"Paleogeomorphological atlas" as a way to accumulate generalized and obtain new information «historical-dynamic morphosystem of the Earth»

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SUMMARY

Now the geomorphology object of the relief of the Earth is specified as a historical-dynamic morphosystem of the Earth.

The historical-dynamic morphosystem of the Earth continuously forms its own space-time - the geomorpholithosphere.

The historical-dynamic morphosystem of the Earth and geomorpholithosphere are studied mainly by paleogeomorphology.

An important task of paleogeomorphology is the development of paleogeomorphological mapping, which involves the creation of paleogeomorphological maps and their atlases.

When compiling paleogeomorphological atlases, theories and methods are directly and indirectly used: non-equilibrium thermodynamics theory, general systems theory, morphochronodynamic concept, morphochronodynamic analysis, regional geomorphological analysis, complex paleogeomorphological analysis, cartographic method, mathematical and statistical method.

There are sufficient conditions to create "paleogeomorphological atlases" of the terrains of the former USSR.

"Paleogeomorphological atlases" consist of the following sections: 1) explanatory text; 2) traditional paleogeomorphological maps; 3) a new type of maps built on a morphochronodynamic basis; 4) special maps for individual objects - traditional and "new"; 5) special maps that have theoretical and practical orientation.
Introduction

According to present representations, the object of geomorphology is the relief of the Earth is concreted as geomorphosystem or morphosystem of the Earth. The morphosystem of the Earth was formed after the gadiy. It is historical-dynamic in content, marked by directional-cyclical development.

The historical-dynamic morphosystem of the Earth continuously forms its own space-time - the geomorpholithosphere. In the course of evolution different parts of the geomorpholithosphere are constantly being complicated and complicated-simplified. The morphosystem of the Earth is an element of the Earth's self-oscillating megasystem, in which the exchanges of matter, energy, information, entropy between the Earth's surface and the Earth's subsoil takes place. The morphosystem of the Earth and geomorpholithosphere are studied mainly by paleogeomorphology.

At the sixth plenum of the Geomorphological Commission (GC) of the USSR the basic attributes and tasks of paleogeomorphology (theory, methodology, methods, practical application, creation of centers of paleogeomorphology development, personnel training, information support) were identified. An important task of paleogeomorphology is the development of paleogeomorphological mapping, which involves the creation of paleogeomorphological maps and their atlases (Problemi…,1970).

In the 70's of the 20th century the largest center of paleogeomorphology at the department of geosciences and geomorphology of geographical faculty of the Taras Shevchenko National University of Kyiv was created. For many years, scientific and applied directions of paleogeomorphology have been developed here, specialists, including the highest category (doctors and candidates of sciences) are being trained.

At present, the department has all the necessary conditions for the creation of paleogeomorphological atlases (in particular for the territory of Ukraine). These are: the developed scientific concept of the atlas, its structure, the content of its maps, which summarize and systematize the accumulated information about historical-dynamic morphosystem of the Earth and allow to obtain new information necessary for the development of the theory of geomorphogenesis and practical purposes, in particular for the through (retrospective, actual, perspective ) prediction of the state of the environment, which can be used in the search for minerals, in ecology, in the protection of the environment, rational use of nature, territories planning and so on.

Method and Theory

When compiling paleogeomorphological atlases, theories and methods are directly and indirectly used:

• The theory of nonequilibrium thermodynamics makes it possible to theoretically substantiate the existence of the historical-dynamic morphosystem of the Earth and its geomorpholithosphere;
• The general theory of systems allows to develop principles of their selection system attributes of the historical-dynamic morphosystem of the Earth;
• Morphochronodynamic concept allows to substantiate its own method of studying the historical-dynamic morphosystem of the Earth at the level of theory, methodology and tasks;
• Morphochronodynamic analysis - implementation at the regional level of the morphochronodynamic method of studying the historical-dynamic morphosystem of the Earth;
• Regional geomorphological analysis allows to obtain additional and auxiliary information about the Earth's historical-dynamic morphosystem;
• Complex paleogeomorphological analysis - selected geological, geomorphological, paleogeomorphological, geophysical, hydrogeological, geographical, cartographic, mathematical and statistical, other methods for studying the historical and dynamic morphosystem of the Earth and the geomorpholithosphere;
• Cartographic method allows to study the historical-dynamic morphosystem of the Earth, to make quantitative parametrization of the information obtained by compiled general, partial, special, additional, auxiliary maps;
• Mathematical-statistical method allows to perform statistical processing of quantitative parameters obtained from maps, to carry out mathematical analysis and modeling of the historical-dynamic morphosystem of the Earth.
Examples

