НАУКИ О ЗЕМЛЕ И ПЛАНЕТЫ

GEOHYDRODYNAMICS SYSTEMS IN UNDERGROUND HYDROSPHERE OF MAINLAND SUBPARTICLES OF PLANET EARTH AS THE BASIS OF HYDROGEOLOGICAL TRATIFICATION (ON THE EXAMPLE OF CENTRAL ASIA)

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Annotation. The aim of the article is a historical conceptual analysis of various principles and methods of hydrogeological stratification (regionalization) of the underground hydrosphere on the territory of the former USSR and the post-Soviet space of Central Asia, as well as the proposal of a fundamentally new approach to hydrogeological zoning on the basis of the hydrodynamic principle with the allocation as the main element of zoning-geohydrodynamic systems. Historically, various aspects of the improvement of zoning – concepts and terms, horizontal and vertical boundaries, hydrogeological structures, target systems, modeling, prognostic role of zoning. A new original stratification technique is proposed, which allows to perform a reliable assessment of the total water resources of the regions taking into account the interaction of surface and underground runoff.

Keywords: Conceptual critical analysis of the historical development of the principles and methods of hydrogeological stratification, new principles and methods of assessing the water resource potential of territories based on the hydrodynamic approach to the study of the process.

1.Introduction to the history of the problem. Issues of General hydrogeological zoning are of major importance in regional hydrogeology. Being the main way of generalization of the accumulated information, they appeared long ago, at the turn of XIX-XX centuries and since then are constantly the object of research and discussion. The works of many researchers-Hydrogeologists are devoted to the solution of actual hydrogeological problems of the territories of Central Asia (CA): Akhmedsafin U. M.[2], Arkhangelsky B. N. [1] , Sydykov Zh. S., Shlygina V. F. [51], Grigorenko P. G.[6-7], Tolstikhin N. I. [11,43,53], Ovchinnikov A.M. [47], Marinov N.A. [41], Lagutin E. I. [13-37], Mirzaev S. Sh. [42],], Shestakov V. M., Pozdnyakov S. P. [54], etc. The data of the study of groundwater indicate the shortcomings of the current principles and schemes of hydrogeological zoning [20-21, 23-24, 32-34], and engineering-geological studies have some difficulties in the integrated assessment of Geosciences [30,31,54].

2. The theory of geographical zonality of ground water. For the first time, the zonal regularities in the geographical distribution, depth of occurrence, water content and mineralization of groundwater on the European plain were revealed by Ototsky P. V., who identified four latitudinal zones in this territory, alternating from North to South [45]: 1) a zone of shallow, merging with surface, abundant, almost completely non-mineralized waters with a surplus of organic matter; 2) a zone of shallow, relatively abundant, extremely little mineralized waters of good quality; 3) the zone moderately watered, places with deep, significantly mineralized waters; 4) the southern zone, low-water and anhydrous, with deep mineralized groundwater. P. V. Ototsky wrote that "in Asian Russia, as far as the scarce literary sources allow us to judge, groundwater is distributed in the same natural order as in European" [45]. The scheme of Ototsky P.V. is the first attempt of groundwater zoning on the basis of natural zonality.

Further development of the theory of groundwater zoning and the principles of hydrogeological zoning based on it are devoted to the work [1,2,3,5,6,7,10,45,11]. Comparison of schemes and maps of these researchers testifies to two different approaches to the problem of zoning. One of them is characterized by the desire to use as signs of zoning natural factors that determine the formation of groundwater: climate, topography, geological structure of the territory. This approach is reflected in [1-2]. However, despite the common approach, the authors used different features in zoning, so the schemes and maps they created differ both in the content and boundaries of the selected taxonomic units. The second approach to the problem of hydrogeological zoning on the basis of natural zonality is found in the works, which based their schemes on the signs reflecting the properties of groundwater itself: their chemical composition, mineralization, type of formation [1,2, 3, 7]. Tolstikhin N.I. applied the theory of natural zonality to artesian waters and identified two large hydrogeological zones of artesian basins according to the peculiarities of the influence of climatic factors on the formation of groundwater in the USSR: 1) the zone of negative temperatures of groundwater (frozen zone); 2) the zone of positive temperatures of groundwater (thawed zone) [11]. Later, he within the land and adjacent seas of the globe identified eight zones of artesian basins: Arctic, boreal, Mediterranean, Equatorial, southern, Antarctic, Antarctic, Pacific. The belts consist of artesian regions that combine artesian basin systems [53].

