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Hydrogeological map of Albania at a scale of 1:200,000, principles of compilation and content – a document of Albanian pioneering hydrogeological research since the 1960s

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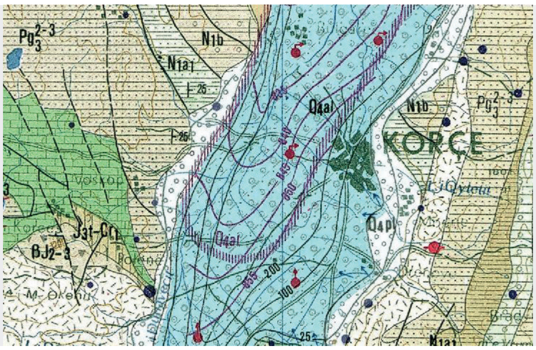
Abstract: The organized hydrogeological investigations in Albania started in 1959, while general hydrogeological prospecting started there in 1963 and finished in 1974. One of the hydrogeological prospecting main goals was the compilation of the hydrogeological map of Albania at a scale of 1:200,000. Hydrogeological maps may differ in content, representation, scale and format, but two main types of these maps are principal: general and/or special hydrogeological maps. The aforementioned map was published in 1985 following principles for general hydrogeological maps as defined in 1970 by IAH/UNESCO, which were subsequently adopted, but also further developed. The areal colours show hydrogeological classification of rocks and the basic elements shown on the map are hydrogeological units. Geological pattern forms the map background, while lithologic units are differed by green colour hatches. Different aquifers and hydrogeological structures identified during the investigations are also shown here, together with important water supply areas of productive drillings and springs. Groundwater quality, thermal springs, seawater intrusion areas and the relation between surface and groundwater can also be recognized. The map published in 1985 can be successfully used until nowadays, not only for the planning purposes, but also as a helping tool in many practical problems of the groundwater use solutions.

Key words: hydrogeological mapping, maps at a scale of 1:200,000, aquifer classification, Albania

Graphical abstract



Highlights

- The only hydrogeological map completely covering the territory of Albania.
- Principles of IAH/UNESCO hydrogeological map legend were further developed to fully describe complex geological settings of the Balkan Dinarides, Albanides and Hellenides.
- The fundamental element of hydrogeological rock classification is transmissivity, reflected by colour of the area – lithology is then illustrated by hatches.

Introduction

Human activity is closely related to groundwater; consequently, the public interest for groundwater is constantly increasing. After the Second World War, hydrogeological investigations and hydrogeological studies were intensified all around the world as humankind was facing both the large demographic development and the intensive development of industry and agriculture in this period. Large quantities of hydrogeological data were accumulated, and the necessity to process them and finally present them on hydrogeological maps of large regions arose. The compilation of hydrogeological maps is the best way to generalize numerous records on groundwater, and these maps then represent a powerful tool for planning, development and environmental protection (Struckmeier, 1989). Hydrogeological maps reflect the natural state of groundwater as well as the possibilities of their exploitation in a condensed form, and therefore can be considered as documents of great practical and scientific value. Basic hydrogeological maps firstly provide information on major groundwater resources, groundwater flow, recharge and discharge zones, groundwater/surface water interactions, location of important springs and pumped wells, vulnerability of groundwater resources, main aquifers and aquitards.

Numerous hydrogeological studies were conducted in Albania during the period of 1960–1985, both those for merely practical purposes (such as water supply of the population and industry, dewatering of mines, use of thermal waters, etc.), as well as those of a practical-scientific character (regional hydrogeological prospecting, groundwater monitoring, application of environmental chemical and isotope tracer methods, etc.). Results of both has been accompanied with data representation that could be depicted on hydrogeological maps.

Necessity of hydrogeological maps compilation was also a consequence of the strong tendency of international hydrogeological community to compile hydrogeological maps of both national and international character.

The purpose of this article is to analyse the principles of compilation of the hydrogeological map of Albania at a scale of 1:200,000 (Eftimi et al., 1985; further on HMA sc. 1:200,000) and to compare it to other international maps, as well as to highlight how these principles serve to reliably reflect Albania's hydrogeological features (Eftimi et al., 1977, 1986).

The HMA sc. 1:200,000 published in 1985 by no doubt reflects the scale of knowledge of the time of publication, nonetheless the basic principles of the compilation of the map are adequate even today and it continues to be a document of great value, both on scientific and practical point of view. The map is produced using traditional printing technologies like this of graving.

Annual mean air temperatures in the coastal regions vary from 15 to 16 °C, and about 10 °C in mountainous areas. Annual mean precipitation in Albania amounts to about 1,450 mm, with more than 3,000 mm in the North Albanian Alps, and about 650–700 mm in the Eastern depressions of Korça and Kolonja.

The hydrographic basin of Albania with a total area of 43,305 km^2 is about in 50 % larger than the total state territory; for this reasons Albania has abundant surface water resources (Pano at al., 1984). Overall renewable resources amount to 41.7 x 10^9 m^3 or 13,300 m^3 per capita, of which 65 % is generated within Albanian territory and the remaining 35 % from upstream countries (Pano et al., 1984). The main river courses in Albania are drained towards the Adriatic Sea. The biggest lakes, namely Prespa, Ohrid and Shkodra, are of transboundary position and of tectonic origin; all of them belong to the Drin River system. Three high dams with large artificial lakes, all in

