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**HISTORICAL OVERVIEW OF BASIC CONCEPTS
FOR DISTANCE LEARNING
OF THE BASICS OF MINERAL RESOURCES MANAGEMENT**

***Annotation.** The educational process is moving to distance learning everywhere. This article highlights the basic concepts for distance learning of the basics of mineral resources management in a historical aspect.*

***Key words:** distance learning, mineral resource manager.*

***Анотація** Навчальний процес повсюдно переходить на дистанційне навчання. У даній статті висвітлено базові поняття для дистанційного вивчення основ управління мінеральними ресурсами в історичному аспекті.*

***Ключові слова:** дистанційне навчання, менеджер з мінеральних ресурсів.*

Introduction. In modern conditions, distance learning is a relevant and popular form of learning in the world. This is primarily due to the Covid quarantine and other force majeure circumstances. In Ukraine, for example, this need is also associated with the long-term martial law regime.

Since 2019, the topic of distance learning has been actively studied all over the world.

For example, at the State University «Kyiv Aviation Institute» an annual international scientific and practical conference «Distance Education: Innovative, Normative-legal, Pedagogical Aspects» (<http://iro.nau.edu.ua/index.php/naukova-robota/konferentsii>) and a special international scientific journal «Distance Education in Ukraine: Innovative, Normative-legal, Pedagogical Aspects» (ISSN 2786-5495 online) (<https://jrnl.nau.edu.ua/index.php/DEU>) are dedicated to this topic. The issues of distance learning research are important not only from the perspective of teachers, but also from the perspective of students [1].

In the current conditions of increased interest in Ukraine's mineral resources, extraction and management of rare mineral resources, and in connection with the fact that Ukraine signed an agreement with the USA on joint mining of minerals (<https://www.bbc.com/ukrainian/articles/crrzvxdlp58o>) [2], the issues of professional training of mineral resource managers are very relevant.

In this article, we have highlighted the basic concepts for distance learning of the basics of mineral resources management in a historical aspect.

Therefore, the chosen research topic is extremely relevant.

The purpose of the article is to provide a historical overview of the basic concepts for distance learning of the basics of mineral resources management.

Research Results. The Book of Ecclesiastes - 8:17: «I have seen all the works of God, and I find that man cannot find out the work that is done under the sun. No matter how much a person studies, he still cannot find it out; and though a wise man says that he knows, he cannot find it out».

Geography studies the natural conditions surrounding a person, one of the most ancient sciences. Many of its foundations were laid in the Hellenic era. This experience was summarized by Claudius Ptolemy in the 1st century AD. The heyday of the Western geographical tradition falls on the Renaissance, which is marked by a rethinking of the achievements of the late Hellenistic era and significant achievements in cartography, which are usually associated with the name of Gerhard Mercator. The foundations of modern academic geography were laid in the first half of the 19th century by Alexander von Humboldt and Karl Ritter.

Astronomy studies the Earth as a celestial body and its position in space. Astronomical activity can be traced in sources from at least the 6th-4th millennia BC, and the earliest mentions of the names of the luminaries are found in the «Pyramid Texts» dating from the 25th-23rd centuries. Babylonian priests left many astronomical tables. They also identified the main constellations and the zodiac, introduced the division of a full angle into 360, and developed trigonometry. In the 2nd millennium BC, the Sumerians developed a lunar calendar, which was improved in the 1st millennium BC. The year consisted of 12 synodic months, six of 29 days and six of 30 days, a total of 354 days.

Planetology is a complex of sciences that study planets and their satellites, as well as the solar system as a whole and other planetary systems with their

exoplanets. Its area of interest includes very diverse objects, from micrometeorites to gas giants. Planetology studies the physical properties, chemical composition, surface structure, internal and external shells of planets and their satellites, as well as the conditions of their formation and development. The history of planetology begins with the ancient Greek philosopher Democritus (460 BC - 370 BC), who said: «There is an infinite number of worlds, varying in size, and some of them have neither the Sun nor the Moon, while others have more of them than we have and are larger in size. The spaces between the worlds are not created equal, here they are larger, there they are smaller, some of them grow, others flourish, others disintegrate, here they are born, there they die, are destroyed when they collide with each other. And some of the worlds are naked, without animals and plants, covered with water». Space geology has provided geologists with a wealth of information that allows them to study the structure of the earth's surface on a global scale, solve the most important problems of theoretical geology and identify patterns in the distribution of minerals. Cosmology studies the general patterns of the structure and development of the Universe. The emergence of modern cosmology is associated with the development of Einstein's general theory of relativity and particle physics. Einstein published his first study on this topic in 1917 under the title «Cosmological Considerations for the General Theory of Relativity».