3. Geological and structural principle of hydrogeological zoning. The geological-structural principle of hydrogeological zoning was developed and applied to deep (artesian) groundwater and is associated with the research of Nikitin S. N.,

Prigorovsky M. M., Vasilevsky M. M. [1-2, 3, 7,9,46,49]. Nikitin S.N. at the end of the XIX century for the first time revealed the patterns of distribution of artesian and groundwater on the Russian plain, dividing it into several hydrogeological basins of groundwater, including The Moscow basin [46]. Later, Prigorovsky M.M. summarized the scattered knowledge about the artesian waters of the Russian plain and characterized the five main artesian basins [49]: 1) the North-Western region of the cambro-Silurian and Devonian artesian horizons; 2) the Central Russian artesian basin (adjacent to the basin near Moscow); 3) the South Russian (Kharkiv-Poltava); 4) artesian waters within the South Russian crystal band; 5) artesian waters South of the crystal band. Six geological sections crossing the described basins gave an idea of the possibilities of using pressure waters in different parts of The Russian plain. Vasilievsky M. M. noted that the geological structure determines the basic conditions of occurrence and movement of groundwater, for the basic units (units of the I order) of hydrogeological zoning of deep artesian waters took hydrogeological basins, hydrogeological provinces and hydrogeological mountainous areas corresponding to three forms of geological structures: depressions, elevations and folded structures [3]. Those parts of the main units of zoning that do not have the characteristic features of the basin or the mountainous region, Vasilevsky M.M. called hydrogeological areas [3]. The author recommended to allocate taxonomic units of the second and following orders on geological-structural or stratigraphic basis. The idea of General hydro-geological zoning and, in particular, deep artesian waters on the geological-structural principle has found a wide response among researchers-Hydrogeologists [1,2, 3, 7, 48].

4. Horizontal boundaries of hydrogeological areas. The boundaries of districts depending on the mapped objects are also drawn differently by different authors. B. L. Lichkov [39], Vasilevsky M. M. [3], Lange O. K. [38] the boundaries of the main hydrogeological areas are drawn along the contours of geological structures, Zaitsev I.K. [11], Tolstikhin N. I. [43] the boundaries between the Arte-zian basins and hydrogeological massifs are drawn along the contact of rocks on the Earth's surface between the cover and the Foundation. N.A. Marinov draws the boundaries of hydrogeological areas of the first order on hydrogeological watersheds [41]. Pinneker E.V. with a view of the boundaries of major structural elements, geologic history and neotectonics. Of course, the boundaries of areas II and the following goryadkov also do not have a single basis; these may be structural boundaries, disjunctive disturbances, distribution contours of the main aquifers, hydrogeological watersheds, etc.

5. Vertical boundaries of hydrogeological zoning. Of primary importance in regional hydrogeological zoning is the allocation of not only horizontal territorial boundaries-hydrogeological areas, but also their vertical boundaries. At the early stages of the development of hydrogeology, the concept of aquifer (layer or formation) was used as the basis for the separation of aquifers in the section. Over time, when the complex structure of aquifers became clear, the allocation of water-bearing complexes and horizons in conjunction with geological stratification began. Regional generalizations required the development and refinement of the principles of hydrogeological stratification. Ovchinnikov A. M., pointing out the importance of taking into account the structural floors in the allocation of groundwater basins, considered it necessary not only to strictly distinguish the structural floor to which each groundwater basin is confined (Paleozoic, Mesozoic, etc.), but also to highlight multi-storey pools [47].

These problems are considered most fully in the work of Sydykov J.S. and Shlygina K.F. [51]. Remaining on positions of the General hydrogeological zoning on the geological and structural principle, they supplemented such approach to zoning with the developed scheme of hydrogeological stratification. They identified the following subordinate units: hydrogeological floor-hydrogeological series-aquifer - aquifer and layer. At the same time, it is impossible to recognize generality, universality of such approach in hydrogeological stratification. Moreover, the authors themselves indirectly pointed to this, approaching hydrogeological zoning from the geological and structural positions used, as has been repeatedly emphasized, separate hydrogeological zoning of artesian (pressure) waters. Indeed, in the artesian basins of the platforms, it is possible to confidently trace horizontal hydrogeological complexes and floors, sustained in area and in section. However, in mountainous areas, where (ground) waters predominate and where water-bearing sediments, crushed into folds, often lie almost vertically with angular and stratigraphic disagreement, such a purely geological-structural approach to characterize the hydrogeological system is obviously not applicable. Water-bearing are here all the sediments that come to the surface of the day, they form a complex of non-pressure or non-pressure-sub-pressure waters. Accordingly, it is expedient to designate these deposits, remaining within the framework of subordination of hydrogeological stratification units, as a complex, and a separate stratigraphically and lithologically sustained layer as an aquifer.

