The Three–ray Megacontinent of the Earth

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The Fundamental Discovery of a Century

By

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Dedicated to

Charles Lyell, the great English geologist, who first showed the three-beam grouping of the continents on the globe (**1833**).

William Hobbs, the great American geologist and a founder of lineament tectonics, who first proved the series of multidirectional regional faults of America (**1904**).

Harold Jeffreys, the great geophysicist of the twentieth century, a developer of the seismic method of studying the depths of the Earth and the model of the three-layer structure of the Earth' crust of the continents **(1926),** and an unshakable advocate of scientific truth.

G. Closs and **C. Behnke,** the great German geophysicists who first proved the vertical growth of the continents in deep depressions on the surface of the planet, on a planetary seismic section of the Earth's crust along the 45^{o}N parallel (**1963**).

F. Nansen, G. Molengraaff, M. Klenova and **G. Lindberg**, the Norwegian, German and Russian researchers who first proved the Early Holocene flooding of the Arctic land and the Indonesian territory by the World Ocean, after the melting of the giant Arctic glacier (**1919–1955**).

A. Irdley, V. Serpukhov, N. Kunin, V. Poselov, S. Kashubin and N. Lebedeva Ivanova, the American and Russian researchers who first proved the continental structure of the Central Arctic Territory, according to seismic studies (**1954–2011**).

ABSTRACT

The purpose of the present book is to unite the fundamental achievements in the Earth sciences – in geophysics, geology, oceanology, geography, cryology, magnetism over the past 120 years and to show a modern representation of the structure and development of the Earth's main continents, as a single megacontinent. It is proved that the megacontinent was initially formed in a huge three-ray pit on the surface of the planet, in the geodynamic mode of vertical mobilism. Two main layers of the Earth's crust have been created over three billion years in this pit: the lower metabasalt layer and the medium granite-gneiss layer, making up the ancient foundation of the Earth's crust, by 90% of its volume. Only the upper, essentially sedimentary layer of the Earth's crust was formed over 1.5 billion years within individual local depressions on an ancient crystalline basement. The Earth's crust is broken by numerous vertical faults and magmatic bodies, generated by the periodic emissions of the endogenous fluid-plumes from the outer core of the Earth, along the radii from it. In the Neocene-Quaternary period, the three-ray megacontinent was completely land, elevated above the ocean level. But the level of the World Ocean was increased by 120 m in the Early Holocene (10,000-8,000 years ago) after the active melting of the great Late Pleistocene glacier, and the water flooded the plains of the Arctic territory and Indonesian archipelago. Therefore, three modern continents, American, Eurasian-African and Australian, were isolated by the ocean water. The proof of the reality of the three-ray megacontinent represents the most important world discovery in the Earth sciences, which means a complete revolution of views in the understanding of the structure and development of the planet.

This book is intended for geophysicists, geologists, geographers, astronomers, university teachers and students, teachers of geography and natural sciences in secondary schools and to all readers.

Keywords: planet's surface, three-ray huge pit, continental crust, vertical growth, three-ray megacontinent

CONTENTS

PREFACE

This publication is intended for foreign readers. It is a shortened and revised version of the Russian monographs *The Northern Three-Beam Fixed Megacontinent of the Earth: The Discovery of the Century*, published in 2016, and *The Northern Three-Beam Fixed Megacontinent of the Earth: The Discovery of the 21st Century*, published in 2017.

Two parts are excluded from this book, one of which concerns non-geological hypotheses of the Earth's crust formation (the hypotheses of plate tectonics and paleomagnetism), and another that was devoted to the reform of the Academy of Sciences. The chapter "Grandiose Hadean volcanoes of the Arctic and their evolution from Hadean to Holocene" has also been excluded so as not to distract the reader from the main theme of the monograph.

A number of additions have been made to this edition. In particular, the title of the book has been clarified, the abstract has been updated and a new Introduction has been prepared. The whole material of the book is divided into four parts:

Part I—The fundamental geophysical discoveries of the twentieth century;

Part II—The three-ray fixed megacontinent of the Earth: the fundamental discovery of the century;

Part III—Formation of the World Ocean and the great glacier in the Mesozoic-Cenozoic: the Ocean's expansion into the megacontinent; and

Part IV—Scientific methodology: Discovery in science as a method for revealing the laws of Nature.

Chapter 2 is supplemented with a section on the seismic method of studying the Earth, as the main method for studying the deep structure of the Earth's crust and the Earth's mantle, and a section on the physical properties of the Earth's crust and mantle. Chapter 3 includes a special section on the planetary geophysical sections of the Earth's crust. The section on the geological structure of the World Ocean's bottom has been expanded with the example of the structure of the Atlantic Ocean's bottom. Chapter 4 is also supplemented by the characteristic of a tectonic and magmatic center, long in time as a specific plume, with polychronic deposits of tin, gold, uranium, iron, and manganese.