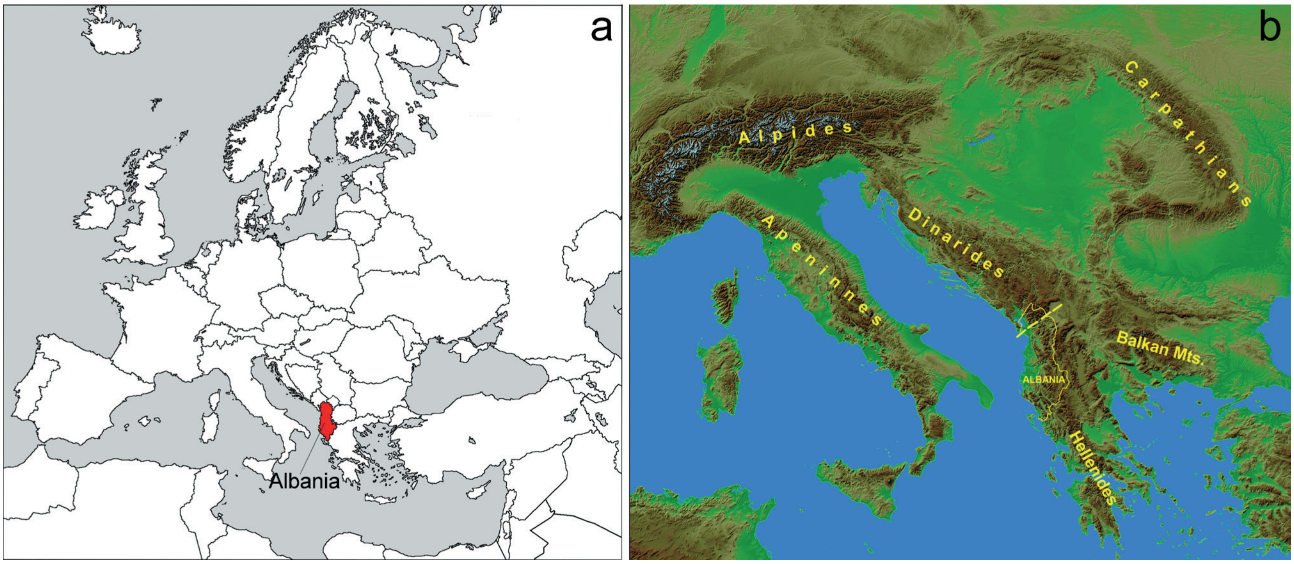


Fig. 1. a) Location map of Albania, b) Tectonic position of Albania.

the Drin River system, have been built for flood protection, irrigation and production of hydroelectric power.

Basic geographic and geological features of Albania

Albania is situated in the western part of the Balkan Peninsula (Fig. 1a). Many peaks higher than 2,000 m above sea level (a. s. l.) are situated in the northern, eastern and southern parts of Albania. The highest of all is Mt. Korab, reaching an elevation of 2,751 m a. s. l. In the Central Western part of the country along the Adriatic coast, the Adriatic Depression is located consisting of plains and hills which elevations are mostly lower than 200 m a. s. l.

Albania belongs to the Mediterranean climatic belt, which is characterized by hot dry summers and mild rainy winters (Jaho et al., 1975). The moderating influence of the sea is encountered only in the western part of the country, and through valleys it penetrates well inland.

From a geological point of view, Albania belongs to the southern branch of the Alpine orogenic system (Fig. 1b). The Shkodra-Peje transversal fault divides the Dinarides from the Albanides and Helenides. The Northern Albanides extend into the former Yugoslavian territory with Dinarides and the Southern Albanides continue southwards to Greece with the Hellenides (Meçe & Aliaj, 2000; Xhomo et al., 2003). There are some inner and some external tectonic zones successively overthrusting each other towards the west.

Though geographically small, Albania has a variety of geological formations of different ages, origin and composition. Among these are rocks ranging from

Ordovician to Quaternary; they comprise sedimentary and magmatic types together with rather less frequent metamorphic. The carbonate sedimentary rocks are ranging from Devonian to Burdigalian in age and constitute many large and small anticline and syncline structures with the SE-NW orientation found throughout all tectonic zones. The Oligocene to Pliocene molasse sediments are mainly consisting of heterogeneously intercalated sandstone, conglomerate, siltstone, claystone and clay layers that mainly fill the deeper part of the Adriatic depression as well as some inland depressions like the Albanian-Thessaly, which is the largest. Pleistocene-Holocene gravelly clayey deposits are the most widely distributed geological unit in the Adriatic Basin, as well as in some inland mountain plains and river valleys. Magmatic rocks are extensively developed mainly in inner tectonic zones. Most developed is the Jurassic ophiolitic magmatism of Mirdita (Subpalegonian) zone, which consists mainly of intrusive and less of volcanic rocks (IGI, 1967, 1983; Meçe & Aliaj, 2000; Xhomo et al., 2003).

History of the compilation of the Hydrogeological Map of Albania

During 1961, the former chief hydrogeologist of Albanian Hydrogeological Service (AHS) Spiro Mitro was the first to propose the performance of the regional hydrogeological survey on the territory of Albania, at a scale of 1:100,000 in the mountain areas and at a scale of 1:50,000 on the plain and hilly areas of the country. In 1963, a project was drafted in AHS and the hydrogeological survey of the entire territory of the country started. The final goal of the hydrogeological survey was the compilation of the Hydrogeological Map of Albania at a scale of 1:200,000, which after a persistent work was published in 1985. The completion of this important and complicated task lasted about 12 years, from 1963 to 1974. The realization of this project was very difficult, if one takes into consideration that the technological equipment of that time in Albania were very scarce or outdated. The field survey groups were equipped with the minimum necessary geological equip-