The morphochronodynamic method was used at the regional level to study the historical-dynamic geomorphosystem of the Ukrainian shield in mesozoic-cenozoic (Bortnik, 1992; Filonenko, 2001; Komliev, 1988; Komliev, 2005; Pohorilchuk, 2002; Remezova, 1997). In these studies, the research algorithm from "static" to "dynamics" was used. Their result is models of historical-dynamic geomorphosystems: horizontal - general and partial paleogeomorphological maps, maps combined and their derivatives, special maps of individual objects (subsystems) of the geomorphosystem - "historical-dynamic basin geomorphosystems", "morphosystems of modern river basins", "mesozoic-cenozoic valley formation"; vertical - sections of the geomorpholithosphere (geological, historical and dynamic, modern and functional); quantitative parameters obtained from horizontal and vertical models, results of their mathematical-statistical processing, analysis, modeling. Most of these results are included in the relevant sections of “paleogeomorphological atlases”.

Results

There are sufficient conditions to create "paleogeomorphological atlases" of the terrains of the former USSR. In the former USSR, the most intensive paleogeomorphological work was carried out in the 40-70's of the 20th century. Then there was a rapid accumulation of paleogeomorphological information and there was an urgent need for its generalization, ordering, use. The urgent task of the new science of paleogeomorphology was to create paleogeomorphological mapping. In the following years, issues of content, principles and methods of compiling paleogeomorphological maps, ways of depicting "ancient relief" on them, choosing "age" intervals for its reproduction on maps, were actively developed.

The first special paleogeomorphological map was "Map of the surfaces of the alignment and weathering crusts of the USSR. Scale 1: 2500000" (Karta poverhnosteiy… 1972). The map mainly contains empirical data. By the way of generalizations it is analytical. It shows, in real time, the categories of ancient relief (buried unopened and reconstructed), which are objects of paleogeomorphology, and combined with relief (surfaces of alignment) conformal deposits. This map, above all, had an applied orientation (the search for hypergenic minerals), and for the geomorphology its significance was in the attempt to create its own timeline (denudational chronology).

Following the aforementioned VI plenum of the GC of the USSR, there was an active discussion on the principles of compilation and maintenance of maps of the future paleogeomorphological atlas. In 1983 was published "Atlas of paleogeomorphological maps of the USSR". In the final version, it used a somewhat adapted to the purpose paleogeomorphological atlas of the lithological-paleogeographic principle, which is used on paleogeographic maps and atlases. But, unlike the latter, the maps of the paleogeomorphological atlas of the USSR reflected the morphology and genesis of land and sea terrain relief, the age of relict land relief, the associated sediments and exogenous minerals, which corresponded to the morphogenesis paradigm that was leading then (Paleohemorfolohichniy atlas...1983). The atlas could not conceptually reflect the historical-dynamic morphosystem of the Earth.

The "Geomorphologic map of the USSR scale 1: 2500000" was issued in 1987 (Heomorfolohichnya karta…1987). It became the first major cartographic generalization of a significant stage (Mesozoic-Cenozoic) in the history of the large-area geomorphosystem. The map is made on a clear conceptual (morphogenetic) basis, which consisted of "size-genetic classification of forms of terrain of the Earth (morphotecture, morphostructure, morphosculpture)" (I. Gerasimov - S. Engeln) and "geomorphological stage of the Earth". It also took into account the significance of the "neotectonic stage of the Earth". By the way of the generalization, this map is analytic-synthetic. Synthetic basis of it is "morphostructure", different types of which are shown by a qualitative background (color and its shades). To convey analytical information, a fairly wide range of different mapping methods were used. These are detailed and partially generalized data on morphology, morphometry, genesis, age of relief, neotectonic movements, relief-forming coverings of loose deposits. The map and its legend have also reflected some of the debating issues of the genetic nature of individual areas. The information needed to use the map for various application purposes is contained directly and indirectly on the map and in its legend.
Map Atlases are a convenient way to collect, store, use, and retrieve new information about a research objects. The content of the atlas maps is influenced by the requirements of the leading paradigm of a particular science. Atlases can be of historical and factual importance to science, contain undisclosed information, theoretical and methodological potential in the study of its object.