6. On concepts and terms in hydrogeological zoning. The literature has repeatedly developed a discussion on the concepts and terms underlying zoning, principles and schemes of zoning of artesian waters, which showed a variety of opinions on this problem. At the same time, the application of one or another of these schemes is determined not by any of its advantages over all others, but often by the departmental competence of the team of researchers developing the scheme. So, the most recent methodology and scheme of the regional zoning of the USSR, was developed in VSEGINGEO under the leadership of Ostrovsky L.A., non-inevitably had to be widely disseminated, as it proceeded from the organization leading methodical providing hydrogeological services to the whole country (through the Ministry of Geology of the USSR) [48]. It should

be noted that this method is one of the most justified and developed. It is the first attempt to analyze and summarize the accumulated experience of General hydrogeological zoning, to take into account and link all possible shortcomings and controversial points of previous methods and schemes. Nevertheless, from the point of view of the system analysis it, to a certain extent, can be considered as a step back due to the fact that it again proposes a combination of the principles of zoning of groundwater and artesian waters.

I must admit that this attempt failed. Based on the geological and structural principle of zoning, Ostrovsky L.A. even in the basins of a smaller order did not take into account the obvious divergent boundaries characteristic of groundwater flows (non-pressure) waters. Such boundaries do not always coincide with the boundaries of geological structures. This led to the fact that some basins of non-pressure waters with a complete cycle of their formation (for example, in the territory of low orogens of Central Kazakhstan) in accordance with the zoning scheme were divided, and their parts were in different structural units of the highest order [48].

A similar situation has developed in the hydrogeological zoning of Kyrgyzstan, where the author of structural-hydrogeological zoning Grigorenko P.G. [7], in order not to violate the principle of zoning, was forced to refer to the category of "artesian basins" as one of the main elements of such zoning, along with "hydrogeological massifs", also taking place in the territory of the Tien Shan groundwater basins called "artesian groundwater basins", which in itself is nonsense.

7. The system of objectives in hydrogeological zoning. The given examples quite objectively characterize the existing state of the system of goals of regional zoning. The above often leads to a situation where the question arises: why, for what purpose, in fact, regional hydrogeological zoning is carried out, if there are products of special hydrogeological zoning-hydrogeological maps of different scales (including large regions, territories of the country), which in principle reflect all the necessary hydrogeological information. According to academician Veselov V.V., it seems appropriate and necessary to introduce a hierarchy in the system of goals of regional hydrogeological zoning [4]. "The main purpose of the performed zoning is the accounting and assessment of groundwater resources on the basis of systematization and generalization of the results of all hydrogeological studies preceding zoning. The allocation of hydrogeological reservoirs with a complete (and complete within these reservoirs) cycle of groundwater formation, with individual conditions of their occurrence and circulation, should precede the accounting and assessment of groundwater resources. Identification of patterns of formation of groundwater, their chemical composition and, in addition, tanks is a target function of the next, lower level. On the basis of these regularities, the actual accounting and assessment of groundwater resources is carried out. Finally, the goal or objective of the third, lowest level is the allocation of hydrogeological reservoirs" [4].

The stated concept allows to answer fairly objectively and clearly the question for what purpose zoning is carried out, it gives an idea of the subordination of goals in the system and, finally, does not contradict the already existing and rather vague ideas about the target functions of regional hydrogeological zoning.

The proposed system of goals of General hydrogeological zoning clearly traces the connection and subordination of General and private zoning. Branch and General on this sign do not differ as in quality of the last the artificially entered difference on object of a regionation acts. As a feedback from the General zoning to the private, in our opinion, it can be called that zoning under the conditions of formation of groundwater on the basis of a direct indicator (for example, in terms of the value of groundwater resources) is possible only within the allocated hydrogeological capacity with a full and complete cycle of their formation [4, 15]. We share this view [15]. Natural resources of underground waters (underground runoff) act as a characteristic of the entrance to the selected hydrogeological system (capacity) and exit from it.

It is widely known that the most perfect General scientific instrument of cognition in recent years is system analysis. You also need to include the fact that the methodology (including modelling) objects which are considered and a mapping model areas in hydrogeology, developed after systemic ideas in geography, where in the first place put forward the problem of separation of functions geosystems (GIS) [4]. By analogy with the geographical system for a hydrogeological system, the function is established on the basis of studying the interrelations of the components of the system, and the study of the migration of material-energy flows gives the territorial timing of its intensity-territorial differentiation [23-27].