This edition seems to be more rigorous, consistent and informative, convincingly proving the fundamental geophysical discovery of the century—the real existence of a three-beam stationary megacontinent on the Earth which formed over 4-5 billion years in a geodynamic mode of vertical mobilism. This is a fundamental world discovery meaning a complete revolution in the concepts of the earth sciences, and the structure and dynamics of the planet's development.

The book is intended primarily for university teachers and students in the specialties of geophysics, geology, geography, astronomy, and geography; for teachers in schools; for scientists in the earth sciences; for geologists and geophysicists predicting deposits of gold and uranium; and for all readers interested in the structure of the Earth as a planet.

INTRODUCTION

The period of the great geographical discoveries finished two hundred years ago. Four large land areas were established on the surface of the planet—the four modern continents: the American, Eurasian-African, Australian and Antarctic continents, covering the planet from the North Pole of the Earth to the South Pole. And the period of the active geological study of the surface of these continents also began two hundred years ago. This study was protracted to the present day since the object of the study was very large natural taxa, in connection with the complexity of their geomorphological and geological structure. In addition, it turned out that the outskirts of the continents are not limited to the coastline, but often continue towards the World Ocean, where they are represented by a shallow shelf and continental slopes to a depth of 2-3 km.

Another important feature of the structure of the continents was discovered during the study of the World Ocean's bottom. It turned out that the continental crust and the Earth's crust of the central part of the World Ocean's bottom differ sharply in the chemical and petrographic composition of their rocks, in the thickness of the layers of these rocks and in their times of evolution in the geological history of the Earth. And this fundamentally important difference in the crust of the continents and oceans has become an important criterion for determining the true boundaries of the continents hidden in the coastal part of the oceans.

Therefore, the main factual data on the structure of the continents and the bottom of the World Ocean were obtained only in the second half of the twentieth century, thanks to the wide application of new methods for studying the surface of the Earth's crust and its deep structure, up to 40 km from the surface and deeper. The seismic method of investigating the depths of the Earth, the bathymetric method for studying the bottom of the oceanic areas and, finally, the underwater drilling within the bottom of the World Ocean have become precisely such methods. Underwater drilling has allowed the determination of the composition of rocks in the ocean floor, the conditions of their occurrence and their geological age.

Thus, the representative data on the structure of the Earth's crust were obtained only in the early part of the twenty-first century. However, due to the huge volume of annual scientific information, some important discoveries about the structure of the Earth's crust have gone unnoticed by contemporary researchers or have not received the necessary scientific interpretation.

In this book, we consider the fundamental geophysical and geological discoveries of the twentieth and twenty-first centuries which formed the basis of the modern geological theory of the formation of the Earth's continents**.** The discovery of a single three-beam megacontinent of the Earth, formed from the beginning of the Earth's geological history in the vertical mobilism mode, was the result of the generalization of the newest geological, geophysical and oceanological discoveries, combined with the bathymetry data of the ocean's bottom, which serve as the basis for proving a single three-beam form of the northern megacontinent of the Earth.

PART I

THE FUNDAMENTAL GEOPHYSICAL DISCOVERIES OF THE TWENTIETH CENTURY

Centuries-old experience in the study of the geological structure and geological history of the continents remains the unshakable foundation of geological science

Yu. A. Kosygin, 1988
the esteemed Russian geologist

CHAPTER ONE

THE HISTORY OF THE IDEAS ABOUT THE AUTONOMOUS GEOLOGICAL DEVELOPMENT OF THE EARTH'S CONTINENTS

Continents are immovable bodies adorning the face of the Earth.

Harold Jeffreys,
Honorary Professor of Cambridge University
and esteemed English geophysicist

The continents are the large parts of dry land where humanity lives. Therefore, the study of the continents began with the advent of geological science, which studies the geological structure of the different territories. In the eighteenth century, the first geological representations were associated with the emergence of the first scientific tectonic hypothesis—the lifting hypothesis (M.V. Lomonosov, D. Getton, P. Pallas, G. Saussure, L. Buch, and B. Studer). This hypothesis explained the formation of the folded mountain ranges by the movement of the surface magmatic masses and the expansion of them along the axis of the mountain ranges. Then sedimentary rocks on their flanks were transformed into folded structures. But in general, geology as a science was born and began to be actively developed only in the nineteenth century, after the development in France of a paleontological method for studying the remains of extinct animals (G. Cuvier), and using their guiding forms to determine the relative age of the rock layers, and after the development in England of the stratigraphy of mountain layers (V. Smith) in 1800-1832.