Cosmochemistry studies the composition and distribution of elements in the evolution of cosmic bodies, and attempts to explain their origin and history on this basis. The greatest attention is paid to the problems of the distribution and distribution of elements.

Geodesy studies the size and shape of the Earth, and the depiction of the Earth's surface on maps and plans. Geodesy arose in ancient times, when there was a need for land surveying and the preparation of plans and maps for economic purposes. In the 7th century BC, geographical maps were made on clay tablets in Babylon and Assyria, which also provided economic information. In the 6th–4th

centuries BC, assumptions were made about the sphericity of the Earth and some evidence was found for this. In the 3rd century BC, In Egypt, the Greek scientist Eratosthenes made the first determination of the radius of the globe based on correct geometric principles, which were called degree measurements. At this time, the name "geodesy" first appeared in the works of Aristotle as a branch of human knowledge related to astronomy, cartography and geography.

Geodesy includes: Topography (deals with the description of the earth's surface); Hydrography (deals with the description of water space).

Engineering geodesy or applied geodesy deals with the organization of geodetic work to solve engineering problems.

Space geodesy or satellite geodesy deals with the use of observations of artificial Earth satellites and spacecraft to study the shape and size of the Earth and its external gravitational field.

Higher geodesy studies the creation of an astronomical and geodetic network, methods and techniques of high-precision geodetic measurements, astronomical observations.

Aerial photogeodesy studies and creates topographic maps based on aerial photography, determining the size, shape and position of objects based on their images in photographs.

Geodetic gravimetry deals with the distribution of gravity on the earth's surface, the movement of rocks and the earth's surface, rock bursts, gravimetric determination of some points.

Mine surveying deals with the field of geodesy serving the mining industry and tunneling.

Mineralogy studies minerals and their genesis. The term «mineralogy» was introduced in 1636 by the Italian naturalist B. Cesium.

Petrography studies igneous and metamorphic rocks. The origin of petrography as a science dates back to the mid-19th century, when G.K. Sorby

demonstrated the possibility of studying the mineral composition of rocks in thin sections under a microscope.

Crystallography studies crystals, their structure, origin and properties. Crystallography was described by the French mineralogist Jean Baptiste Louis Romeu de Lisle in 1772 in his work «An Experiment in Crystallography».

Geochemistry studies the chemical composition of the Earth; processes that concentrate and disperse chemical elements in the Earth's geospheres.

Structural geology studies the occurrence of geological bodies and disturbances in the earth's crust. Structural geology originated in the 19th century in Canada and the USA - C. R. Van Hise, C. Leese, B. and R. Willis; in Western Europe A. Geim, M. Bertrand, E. Argand were involved in structural geology.

Tectonics studies the movement of the earth's crust and forms new areas of research: geotectonics, neotectonics, experimental tectonics. Alfred Wegener gave a report on continental drift at a meeting of the German Geological Society on January 6, 1912.

Volcanology studies volcanic processes. Heraclitus in the 6th century BC and Aristotle in the 4th century BC began to study volcanoes. Their work was continued by Strabo, who described the eruption of the Kaimeni Santorini volcano in the 1st century AD, and Pliny the Younger, who described the eruption of Vesuvius in the 1st century AD.

Seismology studies geological processes during earthquakes and seismic zoning.

Hydrogeology studies underground waters. The first ideas about the properties and origin of natural waters, the conditions of their accumulation and the water cycle on Earth were described in the works of the ancient Greek scientists Thales and Aristotle, as well as the ancient Roman Titus Lucretius Carus and Vitruvius. The study of groundwater was facilitated by the expansion of work related to water supply in Egypt, Israel, Greece and the Roman Empire. In Russia, the first scientific ideas about groundwater as natural solutions, their formation by

infiltration of atmospheric precipitation and the geological activity of groundwater were expressed by M.V. Lomonosov in his work «On the Layers of the Earth» (1763).