8. Modeling in hydrogeological zoning. The involvement of models can be very useful for General hydrogeological zoning, ensuring its logical completeness. In this case, the content of the General hydrogeological zoning can be determined quite clearly [27-29]. The latter is an attempt to obtain a discrete distribution of any parameter over the area in order to introduce weights of the selected territorial fragments in the estimates of the integral value of the parameter on the considered area. In turn, the integral values of the parameter in the selected fragment are a consequence of larger-scale zoning within the fragment [4, 27-30]. Thus, the detail of zoning is determined by the level of generalization (scale) in which zoning is carried out. The proposed formulation of the content of zoning clearly prescribes the sequence of zoning-from large-scale to small-scale, which fully corresponds to the obvious approaches to generalization in cartography; small-scale maps are built on the basis of large-scale, and in any case not the other way around.

9. Prognostic role of hydrogeological zoning. Closely related to this is the problem of the predictive role of zoning. It is shown that " assignment of any object to this or that taxon of classification or zoning is possible only on the basis of some minimum of

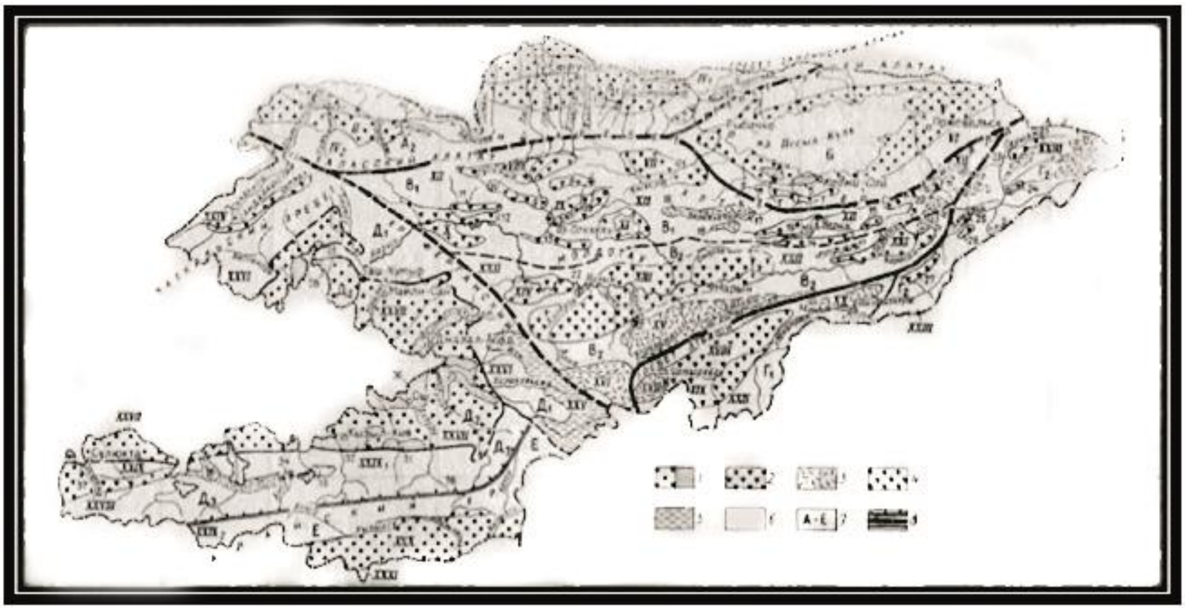
information about this object. Accordingly, the classification of direct predictive value, understood in such a way that the correlation of the object with some taxon classification provides new information about the parameters that characterize the object, does not have. Similarly, the need to generalize the parameters when zoning from a large scale to a small one excludes the possibility of a priori allocation of the object of small-scale zoning and its binding to the territory" [4]. Here lies the reason for attempts to zoning on indirect grounds-geological-structural, geomorphological, climatic and other features of the territory; the use of the latter as a basis for zoning, in principle, eliminates the problem of synergetic effect of zoning, since the similarity of territories in terms of spatial characteristics gives new information about the hydrogeological conditions of regions not yet studied [4, 13-29]. The current hydrogeological study of the territories of large regions, however, does not provide the possibility of establishing clear direct criteria for the zoning of these regions. But, on the other hand, it was possible to empirically establish a successful approach to the zoning of pressure waters, for example, on the basis of geological-structural (indirect) features-geological-structural elements, as it was found, are quite accurately identified with hydrogeological bodies having a complete cycle of formation of pressure waters. Similarly, the use of the geomorphological parameters of the territory in the first place provided an objective allocation of the boundaries of hydrogeological bodies, which are characterized by a complete cycle of formation of non-pressure (groundwater) waters. For example, watershed lines (watershed for surface waters) in some cases quite clearly fix divergent boundaries of groundwater flows, and the lines of erosion bases-convergent boundaries of these flows [4, 13-29].