In 1852 the French geologist Ely de Beaumont put forward a hypothesis of contraction. The appearance of mountains and folded sedimentary rocks was attributed to the cooling of the original hot Earth, its compression and the reduction of its radius. In 1859, J. Hall (USA) substantiated the hypothesis of geosynclinal sedimentary basins which have been of great importance for all subsequent developments of geology and geotectonics. This concept was further developed in the works of J. Dan, M. Bertrand (1873-1887) and many other geologists of the subsequent periods. At the same time, other geologists (E. Haug, A.P. Karpinsky, A.P. Pavlov, and others) developed the theory of the geological structure and development of the continental platforms.

The gravimetric method for determining the density of rocks (in the middle of the nineteenth century) allowed the determination of the different densities of rocks that were observed on the continents (2.5-2.8 g/cm^3 on average) and at the bottom of the oceans (2.9-3.0 g/cm^3). This was confirmed by the finds of individual samples of basalts and peridotites. In 1873, D. Dan formulated an idea on the initially fixed position of the continents in geological time on the basis of the contraction hypothesis, which had postulated the cooling and solidification of the outer crust of the original hot Earth.

In 1887, M. Bertrand proved that the folded zones on the surface of the Earth's continents are of different ages and identified the four main epochs of tectonic mountain formation—the Huron (pre-Cambrian), Caledonian, Hercynian and Alpine epochs. These tectonic units have retained their significance up to the present time (Khain, 1964).

The discovery of the radioactivity of continental rocks containing uranium, thorium and potassium was the biggest discovery of the early twentieth century (1900-1905). It turned out that the half-life of the uranium isotope 238 is 4.5 billion years (4.5 Ga) and it does not depend on temperature and pressure. Thus, the absolute age of the Earth was estimated to be 4.5-4.6 billion years (Carey, 1991; Gradstein et al., 2004).

A summary of the results of the first century of geological exploration of the continents and, in part, of the bottom of the surrounding oceans was done in the monumental three-volume work of the great Austrian geologist Eduard Suess, which ended in 1909 after a 20-year study by the scientist. E. Suess more correctly estimated the importance of contraction in the geological structures of the Earth. Contraction is not a horizontal compression of rocks, as many have imagined, but a vertical collapse of large blocks of the Earth's crust over the shrinking core of the Earth (Khain, 1964). In addition, he introduced the term "sal" (later sial) for the rocks of the continental crust, characterized by a high content of silica and aluminum (sedimentary rocks, granite, etc.) and low density (2.5-2.8 g/cm^3). The term sima was used for rocks in the Earth's lower crust and at the bottom of the oceans—dense, heavy rocks such as basalt (with a density of 2.9-3.0 g/cm^3) (Hallem, 1985, p. 139).

In 1923 the American geologist Ch. Schuchert confirmed, by his analysis, the existing concept of fixity:

> "*Continents*" *and "oceans" are the primary structures of the Earth, possessing a completely different nature and not passing each other over time*" (Belousov, 1962, p. 366).

The great English geophysicist Harold Jeffreys, the developer of the seismic method of exploring the Earth, concluded in 1926 that the Earth's crust and the mantle of planet Earth are solid and that any horizontal movements of the rock blocks in them are impossible, just as convection in the Earth's hard mantle is also impossible. The same opinion was expressed in 1928 by the German geologist R. Straub, who believed that *"the bottom of the Pacific hides in itself a huge hardened primordial mass, forcing the young chains of the Alpine orogen to circumambulate it*" (Rezanov, 1983, p. 84).

A detailed study of the Earth's structure and its physical state is also given in the work of the Soviet geophysicist V. Magnitsky (1953). It shows that the continents and the bottom of the oceans are the two parts of the Earth, different in composition, origin and structure. The process of the growth of the continents is the process of the growth and formation of the sial on the primary ultrabasic (simatic) crust. The lower thin layer of the oceans' bottom, represented by the ultramafic (simatic) rocks, is the primary crust that originated from the beginning (Magnitsky, 1953, p. 194). Convection in the solid mantle of the Earth, often supported by foreign researchers, is impossible (Magnitsky, 1953, p. 279).

The concept of fixity was also supported by F. King:

> "*the fundamental difference between the continental and oceanic crust suggests that the ocean basins are as stable in time as the continental platforms ... It is difficult to allow the transformation of any continental sial into oceanic crust by any known geological processes"* (1961, p. 23).

The idea of the initially fixed position of the continents was later justified by many geologists (Muratov, 1975; Voitkevich, 1979; Likhachev, 2011; and others).