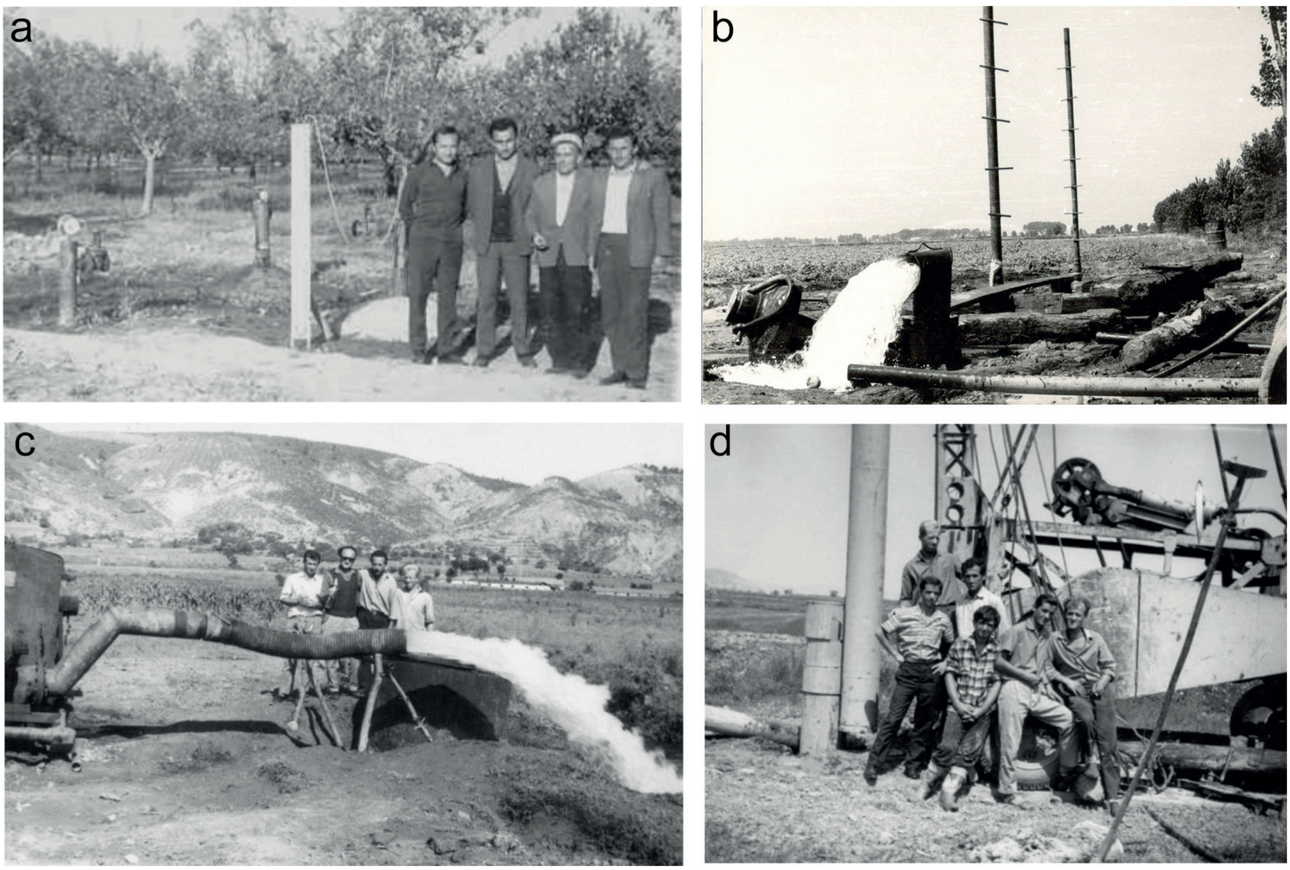


Fig. 2. Historic photos documenting different activities of hydrogeological prospecting of Albania: a – In front of the groundwater monitoring station of Turan, Korça intermountain alluvial basin; manometers are mounted on two wells, while in the third one a primitive instrument with mercury is mounted (photo 1981); b – A free-flowing cable-tool well in Lezha alluvial plain, discharge of about 90 l/s, equipped with two pipe piezometers (in the absence of manometers) for groundwater level observation during the pumping (photo 1970); c – The hydrogeological team during a pumping test, with a centrifugal pump in Elbasan alluvial plain, discharge about 80 l/s (photo 1970); d – The drilling team of a cable-tool drilling machine installed in Elbasan alluvial plain (photo 1976).

ment; at least there was no shortage of paper notebooks and mercury thermometers.

The main results of hydrogeological prospecting of Albania could be summarized as follows:

a) investigation of 13 gravelly aquifers basins, total surface equal to about 2,300 km^2;
b) investigation of some basins filled with Neogene molasses; total area of about 4,700 km^2;
c) investigation of 25 karst massifs with a total area of 6,750 km^2;
d) drilling of about 1,300 groundwater boreholes to the depths from about 30 to 400 m;
e) inventory of about 2,500 springs;
f) groundwater monitoring mainly of the Quaternary intergranular basins;
g) sampling of about 3,000 groundwater samples for chemical analyses, mainly for macro-components.

Very important data regarding the groundwater and surface water disposed by their institutions of Albania has been also collected. The results of the hydrogeological survey are presented in numerable reports available in the archive of Albanian Geological Service (AGS; Mitro, 1963; Babameto et al., 1965; Babameto & Kondo, 1981; Bisha et al., 1980; Bisha & Prenga, 1981; Gjata, 1968, 1978; Gjata et al., 1967; Keta & Mitro, 1968; Keta et al., 1968, 1970; Lako, 1963, 1968, 1973; Prenga, 1984a, 1984b; Rudi et al., 1969, 1972; Tafilaj, 1960–1985; Tartari, 1979; Tyli, 1971, 1972; Shtrepi, 1972, 1973, and many others). On the other hand, the number of scientific articles published in the journal of Albanian Geological Survey was limited (Eftimi, 1966, 1975, 1982; Eftimi et al., 1977, 1979, 1985, 1986; Kazazi, 1971; Kristo, 1973; Lako, 1973; Tyli, 1976; Tafilaj, 1977). Figure 2 shows some historic photos documenting different hydrogeological activities performed by AHS during the period of 1970–1981. The HMA sc. 1:200,000 was published in 1985 (Fig. 3) – it has passed more than 35 years since the first publication of this map, but it continues to be a document of a great value, correct from the technical point of view and really useful from the practical point of view, as continuously verified by a daily practice.

Principles of compilation of basic (general) hydrogeological maps

Groundwater data interpretation in hydrogeological maps vary greatly regarding their content, quantity and the way of data presentation, map scale, geological features, as well as on the depth of knowledge (Jäckli & Tempf, 1972; Manfredini, 1971; Margat, 1966; Margat & Rogovskaja, 1979; Maurine & Zötl, 1964; Karrenberg et al., 1974; Pfeiffer, 1975; Rogovskaja, 1970; UNESCO, 1970; UNESCO/WMO, 1977; UNESCO, 1983; Guzelovski & Kotevski, 1977). Generally, two types of hydrogeological maps are distinguished: general hydrogeological maps and special (purpose-built) hydrogeological maps. General hydrogeological maps aim to distinguish different areas and regions according to their hydrogeological character, in close connection with their geological structure. Special hydrogeological maps are of mainly practical character and are constructed in a wide range of display methods, including maps of aquifer permeability/transmissivity, groundwater resources and their utilization, groundwater vulnerability, hydrodynamic maps, groundwater chemistry or paleohydrogeological maps.