Until the mid-19th century, the study of groundwater developed as an integral part of geology, after which it became a separate discipline. Geocryology studies permafrost rocks. Geocryology as an independent branch of knowledge about frozen rocks (soils, grounds) was formed in the 1920s at the junction of geological, geographical, geophysical and engineering disciplines. The formation and development of geocryology is associated with the names of V.I. Vernadsky, V.A. Obruchev, M.I. Sumgin.

Geology of minerals deals with the study of deposits; methods of surveying, prospecting, exploration of deposits. It is divided into geology of oil and gas, geology of coal, metallogeny. The doctrine of minerals was formed in connection with the increasing needs of human society for mineral raw materials and with the development of mining. The first ideas about the conditions of formation of minerals are found in the views of ancient Greek philosophers.

The founder of the Neptunists Thales, about 625 - about 547 BC, considered the element of water to be the basis of the material world, and his opponent, the Plutonist Heraclitus, about 520 - about 460 BC, considered the element of fire to be the basis of the material world. Thus, two directions of geological ideas arose, according to one of which rocks and mineral deposits located among them are associated with the accumulation at the bottom of water basins), and according to the other - they are formed by the underground heat of the Earth. Engineering geology studies the interaction of the geological environment and engineering structures. Engineering geology originated in the 19th century. Geophysics studies the physical properties of the Earth, including a set of exploration methods: gravity exploration, seismic exploration, magnetic exploration, electrical exploration of various modifications and others.

The formation of geophysics as a complex multidisciplinary science should be attributed to the 1st International Geophysical Year (1882-1883), held on the initiative of the Austrian scientist K. Weyprecht. Denmark, Germany, France, the Netherlands, Norway, Austria-Hungary, Sweden, Italy and other countries took part in the event, organizing a number of expeditions to the polar latitudes.

Geobarothermometry studies a set of methods for determining the pressure and temperature of formation of minerals and rocks. Previously, these studies were called "mineralogical thermometry". At present, the results of these studies are united by a common concept - thermobarogeochemistry.

Microstructural geology studies rock deformation at the micro level, on the scale of mineral grains and aggregates.

Geodynamics studies the planetary scale as a result of the evolution of the Earth and the relationship of geological processes in the geospheres. Geodynamics as a science began to separate itself from other Earth sciences in the 1950s. Its origins were the German scientist A. Wegener, American scientists A. Holmes, H. Hecc.

Geochronology studies the determination of the age of rocks and minerals. In 1658, the Irish Anglican Archbishop James Ussher published the Annals of the Old Testament, where, based on a study of the Bible, he determined the date of the creation of the world as October 23, 4004 BC. This date has become the subject of many theological disputes. Ussher's work is notable as one of the first attempts to determine the age of the Earth using relatively strict methods of «direct or indirect synchronisms with Roman dates».

Stratigraphy studies the determination of the relative geological age of sedimentary rocks, the division of rock strata, and the correlation of various geological formations. The formation of stratigraphy as a science began in the 17th century, when the Danish scientist N. Steno discovered the law of the sequence of rock stratification. The further development of stratigraphy is associated with the

names of M.V. Lomonosov, German scientists I.G. Lehmann, G. Fuxel, A.G. Werner, and Italian scientists G. Arduino.

Historical geology studies the sequence of geological events in the history of the Earth. Historical geology arose in the early 19th century based on the use of the paleontological method of W. Smith and J. Cuvier. In the first half of the 19th century, the development of historical geology took place under the influence of the metaphysical theory of catastrophes by J. Cuvier and A. d'Orbigny. In the second half of the 19th century, the ideas of the evolutionary development of the Earth by C. Lyell and C. Darwin acquired great importance in historical geology.

Paleontology studies life forms and describes fossil remains, traces of the life activity of organisms. J. Cuvier is considered the founder of paleontology as a scientific discipline. A new stage in the development of paleontology began with the appearance in 1859 of the most complete theory of evolution by Charles Darwin, which had a decisive influence on the further development of natural science.