CHAPTER TWO

THE LAW OF THE AUTONOMOUS GEOLOGICAL DEVELOPMENT OF THE CONTINENTS

The establishment of general laws for the development of the continents is the goal of geological science

Yu. A. Kosygin, 1988

2.1. The regularities of the continents' geographic position

For the first time, in the seventeenth century, the English philosopher Francis Bacon drew attention to the natural geographical laws in the structure of the continents of the Earth, as soon as the first globe had appeared—the first model for depicting the Earth's surface: "*We must not forget that in the very structure of the world—in its large parts—one cannot disregard examples of similarity. Such are Africa and the Peruvian region with a continent extending to the Strait of Magellan. For both have similar isthmuses and capes, and this is not accidental. So is the New and Old World. Both of them expand to the North, to the South they narrow and sharpen*" (Sholpo, 1986, p. 44).

In the nineteenth century, the English geologist Charles Lyell showed the different positions of the continents and oceans on the globe. Almost all continents are grouped in the Northern Hemisphere in the form of a three-radial structure, and the Southern Hemisphere is almost completely covered with water (Sholpo, 1986, p. 46). Lyell was the first to show the three-ray grouping of the continents around the Arctic Ocean (Fig. 2-1).

Fig. 2-1. The three-beam grouping of the main continents of the Earth around the Arctic Ocean (Lyell, 1833, from Sholpo, 1986)

The search for general regularities in the structure of the Earth was very exciting for many geologists and geographers in the nineteenth century. This question also interested the well-known traveler and naturalist Alexander von Humboldt. He noted that many mountain systems of the globe are confined to either latitudinal or meridional directions. His conclusions were supported by the geologist Marcel Bertrand, who published a paper on the idea of orthogonal lines of deformation of the Earth's crust in 1892 (Sholpo, 1986, p. 47).

A great contribution to the identification of geographical regularities was introduced by Jacques Élisée Reclus—a scientist, writer and tireless traveler. He left nineteen volumes of *Universal Geography"*–and a six-volume edition of *Earth and Man*. He noticed one important feature in the arrangement of the continents of the Earth in plan—their location in the form of three radial pairs. The first pair is both of the Americas, which he considered the most perfect and harmonious pair. Both continents of America have a triangular shape extending to the north and a sharp ending to the south, and both are roughly equal in size. The second pair of the continents is Europe and Africa, the third pair is Asia and Australia (Fig. 2-2).

Fig. 2-2. The three pairs of continents (black) in the Northern Hemisphere of the Earth (plan), according to E. Reclus (1898, from Sholpo, 1986)

In the twentieth century, many geologists often drew attention to an interesting natural feature of the location of the continents of the Earth (previously established by Ch. Lyell and E. Reclus)—the presence of three "continental rays" in the forms of the pairs of continents. However, the reason for such regularity in the locations of the continents remained mysterious and unexplained (Sher, 1972; Serpukhov et al., 1976; Belousov, 1989).

The most important achievement of the beginning of the twentieth century was the development of a technique for measuring the ocean's depths with the aid of reflected sound and ultrasonic waves (so-called echo sounding), which made it possible to establish important features of the structure of the continents in their underwater part. It was established that the boundaries of the geographic continents are not limited to the coastal line with the surrounding oceans, but often extend far to the sides of the water column. In particular, the shelves and continental slopes were identified.

The shelves are the margins of the continents flooded by the sea—continental shoals, continually bordering the shores of continents and large islands. Their width varies from the first tens of kilometers to 1200-1300 km (as in the Arctic Ocean). The average slope of their surface is very small ($0^{o}07'$), and their average depth is 100-132 m, although in some places it increases to 600 m, or decreases to 50-60 m. The shelf area is 27.5 million km^2 (according to F.P. Shepard).

The mainland underwater slopes have an average height of about 3660 m. They are often cut by numerous underwater canyons. The average inclination angle of the underwater slopes to a depth of 1800 m is 4°07'. Their area is 38.7 million km^2. The total area of the shelves and continental slopes is 66.2 million km^2 (Serpukhov et al., 1976). The bottom of the World Ocean lies deeper than the continental slopes (Fig. 2-3).

The total surface area of the planet is 509.8 million km^2, while the total area of the continents is 148.7 million km^2 (29% of the entire surface of the planet). But if the area of the continents is added to the area of their underwater margins and the area of the bottom of the Arctic Ocean, their total area would be 227.9 million km^2 or 44% of the planet's surface.

Thus, the continents and the bottom of the World Ocean are recognized as the main planetary structures in the structure of the globe, clearly differing in geographic location (Figs. 2-1, 2-2, 2-3).