Hydrogeological maps differ by their scale, also; the small-scale maps are those with a scale of less than 1:200,000, medium-scale maps are those of scale 1:200,000 and 1:100,000, while large-scale maps are those of scale 1:50,000, 1:25,000 or even more detailed. There is a close connection between the scale of maps and their character: small scale maps usually are general and have mainly scientific character; medium-scale maps have both scientific and practical character, while large-scale maps are more detailed and usually have practical character.

Initially, the geological principle of compiling of the hydrogeological maps prevailed, according to which various important point elements, such as the main springs or drilled wells, were placed on the geological map of a given area (Altovski, 1960; Rogovskaja, 1970). This type of maps was initially used in the practice of Albanian hydrogeological explorations, also (Gjata et al., 1967; Keta et al., 1968, 1970). The regionalization principle of compiling hydrogeological maps, commonly used for small and medium scale maps, has also been quite popular (Bulgarian Academy of Science, 1960; Manfredini, 1971; Penchev, 2002). These maps show the limits of depicted hydrogeological regions, which are distinguished from those of neighbouring regions on the basis of any accepted hydrogeological regionalization principle (Eftimi at al., 1977).

After 1970 the practice of intensive compilation of hydrogeological maps, was mostly oriented to the application hydrogeological principle (Anonymous, 1970, 1983; Institute Geologique du Bucharest, 1961; Jäckli & Tempf, 1972; Karrenberg et al., 1974; Margat, 1979; UNESCO, 1970, 1983; UNESCO/WMO, 1977; IHME, 1970–1980; Takahashi, 1971; Giuliani at al., 1974; Guzelovski & Kotevski, 1977). According to this principle the main elements shown on hydrogeological maps are the lithological-stratigraphic-hydrogeological units (hydrogeological unit), which are distinguished and classified (grouped) based on the knowledge of their lithological composition, porosity and hydraulic parameters. These parameters are responsible for the overall aquifer hydraulic character, for the formation and distribution of groundwater resources and their quality, as well as for the productivity of wells and of the groundwater exploitation features of different rocks. Water-bearing and non-aquiferous rocks distinct as hydrogeological units, are included in some "groups", within which some "classes" are distinguished. On hydrogeological maps compiled according to this principle, geology consists the background of the map where each lithological unit is distinguished through ash-coloured ornaments (grey), while hydrogeology is shown more expressively through the areal colours. This principle has served as a basis for compiling the International Hydrogeological Map of Europe (IHME) at a scale of 1:1,500,000 (IHME-UNESCO – Karrenberg, 1970; Karrenberg & Deutloff, 1973; Karrenberg at al., 1974; Karrenberg & Struckmeier, 1979). This method has been also applied by the Albanian Hydrogeological Service for the compilation of hydrogeological maps (Bisha & Prenga, 1981; Eftimi et al., 1977; Prenga, 1984; Tartari, 1979).

The hydrogeological map of Albania at a scale of 1:200,000 is of a general character and for its compilation there are successfully embodied and further enriched the principles of compiling as defined in IHME (Eftimi et al., 1977). The main element contained in this map is the principle of hydrogeological classification of rocks, but is enriched with many original elements (Eftimi et al., 1977). Albania's hydrogeological map at a scale of 1:200,000 was published in 1985 and is based on Albania's geological map of the same scale which was finalized in 1983 (IGI, 1983).

Map content

a) Hydrogeological classification of rocks

The hydrogeological classification of the rocks can be considered as the fundamental principle of the compilation of hydrogeological map of Albania at a scale of 1:200,000 and is shown in the first three chapters of the legend. On the map, 46 "hydrogeological units" are distinguished and classified into three "groups of rocks" within which seven "classes" are categorized (Fig. 4).

In each of the seven aforementioned classes of aquifers or "non-water-bearing units" / aquitards / aquicludes (or rocks), several hydrogeological units are included complemented by lithological specification for each unit and respective stratigraphic indications (stratigraphy shown by respective symbols). The stratigraphic units of the basic geological map are in different relationships with the hydrogeological units of the hydrogeological map. They can constitute a hydrogeological unit on the hydrogeological map also, or could be a part of a hydrogeological unit, or – in some cases – several hydrogeological units could be distinguished in one stratigraphic unit. Each hydrogeological unit may represent an aquifer or a group of aquifers (hydrogeological complexes). The difference between the aquifers and aquifer complexes has not been shown on the map.

Each group of rocks, and the classes they contain, are characterized in the map Legend with some data regarding hydraulic conductivity (generally high, moderate or variable, frequently high or variable, high to variable, moderate to low, low to very low and very low, while for each class of rocks a short hydrogeological characterization instructive is given (Fig. 4a, b).

Group I – mainly Quaternary aquifers are included, which are classified into two classes:

- Ia – mostly alluvial intergranular aquifers of the western coastal lowland, river valleys and of high elevation intermountain basins. The hydraulic conductivity is generally high and the yield of wells usually varies from about 10 l/s to about 100 l/s.
- Ib – mainly fluvial deposits of high river terraces, glacial deposits (moraines) and slope debris. The hydraulic conductivity is moderate or variable and discharge of springs is usually less than 5 l/s.

Group II – rocks of different ages and various lithology are included and classified into two classes:

- IIa – carbonated deposits of Paleozoic to Eocene age and Perm-Triassic gypsum deposits. Their hydraulic conductivity is generally high, but very non-uniform (nonhomogeneous rocks), so the yields of wells practically is unpredictable.
- IIb – differently cemented sandstone-conglomerate of Neogene molasses, limestones with schist and heterogeneous sandstone-schists-limestone deposits of the Low Triassic, usually having moderate to low hydraulic conductivity and the yield of wells usually varies from 0.2 to 4 l/s.

Group III – various rocks in terms of genesis, lithology and stratigraphy such as sedimentary, magmatic and metamorphic are included and classified into three classes:

- IIIa – intrusive rocks characterized by low to average hydraulic conductivity mainly related to the tectonic fault zones. The yield of wells varies from about 2 l/s to more than 10 l/s.
- IIIb – both fissured and porous Neogene deposits, with prevailing clayey-claystone deposits and to a lesser extent of sandstone-conglomerate deposits, as well as volcanic and volcanogenic-sedimentary rocks; generally of low hydraulic conductivity. The yield of wells is usually less than 0.3 l/s
- IIIc – mainly Quaternary and Neogene flysch to flyshoid deposits and Paleozoic to Paleogene metamorphic rocks with very low hydraulic conductivity.