Summing up the review of the most important works on the principles of hydrogeological zoning, we note that these issues are most studied in the present time for platform conditions. It is established and recognized by the authors that the main regularities of groundwater formation, expressed in the form of hydrodynamic and hydrogeochemical zones, are mainly determined by the geostructural position of hydrogeological basins [6-7, 11].

10. Features of hydrogeological zoning of mountain-folded regions of Central Asia. For mountain-folded areas, these issues are clearly insufficiently developed, poorly covered in the literature. At the same time, according to Marinov's N. A. fair remark, "the allocation of folded regions and massifs on hydrogeological maps is already insufficient at the present time, because it does not reveal their internal content" [41]. Marinov N.A. considers that if for a subject of hydrogeological zoning to take underground waters and structures to which they are confined, or geomorphology, in each concrete area it is possible to establish easily character of the underground waters formed in them [41]. The first experience of hydrogeological zoning of the territory of the Tien Shan orogen is associated with the research of Terletsky B.K. [52]. As a basis for this zoning, generally accepted geographical concepts are taken, but, along with this, some geostructural and lithological-stratigraphic features are also taken into account. Krylov M. M. and Schmidt M.A. in 1936 proposed hydrogeological regionalization of Central Asia taking into account the types of groundwater and hydrogeological types [12]. These authors noted the presence of vertical-zonal and azonal groundwater. When zoning mountain areas, they considered it necessary to take into account the underground watersheds. Vasilevsky M. M., Borsuk N.V. [3] proposed the first hydrogeological zoning of the Asian part of the USSR on the geostructural principle. They are already considering the Tien Shan as part of the Pamir-Tien Shan mountain-fold hydrogeological region. Within the Tien Shan, these authors distinguish hydrogeological regions - the Karatau ridge, the Northern arcs of the Tien Shan (with fractured waters), the Issyk-Kul and Fergana hydrogeological basins (with reservoir waters) [3]. Developing from these positions hydrogeological zoning of Kyrgyzstan, Grigorenko P. G. and Krylov M. M. [6] highlight for the Northern part of the Chui, Issyk-Kul and Talas basins and emphasize the emerging hydrogeological zoning within the basins.

More broadly, the question of hydrogeological zonality of intermountain basins was considered by Lange O. K. on the material of Central Asia [38]. The author singles out an independent hydrogeological zone of foothill plumes and foothill plains, the latter is subdivided into a subzone-water absorption of atmospheric precipitation and surface watercourses, groundwater vyklinivaniya, immersion of underground waters of alluvial valleys [38]. All mountain territories (including Kyrgyzstan) are allocated by Lange O. K. in "area of azonal ground waters of different types" [38]. A little later Grigorenko P. G. United intermountain depressions of Kyrgyzstan on geostructural and geomophological signs in three main complexes - mountain, foothill and plain. Within the intermountain depressions, peculiar geomorphological types are distinguished - the cone of removal, the proluvial weakly inclined plain, the alluvial draining valley, the lake plain, which differ in the originality of different complexes [6-7]. The named complexes according to Grigorenko P. G. "are at the same time hydrogeological, as the main features of regional regularities of their hydrogeological conditions are most clearly reflected in geomorphology". In the work [6] practically all the largest depressions of Kyrgyzstan were systematized for the first time from the point of view of their hydrogeology. Although this classification was not without drawbacks, it was a significant step forward in the systematics of the hydrogeological conditions of the Tien Shan as a whole. Its main disadvantages include, in our opinion, exaggeration of the geomorphological factor in the formation of groundwater and underestimation of such important factors for the conditions of mountain-folded regions as climate and landscapes, with their peculiar patterns of distribution. Features of dynamics of underground waters, especially deeply submerged, are insufficiently clearly revealed in geomorphological forms. In [6-7] there is no clear definition of hydrogeological boundaries of isolated depressions. In 1971 P. Grigorenko proposed a "Scheme of regional hedrogeological zoning of the Kyrgyz Tien Shan" [7]. The main types of hydrogeological structures are "artesian basins" and "hydrogeological massifs". The boundary between them is drawn by the contact of the Foundation (pre-Paleozoic and Paleozoic rocks) and the cover (Mesozoic-Cenozoic formations). Artesian Bassani divided into slope and intermountain; intermountain – United later in four groups. According to the combinations of artesian basins and hydrogeological massifs, hydrogeological regions and sub-regions are distinguished.This detailed and complicated scheme of hydrogeological zoning of Kyrgyzstan is the most successful attempt to use geological and structural principle in hydrogeological zoning of the Tien Shan mountain-fold region (Rice.1). However, under professional critical consideration, the above Scheme (Rice. 1) has a number of significant shortcomings, the main of which, being the shortcomings of the structural-hydrogeological principle of zoning, are most pronounced in the conditions of mountain-folded regions such as Pamir, Tien Shan, Tarbagatai, Altai, etc. On the example of Kyrgyzstan, which occupies the vast part of the Tien Shan mountain-folded region, they can be formulated as follows:

Allocation of hydrogeological massifs according to the fair remark of Marinov N.A. is not enough at present, because "it does not reveal their internal content" [41]. This correct remark is particularly noteworthy in hydrogeological zoning of the mountain-folded region, since it not only does not reveal the essence of the dynamics of groundwater in mountain areas, but, on the contrary, obscures the regularities of groundwater formation, which become clear only after hydrogeological analysis and the corresponding hydrodiamic differentiation of sub-earth runoff of the territory of hydrogeological massifs. The boundary between the main hydrogeological structures of artesian basins and hydro-geological massifs is drawn by the contact of the projections of the crystalline basement on the Earth's surface and the sedimentary Mesozoic-Cenozoic cover. This contact is sometimes tectonic and in some cases plays the role of a kind of barrier to the movement of groundwater, which has led to the opinion often prevailing among researchers-Hydrogeologists about the practical absence of overflow underground from the mountain ranges into the hollows of the bedrock. Studies carried Out by S. S. Mirzaev [42] for the mountainous regions of Uzbekistan, V. F. Shlygina [51] for Kazakhstan, Lagutin E.I. [14-29] for Kyrgyzstan showed the presence of such a flow in very tangible quantities, which indicates a hydraulic connection between artesian basins and hydrogeological massifs (Fig.2). This was well understood and noted by Mitgarts B. B. and Tolstikhin N.I. in 1961 [43]. Following the path of geostructural zoning with the allocation of the main hydrogeological structures of artesian basins and hydrogeological massifs, they did not deny at the same time the possibility of a second approach by which it can be carried out, since "the flow of surface and groundwater is usually directed from the

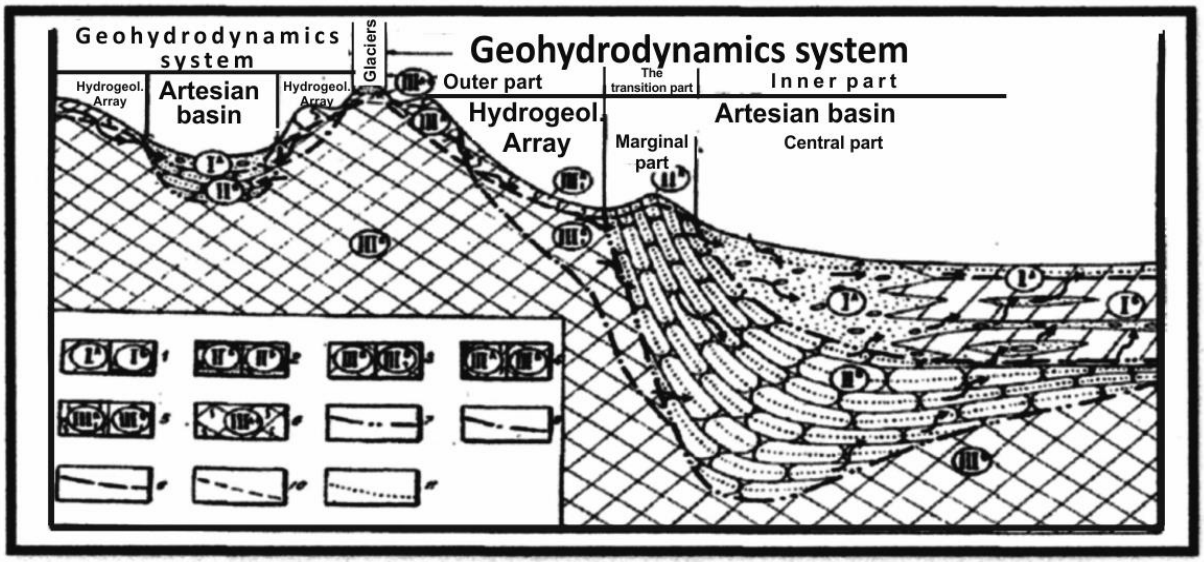


Rice.1. Scheme of structural-hydrogeological zoning of Kyrgyzstan by P. G. Grigorenko [7]