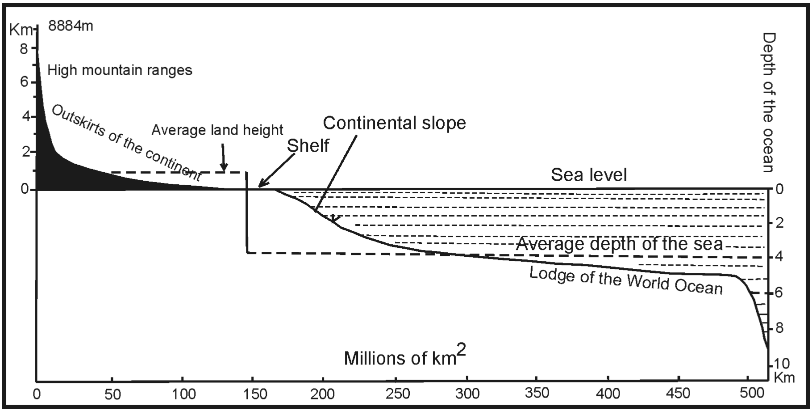

Fig. 2-3. The hypsometric curve of the continent's terrestrial and submarine margins (Magnitsky, 1953)

2.2. A seismic research method as the main method for studying the depths of the Earth

The seismic method of investigating the deep structure has become the most important method for understanding the deep structure of the Earth's crust and the Earth as a whole in the present time. This method is based on the different speeds of transmission of longitudinal (and transverse) seismic waves from large earthquakes through rocks of different density.

The solid Earth crust and the Earth's mantle react to the passage of such waves as an elastic body, and seismic waves travel the entire globe in a few minutes. But the speed of such waves' propagation into the depths of the Earth changes significantly, depending on the hardness (density) of the intersected strata. The seismic method was developed by different researchers (Oldgem, Mohorovichich, Gutenberg and Jeffreys) in 1906-1915. The discovery of the lower boundary of the Earth's crust at a depth of about 40 km was a major theoretical achievement, made by A. Mokhorovichich in 1909. The accuracy of the method was insufficient for individual regions, but quite acceptable for characterizing the deep structure of the Earth as a whole (Rezanov, 1974).

A rather accurate seismic model of the deep structure of the Earth right up to the solid core of the Earth was developed by B. Gutenberg in 1914. In 1926, the English geophysicist H. Jeffreys introduced three layers of separation into the seismic model of the section of the Earth's crust: the sedimentary, granite, and basalt layers. The most reliable seismic model of the Earth's structure was created in 1939, and was known as the Jeffreys-Gutenberg model (Fig. 2-4), which is still used today (Gavrilov, 2005).

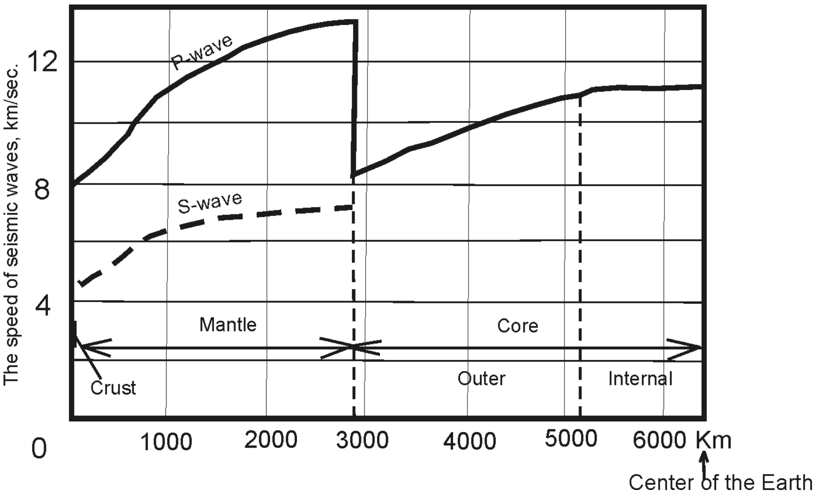

Fig. 2-4. Graph of the seismic waves' velocity change in different depths of the Earth—the Jeffreys-Gutenberg model (Gavrilov, 2005)

Further development of the seismic method is associated with the use of artificial earthquakes, created by specially exploded charges, at a distance of up to 400 km and more from the investigated section of the

Earth. This method, called the Deep Seismic Sounding (DSS) method, was developed by the Soviet geophysicist G.A. Gamburtsev, who applied it with high accuracy to study the deep three-layer section of the Earth's crust of Northern Tien Shan in 1954 (Rezanov, 1974; Gavrilov, 2005).

Representative geophysical sections for all large regions and for all continents of the Earth were obtained in the following years, based on a wide application of the seismic method in world practice.

Other geophysical methods are not effective enough for a reliable study of the deep structure of the Earth. In particular, the gravimetric method for solving the inverse problem of gravimetrics cannot lead to a scientifically valid, reliable result (Kunin, 1989; Kobrunov, 2008).