Modern evolutionary paleontology was founded by Vladimir Kovalevsky. It was thanks to Kovalevsky's research and his findings that Darwinism acquired a paleontologically substantiated basis. The emergence of paleobotany is associated with the name of Adolphe Brongniart.

Geomorphology studies the appearance of the relief, its origin, age, patterns of combination and distribution of individual forms. Geomorphology developed as an independent scientific discipline in the late 19th - early 20th centuries. By this time, two geomorphological schools had formed: the American one led by W. M. Davis and the European one, which was represented by F. Richthofen, A. Lenk and V. Penk.

Lithology studies sedimentary rocks. Lithology as one of the branches of geology became distinct in the late 19th and early 20th centuries as a result of stratigraphic, paleogeographic and other studies, accompanied by the study of the material composition of sedimentary rocks and associated minerals. Of great

importance for the separation of lithology were the materials obtained by the English oceanographic expedition on the ship «Challenger» (American scientist J. Murray, Belgian - A. Renard, 1891), as well as the research of the German geologist J. Walter (1893-94), devoted to issues of sedimentary rock formation.

Lithology took shape as an independent science in the 1910s.

Marine geology studies the structure, composition, geological history and development of the earth's crust, which makes up the bottom of the seas and oceans. The scientific geological study of the seabed was initiated by the studies of bottom sediments by the English oceanographic expedition on the ship «Challenger» (1872-1876). The results of the studies were summarized in the classic monograph by J. Murray and A. Renard (1891). Later (late 19th - early 20th centuries), large oceanographic expeditions on the ships «Albatross», «Planet», «Valdivia», «Meteor» and others continued deep-sea geological studies of the ocean; the main features of the ocean floor relief, types of bottom sediments were identified, an idea of their distribution was obtained, a method for collecting samples was developed, echosounder measurements began to be introduced, and the first scientific reports appeared. Subsequently, the study of underwater geology firmly entered the programs of oceanographic research.

Geotoxicology aims to study the impact of geological processes on the environment based on the study of its material composition, structure and processes that change the geosphere state: internal (barysphere, lithosphere, hydrosphere) and external (atmosphere, magnetosphere, cosmosphere). At present, geotoxicology is a combination of many scientific disciplines.

The beginning of geotoxicological study was formalized in the works of V.P. Punko (1989, 1990, 1991, 1992, 1996, 1997, 1999, 2002, 2003, 2013, 2017, 2019, 2021) [1] and others. Geotoxicological research is carried out on objects with various components, from the barysphere to the cosmosphere and ending with the identification of modern environmental aspects, which mainly assess the

anthropogenic factor. The following issues have become relevant in the section of geotoxicology: waste recycling and environmental impact assessment.

In the modern world, the issues of waste recycling and environmental impact assessment are extremely relevant. Thus, S.V. Kozhevnikov analyzed the issues of recycling PVC window profiles (Ukrainian and European experience) in the journal «Ecological Safety and Environmental Protection Technologies» [4].

The article examines the problems of recycling polyvinyl chloride (PVC) in profiled window systems to reduce the negative impact on the natural environment. The author presents a brief analysis of the impact of PVC on the environment, highlights the main problem areas where PVC material is most used, and studies methods of combating this problem suggested by specialized international organizations, such as EPPA (The European Trade Association of PVC window systems supplier, VinylPlus, Gütegemeinschaft Kunststoff-Fensterprofilsysteme, WildLife Research) and others. The author analyzes annual studies and reports from these organizations, which provide world statistics and calculations on the total volumes of old PVC profiles recycling and information on the possibilities of reusing the recycle. The studies on the topic of recycling PVC profiles are very important for Ukraine today due to the significant increase in the number of destroyed translucent PVC structures as a result of military aggression by the Russian Federation [4].

A significant contribution to the development of issues related to the mineral resources of Ukraine was made by V.O. Yemelyanov, director of the Center for Problems of Marine Geology, Geoecology and Sedimentary Ore Formation of the National Academy of Sciences of Ukraine, S.B. Shekhunov, director of the Institute of Geological Sciences of the National Academy of Sciences of Ukraine.

Conclusions. Thus, the educational process is moving to a distance learning format everywhere. Therefore, it is necessary to have a thorough knowledge of the basic concepts for distance learning of the basics of mineral resource management.

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