In HMA sc. 1:200,000, the hydrogeological classification of rocks has been enriched related to that of Interna-

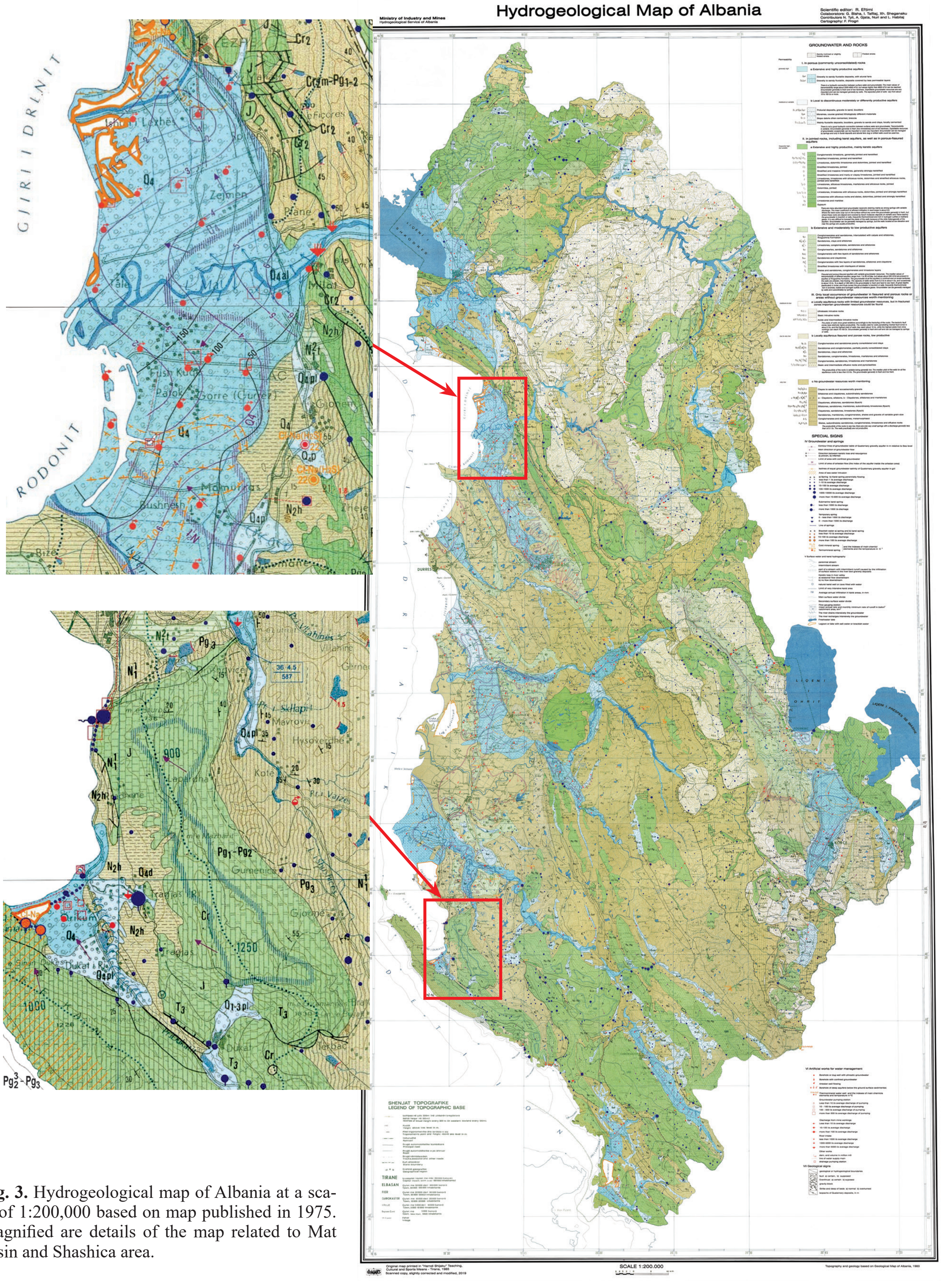


Fig. 3. Hydrogeological map of Albania at a scale of 1:200,000 based on map published in 1975. Magnified are details of the map related to Mat basin and Shashica area.