2.3. The physical properties of the Earth's crust and mantle

The important characteristics of the Earth's different depths are density and pressure, naturally associated with the speed of seismic waves. The rock density varies from 2.4-2.9 g/cm^3 in the Earth's crust to 3.0-3.3 g/cm^3 in the upper mantle below the Earth's crust. Then density gradually increases to 5.7 g/cm^3 at the bottom of the lower mantle (Koronovsky, Yasamanov, 2014).

The pressure rises sharply with depth. If it is 9-12 kbar at the base of the Earth's crust (about 40 km), then the pressure is 20 kbar at a depth of 60 km, 100 kbar at a depth of 300 km, and 130 kbar at a depth of 400 km (Sobolev, Zolotarev, 1974). A sharp increase in pressure is established from the mantle of the Earth right up to the inner core of the Earth (Fig. 2-5).

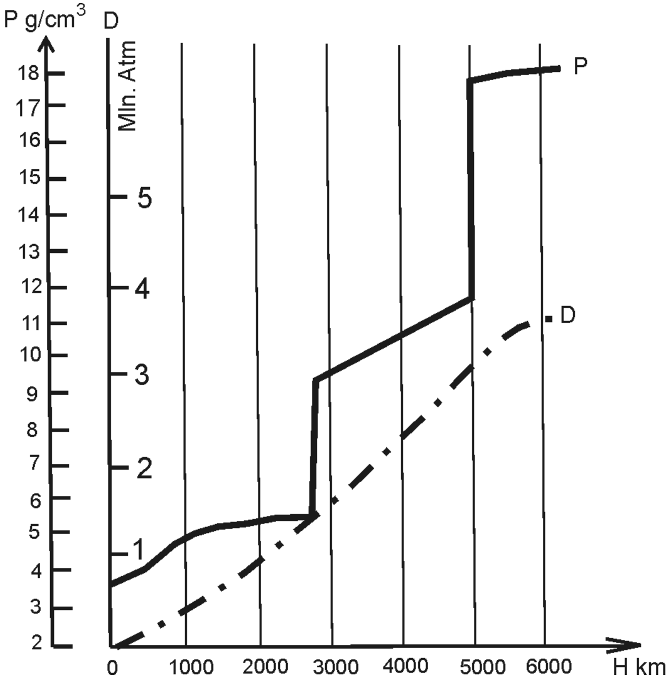

Fig. 2-5. Graph of the sequential increase in density and pressure in the depths of the Earth, according to K. Bullen and V. Magnitsky (Khain, 1964)

The sequential increase of pressure in the depths of the Earth is illustrated in Table 2-1.

Table 2-1: The nature of changes in pressure in the depths of the Earth (Belousov, 1975; Koronovsky, Yasamanov, 2014)

Depth (km)	40	100	410	1000	2900	5000	6370
Pressure (kbar) MPA	10 1.0	31 3.1	140 14.0	350 3.0	1360 137.0	3200 312.0	3610 361.0

For long-acting stresses, the viscosity of the substance is used instead of the density. They are almost identical to the density values. The viscosity of the substance appears with prolonged stresses (tens of thousands of millions of years) and also under the influence of the modern increased heat flux in some places, which affects the decrease in the velocity of transverse seismic waves in the asthenosphere. The asthenosphere is a layer of the upper mantle, in the depth interval of 60-120 km or more, in which the reduced velocities of transverse seismic waves has been fixed and, in contrast, there was also increased electrical conductivity, which is partly explained by the amorphous (viscous) or more heated state of the mantle substance (Khain, 1973; Koronovsky, Yasamanov, 2014). The melting of an amorphous substance begins with a local increase in the temperature of the asthenosphere, especially in the areas of young folded structures and on the eastern edge of the Asian continent (Khain, 1973).

The viscosity for water is 10-^{2} P (poise), 10^{18}-10^{20} P for steel, 10^{22} P for the mantle, 10^{22} P for the lithosphere, and 10^{20} P for the asthenosphere (Gavrilov, 2005). Thus, even in some of the partially viscous parts of the asthenosphere, there is huge pressure that exceeds the density of steel.

These values of the physical properties of matter within the Earth’s crust and in the Earth's mantle are of great importance for various geological processes in the Earth’s crust and in the lithosphere. They limit the possibility of the manifestation of certain geological processes, and strictly determine the possible directions of tectonic movements in the Earth’s crust and mantle of the Earth.

2.4. The continents as geological, geochemical and geophysical anomalies of the planet

The first data on the different geological compositions of the continental rocks and the ocean floor had already been obtained in the nineteenth century. It was found that acid magmatic rocks (granites, granodiorites and diorites) and metamorphic rocks have the main importance in the composition of the Earth’s crust. The main rocks of the ocean floor are basalts, gabbros and peridotites, while granites are completely absent.

