. Comparative estimate of sketching on location (A), topographic map of the same locality, the relief forms of which are presented by the curves of the horizontal lines (isohypses) (B), relief plastics map, where the same locality is given in another form (the convexities are shaded).

Fig. 2. New relief plastics maps show the structures of the Earth surface and soil space.

A - Vortical structures of the relief and soil space on the territory of the Urals and Kazakhstan.

B - Hexagonal structures of the Earth surface and soil space on the territory of Moscow Region. The picture of optical diffraction (Furier transformation) obtained from the relief plastics map in the Institute of Crystallography USSR Academy of Sciences.

C - Spatial patterns of various types and subtypes of soils in the USSR obtained by means of the relief plastics map compiled on the basis of optico-structural analysis.

D, E - patterns of soil space in the vicinity of Pushchino, Moscow region, drawn according to the relief plastics map at a scale of 1:50 000. D-soddy podzolic, E-grey forest soils. The patterns differ in the form of treelike structures.