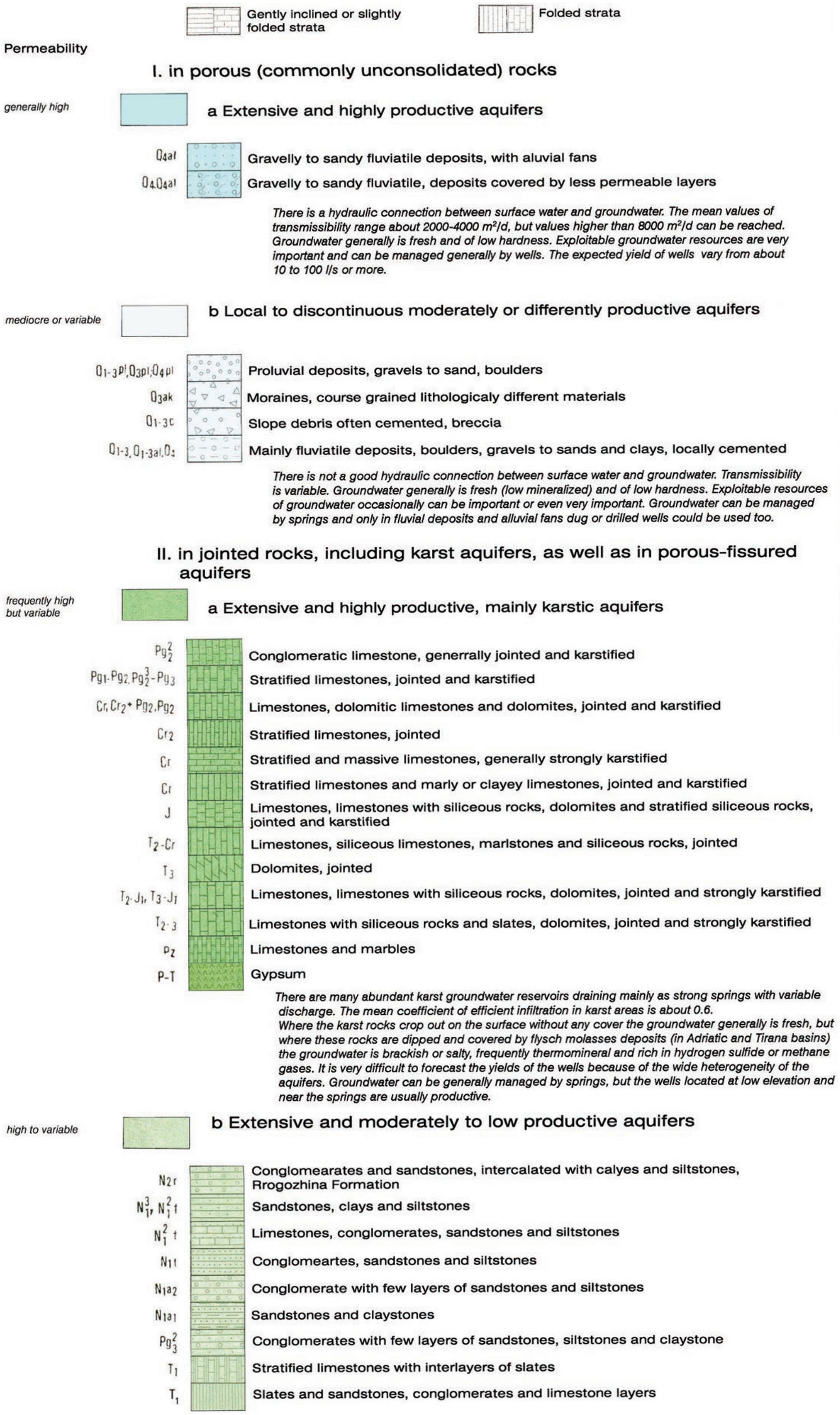


Fig. 4a. Hydrogeological map of Albania sc. 1:200,000; hydrogeological classification of the rocks – first part.

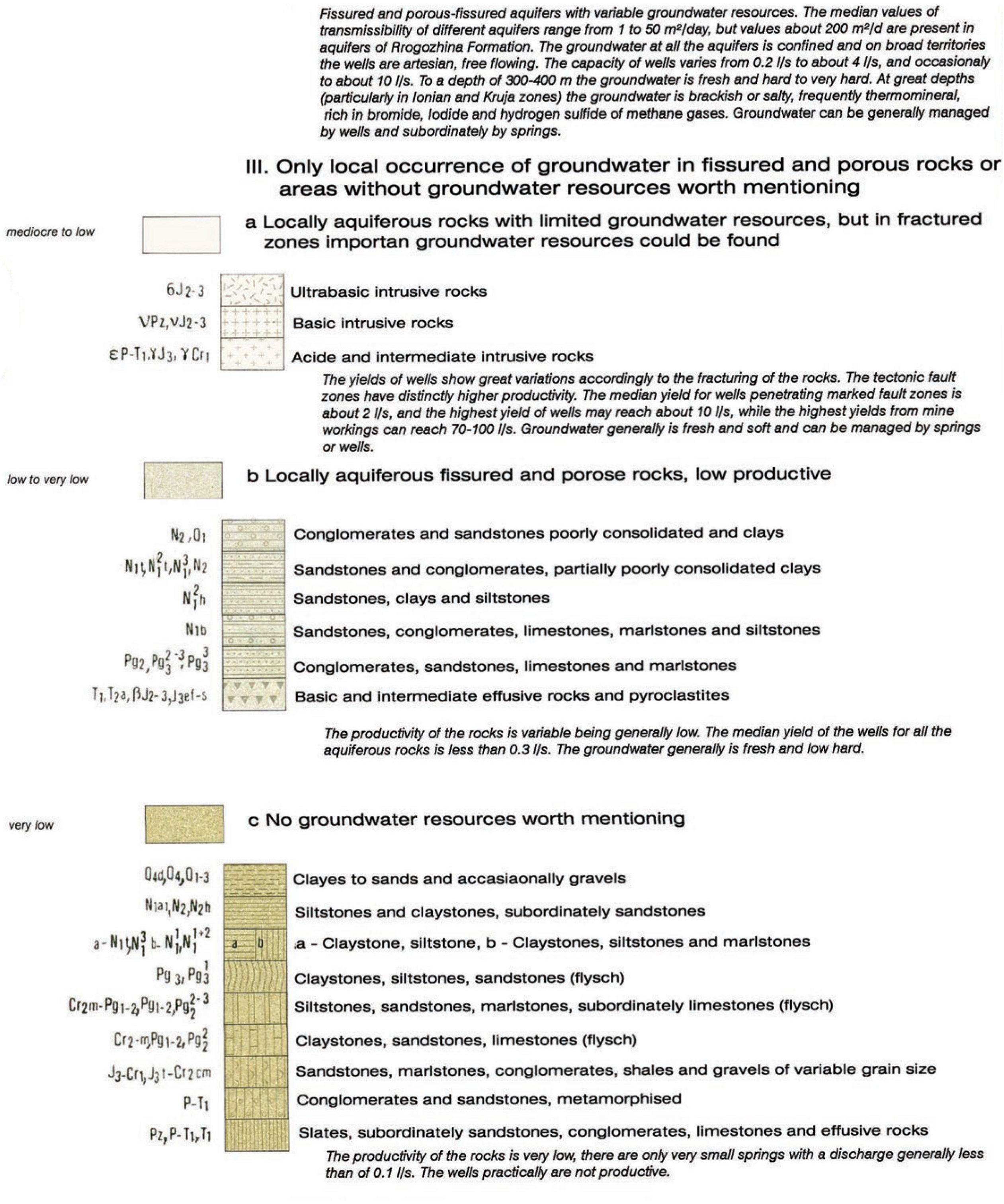


Fig. 4b. Hydrogeological map of Albania sc. 1:200,000; hydrogeological classification of the rocks – second part.

Fig. 5. Hydrogeological map of Albania sc. 1:200,000 – Special signs.