The thickness of the continental crust was quite accurately assumed by geologists (50 km according to S.S. Kutorg in 1858, 35 km according to A.A. Aliens in 1865, etc.). An idea of a three-layer sedimentary-granite-basalt terrestrial crust, and, accordingly, of the different densities of rocks with different compositions, was developed by the American geologist R. Delhi in 2014 (Rezanov, 1974).

Active geochemical studies of these rocks were carried out in parallel with studies of their petrography. The American geochemist F.U. Clark had established, over 40 years of research, that the upper horizons of the

Earth's crust consist of only ten elements, in which oxygen, silicon, and aluminum predominate. He published the first results of his calculations in 1889. According to modern, more precise data, the most common elements in the Earth’s crust are oxygen (49.13%), silicon (26%) and aluminum (7.45%) (Koronovsky, Yasamanov, 2014). If this is expressed in volume, then it turns out that the upper horizons of the earth's crust are represented by a continuous lattice of oxygen atoms, in the intervals of which atoms of other elements are located (Serpukhov et al., 1976).

But the chemical composition of the continental crust differs sharply from the chemical composition of the ocean floor, the composition of the upper mantle and the composition of meteorite chondrites (Table 2-2).

Table 2-2: The chemical composition of the crust of the continents and oceans, according to B.G. Lutz (Belousov, 1975)

Components	Chondrites (weight %)	Continental crust (Silicate analyzes, weight %)			Oceanic crust Silicate analyzes (weight %)	
		Granulite-basite layer	Granite-gneiss layer	Average composition of the crust	Upper mantle (after separation of basalt)	Oceanic crust
SiO_2	47.04	58.2	65.6	61.9	45.0	48.65
TiO_2	0.14	0.8	0.5	0.6	0.1	1.40
Al_2O_3	3.09	16.0	14.9	15.5	1.7	16.52
Fe_2O_3	-	2.8	1.1	2.0	6.8	2.29
FeO	15.40	4.8	3.4	4.1	2.2	6.23
MnO	0.31	0.15	0.1	0.1	0.1	0.18
MgO	29.48	5.3	2.4	3.8	42.6	6.79
CaO	2.41	6.0	3.4	4.7	0.7	12.28
Na_2O	0.81	3.2	3.5	3.4	0.2	2.57
K_2O	0.11	2.0	3.7	2.9	0.1	0.37
Sum	98.79	99.25	98.6	99.0	99.5	97.28
The content of the small lithophile elements (g/t)						
Rb	3.0	35	160	100	0.54	-
Li	2.0	8.0	25	16	3.2	-
Sr	11	265	376	320	10.2	-
Ba	3.4	540	777	660	-	-
TR	5.2	86	200	143	11.5	-
Th	0.04	27	14.6	8.65	0.641	-
U	0.014	0.7	2.0	1.35	0.15	-
Zr	33	140	150	145	-	-

Thus, the continental crust is greatly enriched with silica and potassium, and also with the whole complex of small lithophile elements in comparison with the oceanic crust (Belousov, 1975). This is the so-called group of incompatible (incoherent) elements (excluding zirconium), whose ions, because of the dimensions of ionic radii and ion charges, cannot easily replace other ions in the main crystalline phases of the mantle.

The sharp difference in the chemical composition of the oceanic basalts and ultrabasites from the basalts and ultrabasites of the continents, especially in the composition of alkalis, rare earths and radioactive elements, does not allow us to identify the ocean floor with any endogenous zones of the continents. It indicates that the "continents" and "oceans" are firmly connected with "their" parts of the upper mantle (Belousov, 1975, p. 221).

This conclusion is confirmed by the geophysical data (Fig. 2-6).

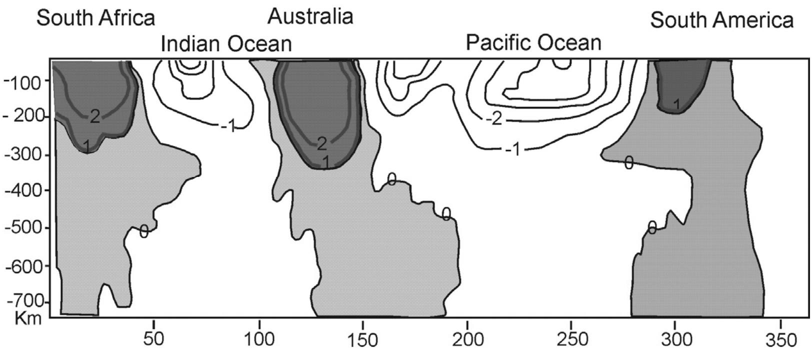

Fig. 2-6. The "roots" of the continents to the lower mantle of the Earth: positive under the continents, negative under the oceans (cut along 22° S latitude), according to the velocities of propagation of transverse seismic waves (Vs, %) (Grand et al., 1997, from Marakushev, 2004).

