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Annoying Errors in the Theories of Subduction zones, Plate Tectonics, and Spreading Zones

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Article

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Annoying Errors in the Theories of Subduction zones, Plate Tectonics, and Spreading Zones

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Abstract

Since Plate Tectonics emerged victorious in the scientific debate against the Geosyncline and Expanding Earth hypotheses, several serious objections have accumulated regarding its key tenets, particularly Subduction zones, Spreading zones, and Divergence zones—the theoretical foundations that contradict an exact science like mathematics. While the plate tectonics theory is based on subjective evidence provided by individual geophysicists, their personal opinions, their authority in scientific circles, and indirect geophysical data, our findings are based on mathematical calculations that take into account the objective physicochemical parameters of the rock massif—parameters that, for some inexplicable and incomprehensible reasons, were not considered by the developers of plate tectonics theory. For example, such an important parameter as the coefficient of thermal expansion of basalt ß, which determines another important parameter—the specific gravity of the rocks γ—was completely ignored when determining the "buoyancy" of the plates. We do not know how this could have happened, but when basalt is heated from zero to its melting point, the coefficient ß is $\approx 6.5 \rightarrow 8.0 \bullet 10^{-6}/°C$, which accordingly changes the density of the basalt ρ by an insignificant amount, $\rho \leq 2\%$. From this, it becomes completely obvious that with such a value of ß, the specific gravity γ will practically not change and will remain within the range $\gamma = 2.5–3.0$ t/m³. It turns out that the ambient temperature does not have a significant impact on the "buoyancy" of tectonic plates and cannot be the cause of their movement and the formation of subduction zones, as theorists of plate tectonics postulate. In theory, we would like to point out other errors that show the theory of plate tectonics, subduction zones, and divergence zones requires significant refinement; without correcting these errors, it is impossible to move forward in studying the seismicity of our planet.

Keywords: earthquakes, plate tectonics, Archimedes' forces, Isostasy theory.

From the history of the development of plate tectonics theory — the foundation of all geophysics today — it is known that geophysicists have explained the movement of tectonic plates through mantle convection, and the energy source driving this process is the temperature difference between the plates, which, as a result, leads to changes in their buoyancy. Is it so? Theoretical and numerical modeling of the plate movement process shows that an error has crept into the theory, rendering all its conclusions invalid. Let us assume the following geological data for the

oceanic plate: the rocks are basalt, $\gamma = 2.5$ t/m³ – 3.0 t/m³; magmatites have $\gamma = 1.3$ t/m³ – 4.0 t/m³; the depth of subduction zones is up to 800 km; the temperature of the rocks ranges from 200 °C to 1200 °C; the average plate movement speed is approximately 10 μm per day. Our main parameter for doubting the validity of the Plate Tectonics theory was the thermal expansion coefficient of basalt, ß, which, when heated from 200 °C to 1200 °C, is $ß \approx (6.5–8.0) \times 10^{-6}$ °C⁻¹, which accordingly changes the density of basalt, ρ, by an insignificant amount of ≤ 2 %. It is obvious that with such a value of ß, the specific gravity of basalt, γ, will practically not change and will remain within the range of 2.5–3.0 t/m³. That is, there can be no talk of any significant change in the buoyant properties of the plates at the existing temperatures in the mantle. It would be naive to expect a different result for γ with such ß, and it is unclear why plate theory theorists did not pay attention to these indicators. In fact, this means that the statement made by the theorists regarding the convective "buoyancy" of large geological objects contradicts the theory of Isostasy [75]. Here, we should note that the presence of numerous folds in the form of synclines in the Earth's crust (Fig. 1) indicates that the plates have two vectors of movement: horizontal and vertical. No one can dispute this, but at the same time, using the example of the Alpine mountains, which rise faster than they move, we can also conclude that the main part of the convection energy is spent not on horizontal but on vertical movement of the plates, and only a small part of it is distributed, taking into account the sinθ angle of inclination of the rock layers [76]. It follows that the theory of plate Tectonics is in trouble, and the closely related theories of Subduction zones and the modern interpretation of spreading theory are in great doubt. Let's figure out what's wrong with the Spreading theory. Currently, it is believed that the mechanism of plate pushing (ridge push) and plate retraction (slab pull) [77], [78], and five other secondary forces are responsible for spreading processes. The spreading process begins with mantle convection. The plate, due to the high temperature and high pressure caused by the influence of mantle flows, rises, forming a dome (bulge), and then splits in two, with the oceanic plate sliding under gravity along the sloping spherical surface of the Earth on both sides of the fault (rift). Thus, the process of creating new crust in spreading zones and the recycling of old crust in subduction zones occurs; i.e., the expansion of the Earth's surface is compensated for, which is proven by the age of the oceanic crust. We emphasize that this fact has been proven by geological services and is beyond any doubt. However, what follows in the theory is where mysticism comes into play, for, according to the (unsubstantiated) creators of this mystical picture, the process involves the drawing in of two halves of the plates due to gravitational forces into the mantle in subduction zones. Why do we believe this does not correspond to reality? Because the process of mantle convection, pushing, and drawing in of the plate does not align with basic mathematical calculations.



Fig. 1. The form of synclines in the Earth's crust

In order for the process of pushing the plate to start and for it to begin its gravitational movement, the slope of the plate from the rift to the continental margin must (!) be at least several tens of degrees. Let's assume that if we take the angle of the plate's slope to be only 10 degrees, then, given its length from the rift to the margin of 1,000 km, the end of the plate must be raised to a height $h \geq 17$ km. If we assume a slope of at least 50 (the slope angle of the roof for snow sliding is ≥ 90), then, in order to ensure its sliding, the elevation of the end of the slab at the rift must be $h \geq 87$ km. Such a height of ridges does not even exist on Mars, and making further calculations for angles ≥ 200 makes no sense. We repeat: we agree that the process of plate formation in spreading zones is proven by the geological dates of the formation of new crust, but this in no way constitutes a fact that explains the existence of subduction zones. Consequently, the generally accepted mechanism of plate pushing, to use the language of poker players, is a bluff. We can assert the same for the mechanism of plate subduction, because due to the small angle of inclination and, as a result, the emergence of a large frictional force, the plate will simply break in several places, which is clearly visible in the figure.2.