1-5. Artesian pools: intermountain outdoor pools, three-story buildings with a large capacity top-out underground floor (1 big point), with small (private mi) swimming pools (1 fine point) in the internal basins of three-story buildings with relatively small capacity of the upper floor of groundwater intermittent (2) and solid (3) distribution; indoor pools in two-story buildings (4), the middle floor falls; 5 - slope; 6. Hydrogeological massifs: I-XXXI - numbers of artesian basses and hydrogeological massifs; 1-38- rooms of private and small independent pools); 7. Hydrogeological areas: Tien Shan and Pamir-Alai regions; regions: a-Chu-Talas, B-Issyk-Kul ; B-Naryn, G-Sarydzhaz-Aksai. D-Ferghana. E-Alai; sub-regions:

A, - Chui. A2 - Talas, In The Northern Of Narinskii ; B2 - South Of Naryn, G1 - Aksai, G2 - Saridzhaski, D1 - Has Chatkal-Fergana. D2-Osh-Jalal-Abad. Dz-Alay-Turkestan.8-Boundaries: between regions, sub-regions, artesian basins and hydrogeological massifs. Dotted lines show the boundaries coinciding with the zones of regional newest faults or older ones, but updated with the latest movements.

massifs towards artesian basins and ends with their overflow into artesian basins. Water from the massifs enters the basins in several ways, the value of which in the nutrition of the basins depends on the local hydrogeological situation. First, water is transferred to the pool of permanent and temporary rivers, and second, flows of groundwater of the Quaternary cover, pouring into pools through the cones, in the third streams and jets of fissure waters penetrating through the thickness of the cover through the bed and sides of the Foundation. The slopes of the massifs connected to the basins, together with the artesian basins, form a single water-pressure system hydraulically and hydrodynamically" [43]. We share this view. If for Central Asian large bass- f the above considerations are hardly perceptible in quantitative terms, then in the conditions of mountain-folded regions of Central Asia, they are important in the first place. This is important in understanding the role of groundwater, i.e., underground



Rice.2. A fundamental comparative model of vertical - slit geohydrodynamics systems, artesian pools and hydrogeolo-logical arrays in the scheme of formation of underground runoff

1 - geohydrodynamics the top floor of the pore water - ground substage (1A) and substage subatomic waters (1B); 2 - medium geohydrodynamics floor porous fractured and PLA-stove-pore water-soil (PA) and subatomic (IIB); 3 - slope basins of underground-tion runoff, substage fractured groundwater - soil (SHA) and pressure (SB); 4 - lower geohydrodynamics floor fracture groundwater - groundwater (IIIA) and pornih (IIIB) ; 5 - the outer part geohydrodynamics system (floor fractured under the earth, water - soil (SHA) and pressure (SB)); 6 - permafrost zone; 7-11-terraces-7-geohydrodynamic floors, 8-private pools of underground flow; 9-geo-hydrodynamic sub-floors; 10-glaciation; 11-groundwater level.

hydraulic boundaries, characterized by the lack of overflow or hydraulic connection between the shared structures, while the boundaries of the contact of the Foundation and the cover-are largely conditional. Therefore, characterized hydrogeological zoning Grigorenko P. G. (See. Rice.1) according to the structural-hydrogeological principle [7], it can not be fully used in the assessment of groundwater resources (underground flow), because such methods as balance and dismemberment of the hydrograph of rivers can not be fully used .

B. According to the generally accepted opinion reflected in the publication "reference guide hydrogeologist "artesian groundwater basin - is a complex of aquifers, composing structures in the form of syneclyses or synclinal deflections" [50]. From this point of view, the very allocation of artesian basins in the conditions of the mountain-folded region, including in the Tien Shan, looks conditional, because artesian basins can be allocated only in the cases of synclinal structures with clearly marked water barriers. On the other hand, in order not to violate the principle of zoning, the author is forced to unite in artesian basins also basins with a known lack of pressure waters, allocating them to a separate "group of artesian groundwater basins", which is unacceptable from the classical point of view given above. From the same positions, the name "artesian" is hardly justified for the basins of a single pressure complex of groundwater in the upper "floor" - "ground and pressure waters of Quaternary deposits" [19-29, 32-34]. It is well known at the present time that the groundwater heads in this particular case are formed not in the conditions of synclinal structure, but by reducing the water supply capacity of aquifers and creating a backwater in the path of the underground flow. For such aquifers Lange O. K. [38] proposed Ter-min "sub-pressure", which allows to distinguish them from the" pressure " horizons and more corresponds to the essence of the reflected phenomenon. Therefore, the latter term is more appropriate to use. At the same time, the necessity of isolation of artesian basins in such a hydrogeological development becomes obvious [29].