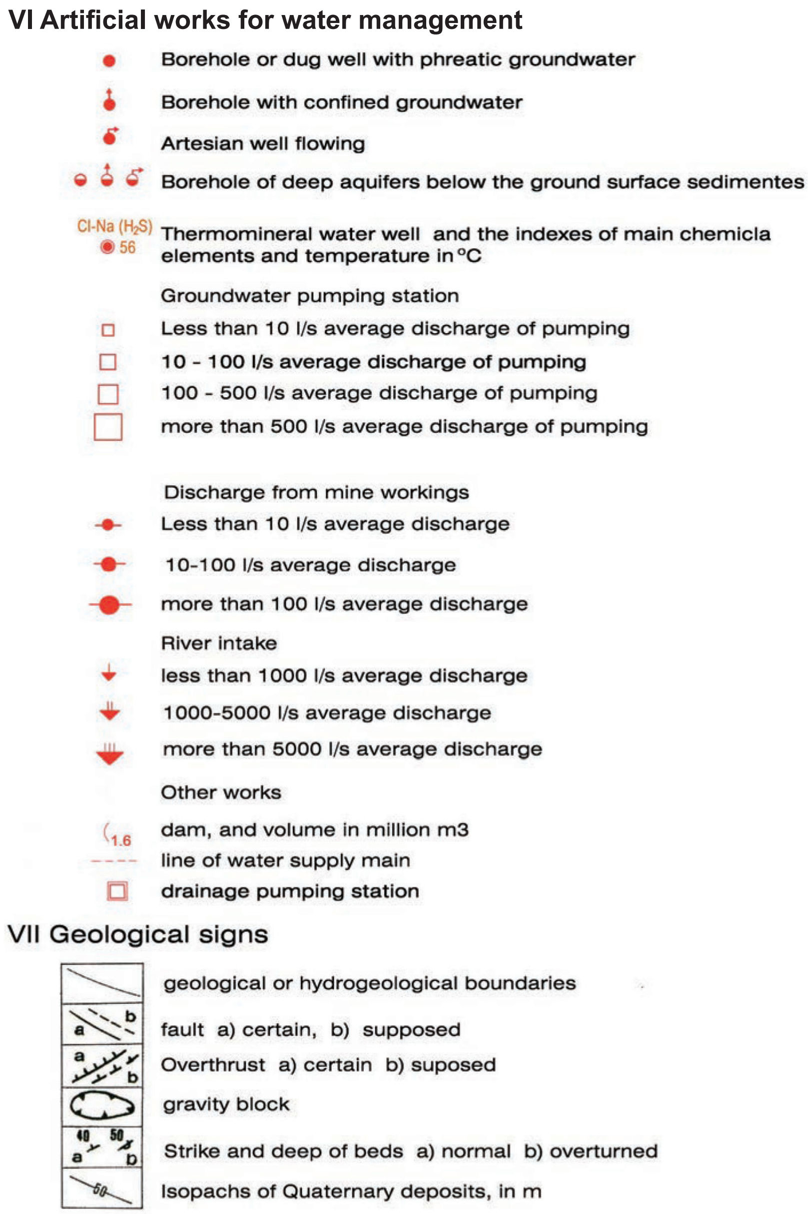


Fig. 6. Hydrogeological map of Albania sc. 1:200,000 – Geologically signs.

tional Legend (Karrenberg et al., 1974; UNESCO, 1970, 1983; IHME, 1970–1981). So, in section III of the hydrogeological map of Albania, an additional class is added, enabling to better distinguish the locally aquiferous rocks, showing a fairly wide distribution and high-water bearing variability. For each class of aquifers and rocks of HMA sc. 1:200,000, a short text of hydrogeological characteristics is given, missing in most of the maps, but helping the map user in better and more rapid understanding of the map content.

b) Special signs

This part of the legend includes the fourth and fifth chapter of the hydrogeological map legend, respectively: Chapter IV – Groundwater and springs and Chapter V – Groundwater and karst hydrography (Fig. 5).

Chapter IV of the legend contains signs reflecting some point or areal data characterizing the groundwater occurrence and its properties. More in detail are characterized the Quaternary intergranular, mainly gravelly aquifers, through isolines of groundwater levels (hydroisohypses), the directions of groundwater flow movement, the areas with unconfined, confined and those with artesian flow, isolines of groundwater salinity in the ranges of 0.5, 1 and 3 g/l etc. The fresh water springs classified according to their mean discharges are presented in detail in the following ranges: up to 1 l/s, 1–10 l/s, 10–100 l/s, 100–1000 l/s, 1000–10,000 l/s and more than 10,000 l/s; Among the springs, the karst springs, temporary springs, submarine springs, as well as the linear springs are also distinguished by the use of special signs. Brackish water springs, cold mineral springs (water temperature below 20 °C, as well as hot thermal springs (water temperature above 20 °C), are also shown. In the coastal karst areas, the sea water intrusion is shown by a special sign.

Chapter V summarizes hydrological data, starting with the relation of surface water and groundwater. Various symbols are applied for different phenomena, such as the parts of river beds temporarily dry due to the loss of surface water into gravelly deposits, parts of rivers which serve as intensive groundwater drains (gaining steams), or – in opposite – parts of the rivers which are intensively recharging groundwater resources (losing streams). Important hydrometric data for the main rivers at selected gauging stations, are also given. In karst areas, the limits of intensive rocks' karstification are identified, together with swallow holes (ponors), natural wells (groundwater windows), directions of verified or possible karst water flows, as well as for many karst areas annual values of effective precipitation / recharge are shown in [mm]. The effective precipitation (infiltration) values were calculated using the Turc (1954) formula, but applied only in karst areas without surface runoff (the effective precipitation is considered as the unevaporated part of precipitation, which directly infiltrates into the subsoil and subsequently recharges groundwater resources).

In the Chapter VI of the legend, the artificial human interventions in water management practices are presented (Fig. 6). In addition to the boreholes, where respective signs differ according to the hydraulic character of the tapped aquifers, deep wells with thermo-mineral groundwater and some key physic-chemical parameters are also given. Discharges of the mining works (mine shafts and mine adits) are shown, classified in the ranges of up to 10 l/s, 10–100 l/s and over 100 l/s. Groundwater pumping stations (groundwater intakes) are distinguished according to the discharges as follows: up to 10 l/s, 10–100 l/s, 100–500 l/s and over 500 l/s. Pumping stations, in the case of springs, represent their capture structure, while in the case of drilling works, these mostly represent the central pumping station collecting water from several drilling wells, and only in particular cases these represent a single pumped borehole. The lines of water supply mains are also shown on the map, as well as river water intakes (mainly for irrigation), which according to their capacities are classified into three groups: up to 1000 l/s, 1000–5000 l/s and more than 5000 l/s.