Some common modern theories (nonequilibrium thermodynamics, thermodynamic evolution of the Earth) allow us to understand the fundamental nature and causes of the emergence of new geosystems on our planet (one of them is the geomorphosystem). The relief of the Earth is a historical-dynamic morphosystem of the Earth that emerged at the planetary stage of its development and which continuously forms its own space-time - the geomorpholithosphere. An important characteristic of the historical-dynamic morphosystem of the Earth is directed-cyclic development. After reaching a certain spatial constancy (power) in the archaea, the geomorpholithosphere has 2 main tendencies of changes of internal structure and form its «body» - complication and complication-simplification. The morphosystem of the Earth is an element of the planetary self-oscillating megasystem, in which the exchanges of matter, energy, information, entropy between the Earth's surface and the Earth's subsoil takes place. At the same time, it reflects, self-develops, self-organizes and influences other elements of the megasystem - the tectonosphere, lithosphere, asthenosphere (Gutenberg), which interact on a cause and effect principle.

"Paleogeomorphological atlases" of a new type should be created on a methodological basis of system theory, contain the necessary data on historical-dynamic morphosystem of the Earth, its composition, structure, history, evolution, modern dynamics, and give new information in a convenient way for traditional and new users. Paleogeomorphology has long been regarded as a potential "growth point" of geomorphology (M. Florensov, V. Filatov). It allows to extend considerably the spatio-temporal framework of the object of geomorphology and presents a morphochronodynamic method of its study. "Paleogeomorphological Atlases" are becoming an important part of the new generation of geomorphological atlases, created on a methodological basis of systems theory. Paleogeomorphology, performing its main task - disclosing the history of development into separate stages of the Earth's geomorphosystem (relief), gives, at the same time, information about its present state (the materially-morphological complexes that make up the geomorpholithosphere). Such atlases are also becoming more suitable for contemporary global and regional problems.

"Paleogeomorphological Atlases" consist of the following sections: 1) explanatory text, which describes the prerequisite creation, theoretical concept, scientific and methodological achievements of geomorphology in the study of the Earth's historical and dynamic morphosystem; 2) traditional paleogeomorphological maps, built on a historical-genetic basis for individual stages of the Precambrian, Paleozoic, Mesozoic and Cenozoic territories; 3) a new type of maps built on a morphochronodynamic basis; 4) special maps for individual objects of historic-dynamic geomorphosystems - traditional and "new"; 5) special maps that have theoretical and practical orientation (Komliev,2014; Komliev, 2015; Komliev, 2015; Komliev et al.,2015; Komliev et al.,2015; Komliev et al.,2016).

The latter include **prognostic** maps that allow for the so-called **cross-cutting forecasting**, whose components are retrospective, topical, perspective types of forecasting. Retrospective forecasting is traditional - the search for mineral minerals, relevant and perspective are more relevant to solving the problems of rational use of nature, nature protection, ecology, territorial planning. All these types of forecasting are united by the purpose and the task of carrying out the **balance calculations** of the movement of matter in and through the geomorphosystem during the developmental cycles. This opens up the fundamental possibility of calculations for planetary integral mega-systems comprising the morphosystem of the Earth. This and the above considered integral megasystem "earth surface - the lithosphere - the asthenosphere of Gutenberg". In it there are material, energy, information, entropy exchanges of the earth surface and subsoil: the subsoil is replenished by exogenous energy bound in the crystalline lattice of silicate and aluminosilicate minerals, which the geomorphosystems of the earth surface transits into into the platform basins, geosynclinal deflections, deep-water gutters. In other thermodynamic conditions, subsoil, this energy is released and transformed into physico-chemical systems, transforms into tectonic, magmatic, metamorphic systems, and then returns to the earth surface, creating on it gravitational potentials.
Conclusions

Atlases are recognized as the most convenient way of generating, storing and using information about a research object. "Paleogeomorphological Atlas" should contain the necessary data on the historical and dynamic morphosystem of the Earth. The main scientific (and practical) purpose of the atlas is to keep generalized data on the geomorphosystem of Ukraine - its structure, structure, history, evolution, modern dynamics, on a modern theoretical and methodological basis, to give new information in a convenient way for traditional and new users.

The Paleogeomorphological Atlas of Ukraine should become a necessary link for the creation of geomorphological atlases on a more modern theoretical and methodological basis. Paleogeomorphology, performing its main task - disclosing the history of development into separate stages of the Earth's geomorphosystem (relief), gives, at the same time, information about its present state (the material-morphological complexes that make up the geomorpholithosphere). Such atlases are also becoming more suitable for contemporary global and regional problems.

The value of paleogeomorphological atlases for geoinformatics lies in the ability to investigate the Earth's historical and dynamic morphosystem based on the use of map data after quantitative parameterization of the studied objects, and create quantitative data banks. It provides opportunities for wide application of methods of mathematical statistics, mathematical analysis, to use mathematical modeling.

References

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