11. Conclusions on the basic principles of hydrogeological stratification (zoning) and fundamental proposals for assessing the resource potential of groundwater. Years of controversy and the misunderstandings of the authors of the various approaches to zoning in aquifers occurs from a lack of appreciation of the fact that the underground hydrosphere, including two major components, the fluid (aqueous solutions of complex composition) and enclosing litho-sphere substance (the entire amount of the geological and tectonic formations) techniques are respectively based on two completely different forms of matter in motion. Modern state of the lithosphere is the product and result of geological forms of matter in motion its oscillations and cycle-mi, measured in many millions of years old, and the movement of groundwater (meaning under consideration in the zone of active water exchange) – there is a process that is based primarily on hydrodynamic parameters of water-bearing environment pressure, permeability from one side and then the cyclic effects of the elements of the external environment that determine, in turn, the entire oscillatory process and cycles in the movement of groundwater (subsurface runoff). In connection with the above circumstances, the principles, schemes and boundaries of zoning, performed on the basis of mechanical mixing of the above regularities, can not logically and in fact give a verified result, which has been shown and justified on the basis of intracontinental orogens of Central Asia [32-34, 37,52].

On this basis, zoning in the underground hydrosphere should be performed separately for hydrogeological reservoirs, that is, structural-hydrogeological formations containing deep underground waters, and for groundwater moving in the host medium, namely, for underground flow of the "upper hydrodynamic zone" [13-29, 44]. The laws of formation, distribution of such substances, as well as the boundaries of stratification units allocated on their basis will be completely different. The structural-hydrogeological principle of zoning can and should be used mainly to characterize the distribution, quantity and properties of groundwater in accordance with the requirements of hydrogeology as a science. Thus the description of hydrogeological structures (areas), it is necessary to carry out with use of the mathematical device that, will increase both quality and accuracy of estimates [21,29-30,34-36].

The study of regional underground runoff, as well as related surface runoff in the form of renewable water resources, requires a kind of geohydrological approach to the substantiation of its divergent and convergent boundaries, the typification of the conditions of its formation, the assessment of moving masses of groundwater. It uses the mathematical apparatus of the theory of hydrodynamic systems absolutely necessary justification for input parameters and using the apparatus of probability theory and mathematical statistics as well as forecasting this process involving the theory of random functions [26-28,33-37].

The lithosphere, together with the deep horizons of groundwater contained in it, is the product and result of the geological form of the motion of the earth with its processes, oscillations and cycles measured by many millions of years. The movement and the nature of changes in groundwater of the upper hydrodynamic zone [37] is a complex oscillatory process determined by the hydrodynamic parameters of the water-containing medium (pressure, permeability of the containing sediments), as well as by cyclic influences of the elements of the external environment, that is, factors that collectively determine the oscillatory processes and cycles in the movement of the underground flow.

General zoning in the underground hydrosphere should be performed separately for hydrogeological reservoirs as structural-hydrogeological formations containing usually pressurized groundwater, and separately for underground flow moving in the host medium, confined mainly to the upper hydrodynamic zone of the underground hydrosphere [37].

At the same time, “geohydrodynamic systems” (see Fig.2.), the ideas of which are developed in our studies [13-37], naturally unite both categories of the underground hydrosphere and on this basis can serve as a single basis for the General stratification (zoning) of the underground hydrosphere in the lithospheric part of the Earth, which does not exclude the separate zoning of the "second strand" within large hydrogeological taxa.

Geological age stratification in the hydrogeological area currently has a subordinate value, acting only as an information base for the allocation of hydrogeological reservoirs.

Geohydrology as a science that has renewable water resources of the hydrosphere as the object of its research, including surface and underground runoff in their interrelation and interaction, is based on the study of geohydrodynamic systems in the underground hydrosphere of the Earth and the use of the original methodology of quantitative estimates and forecasting of renewable water resources [26,29,33]. Total renewable water resources of the Earth include surface and underground runoff of continents. They remain approximately stationary during the current period of geological development. In addition to its own original ideas and methods [26,29,33,54], geohydrology also uses the techniques and methods of boundary Sciences with it-Geology, Geochemistry, geography, ecology, hydrology, soil science, landscape, hydrodynamics, probability theory and the theory of random functions.

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