The continental crust also differs sharply in its other geophysical properties from the oceanic crust. The density of the continental crust is 2.4-2.8 g/cm^3, while the density of the oceanic crust is equal to 2.9-3.0 g/cm^3. This had already been established in the middle of the nineteenth century and was confirmed according to research data in the twentieth century (Fig. 2-7).

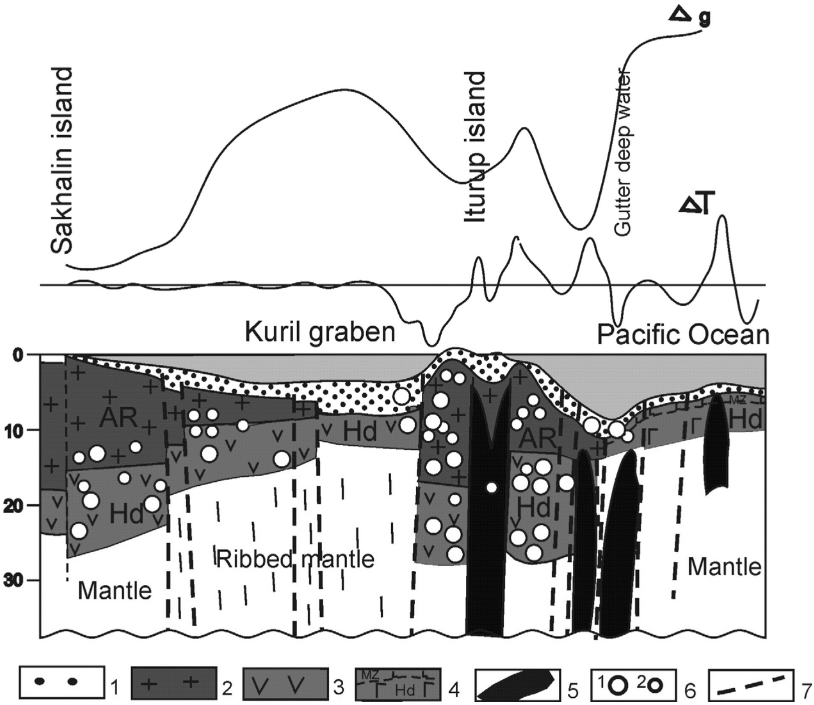

Fig. 2-7. Cross section of Asia's margin (in Russia) along the Sakhalin Island-Iturup Island-Pacific Ocean line (Zhirnov, 2017, according to data of Rodnikov, 1979; Zlobin and Polets, 2009; and others; the age of the layers is added by the author).

1– Volcanogenic-sedimentary rocks MZ-KZ; 2 – Granite-gneiss layer; 3 – Granulite-basite layer; 4 – Basalt (MZ) and peridotite (Hd) layers of the oceanic crust; 5 – Dykes of peridotites; 6 – Centers of earthquakes: 1 – large, 2 – small; 7 – Faults. Above is the gravity field density curve; below is the magnetic field strength curve.

CHAPTER THREE

THE LAW OF THE CONTINENTS' VERTICAL GROWTH IN THE HUGE PITS OF THE PLANET'S SURFACE

3.1. The planetary geophysical sections of the Earth's crust

The planetary geophysical sections of the Earth's crust began to appear in the second half of the twentieth century, after a wide application of the seismic method of investigation on all continents (Fig. 3-1). They became the most important documents for deciphering the geological structure of the Earth's crust.

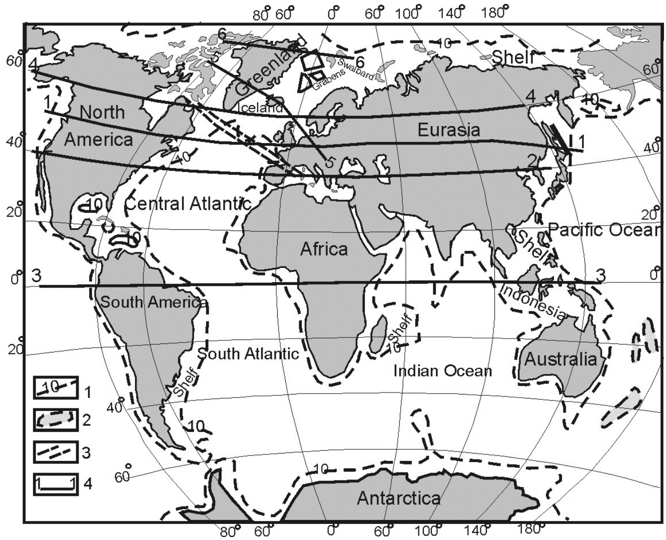

Fig. 3-1. The lines of the planetary geophysical sections of the Earth's crust (Closs, Behnke, 1963; Demenitskaya, 1975; Kunin et al., 1985)