Geological features are presented in the Chapter VII of the legend (Fig. 6). Here, in addition to the signs of geological boundaries, tectonic contacts, strike and deep of beds, also isolines of the Quaternary deposits thicknesses (isopaches) are also shown, practically marking the maximal effective depths of water wells in these deposits.

Discussion and Conclusions

The hydrogeological map of Albania at a scale of 1:200,000 is a general hydrogeological map and based on the hydrogeological classification of rocks that can be considered as a key element of the map. Such a principle of hydrogeological map compilation is of the same nature as the one used for the compilation of the International Hydrogeological Map of Europe (IHME) at a scale of 1:1,500,000, but another details were further on developed and enriched by additional original signs, particularly those related to groundwater chemistry (Eftimi at al., 2013). In general, respective geological situation represents the background of the map, while hydrogeological features are shown through seven areal colours representing the hydrogeological classification of the aquifers, aquitards and aquicludes formed by the rock environment.

In the HMA sc. 1:200,000, together 46 "lithological-stratigraphical-hydrogeological units" were distinguished, and these were subsequently classified into three "groups of rocks" within which a total of seven "classes" were differed. Comparing with the IHME, an additional class was added, enabling better classification of the local aquifers, which have a fairly wide distribution in Albania and high-water bearing variability. For each class of aquifers and less-permeable rocks, a short text of hydrogeological characteristics was given, missing in majority of similar hydrogeological maps, but helpful in better and quick understanding of the content.

The principles applied in the process of construction of the Hydrogeological map of Albania at a scale of 1:200,000 can therefore provide important information about location of the aquifers and less-permeable rocks, groundwater resources and their quality, groundwater dynamics, the relationship between surface water and groundwater and the location of important springs and groundwater pumping stations. This map is sufficiently rich in details, so it can be used not only for planning of groundwater exploitation, but even for solving many practical problems of groundwater use and its protection.

The HMA sc. 1:200,000 was published in 1985 and by any doubt it reflects the scale of knowledge in the time of its publication, nonetheless the basic principles of the compilation of the map are adequate even today and it can be considered both as a document of hard work in uneasy times, but still preserving its scientific and practical value (Malík et al., 2015; Duscher et al., 2015).

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Hydrogeologická mapa Albánska v mierke 1 : 200 000, princípy jej zostavenia a obsah – dokument priekopníckeho prístupu k hydrogeologickému prieskumu v Albánsku od šesťdesiatych rokov minulého storočia

Koordinovaný hydrogeologický výskum v Albánsku (obr. 1) sa začal v roku 1959. V rokoch 1963 – 1974 celoštátny prieskum na tomto území (obr. 2) vyústil do zostavenia *Hydrogeologickej mapy Albánska v mierke 1 : 200 000*. Táto mapa bola publikovaná v roku 1975 (obr. 3). Spĺňala kritériá, ktoré definovala Medzinárodná asociácia hydrogeológov a UNESCO v roku 1970 pre generálne hydrogeologické mapy. Tieto kritériá sa ale pri zostavovaní mapy ďalej zdokonaľovali ďalšími originálnymi prístupmi (obr. 4A, B, 5 a 6), týkajúcimi sa predovšetkým chemického zloženia podzemnej vody (Eftimi et al., 2013). Hydrogeologická klasifikácia hornín je vyjadrená siedmimi farbami, čo reprezentuje zdokonalenie dovtedy používanej kvantitatívnej klasifikácie zvodnencov. Hydrogeologická klasifikácia hornín predstavuje základný a inovatívny prvok mapy. Základné chemické prvky zobrazené na mape reprezentujú bázu na vyčlenenie hydrogeologických jednotiek. Na mape je zobrazených celkovo 46 „litologicko-stratigraficko-hydrogeologických“ jednotiek. Tie sú následne klasifikované do troch skupín hornín, v rámci ktorých je definovaných sedem tried. Na rozdiel od *Medzinárodnej hydrogeologickej mapy Európy v mierke 1 : 500 000* bola na *Hydrogeologickej mape Albánska v mierke 1 : 200 000* pridaná ďalšia trieda. Umožnila lepšiu klasifikáciu lokálnych hydrogeologických kolektorov a izolátorov, ktoré majú v Albánsku veľké rozšírenie a majú značnú variabilitu hydraulických vlastností. Pri každej triede zvodnencov a menej priepustných hornín je na mape pridaný krátky vysvetľujúci text o ich hydrogeologickej charakteristike. Napriek tomu, že tento vysvetľujúci text je veľmi užitočný na ľahké a rýchle pochopenie regionálnych hydrogeologických pomerov, na zahraničných hydrogeologických mapách spravidla chýba.

Geologickú stavbu územia reprezentuje na mape spodná vrstva, pričom jednotlivé litologické jednotky sa vzájomne odlišujú šrafovaním zelenej farby. Na mape sú zvýraznené aj rozdielne zvodnence a identifikované hydrogeologické štruktúry a vyznačené aj významnejšie vodárenské zdroje a hydrogeologicky produktívne vrty. Mapa poskytuje informácie o kvalite vôd, termálnych prameňoch, oblastiach ovplyvňovaných prenikaním morskej vody a vyjadruje vzťah medzi povrchovou a podzemnou vodou

Hydrogeologická mapa Albánska v mierke 1 : 200 000 publikovaná v roku 1975 odzrkadľuje nielen rozsah vtedajších hydrogeologických poznatkov. Základné princípy jej zostavovania sú aktuálne aj v súčasnosti a vyjadrujú množstvo kvalitnej zrealizovanej práce a vtedajší vedecký potenciál, ktorý bol využitý pri zostavovaní mapy (Malík et al., 2015; Duscher et al., 2015). Táto mapa sa stále využíva predovšetkým na účely plánovania a ako pomôcka pri riešení mnohých praktických hydrogeologických problémov.

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