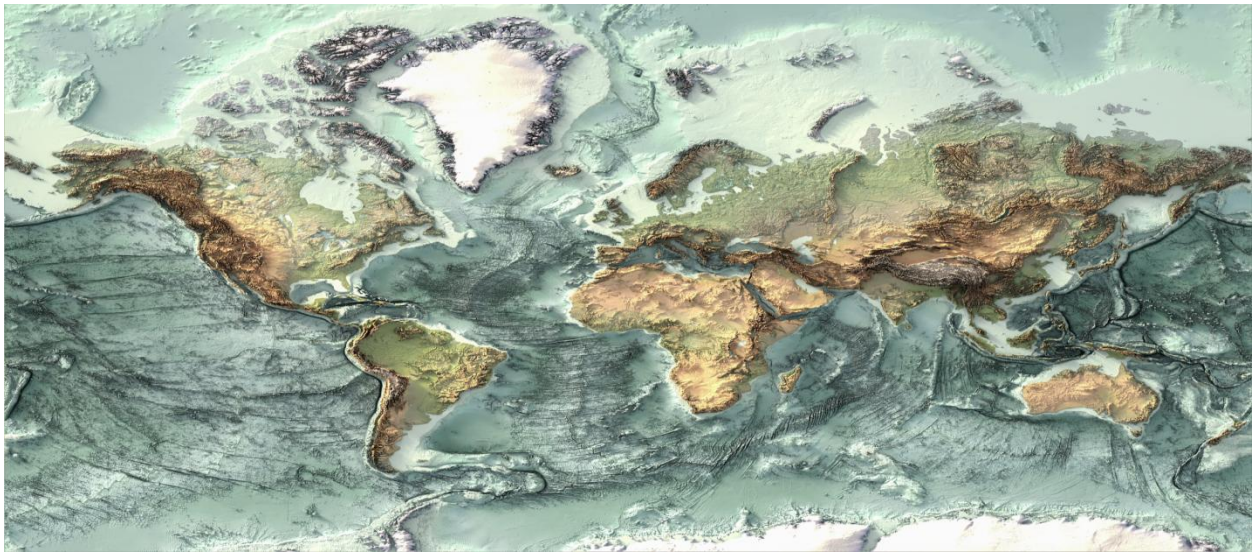


Fig. 2. Spreading Zones:https://www.reddit.com/r/geography/comments/1f4b21x/detailed_topography_of_the_continents_with_ocean/?show=original

As you can see, the childish calculation presented above, and, what is especially important, the experience of geological observations, completely refutes the mechanism of the spreading process, as established by geophysicists, and, consequently, the mechanism of subduction zones. It has been shown that modern interpretations of this mechanism do not correspond to mathematical calculations and the fundamental laws of mechanics and physics. It is simply unrealistic to imagine, let alone scientifically substantiate, the idea that a basaltic plate with a density of $\gamma \sim 2.9$ t/m³ can penetrate mantle rocks with a density of $\gamma \sim 3.3$ t/m³. But even this is not the whole truth, for in order for the slab to begin moving spontaneously downhill, nothing should obstruct its descending end in the continental margin zone, and it should not come up against anything. However, our plates run into continental rocks and mantle rocks, and according to scientists who advocate for the existence of subduction zones, oceanic plates, when they meet continental rocks, magically bend and, instead of taking the easier path to the surface, choose the most difficult path — they pierce through the mantle rocks and sink into them to a depth of about 800 km, where they turn into magma. The simplest question that arises when we imagine this process is: why do oceanic plates, when they meet continental plates, dive down into the mantle, choosing the most energy intensive trajectory of movement rather than the easiest path to the Earth's crust surface? This simply cannot happen, because the unshakable principle of nature follows from the foundations of absolutely all fundamental sciences - any processes always follow the path of least resistance with minimal energy expenditure: in physics, the system strives to minimize potential energy and thermodynamic equilibrium, in chemistry, the direction of any chemical process is determined by the Gibbs energy G, i.e. a reaction is possible only if this energy decreases ($\Delta g < 0$), in thermodynamics - any physical system spontaneously tends to enter a state with minimal free energy, electric current: - the current goes inversely proportional to the resistance, in quantum mechanics - the path of the particle interferes so that in the end the path described by The classical principle of least action in evolution is that living organisms adapt in such a way as to spend a minimum of energy on survival and reproduction. In this regard, a major question arises for plate theorists: if all the laws of science and Nature itself clearly show us that the subduction of plates into the mantle is physically impossible, then why do geophysicists still believe in this unrealistic process? On what law is this based, and why is the oceanic crust obliged to dive deep into the mantle, violating all the laws of science and nature? As an example, let us consider the collision of the Indian and Eurasian plates. Interestingly, their collision does not result in the formation of a subduction zone; on the contrary, it is a classic example of a plate collision, which led to the formation of the Earth's highest mountain systems — the Himalayas and the Tibetan Plateau. Proponents of Plate Tectonics explain the absence of subduction zones in this region of the planet by claiming that both plates have a thick and equivalent crust, which crumples but does not bend, and thus does not subduct under each other. However, the science of geology tells us that this is not the case,

since the areas of the plates are in the ratio of ≈ 68 million km2 / ≈ 11 million km2 [79]. This means that the Eurasian Plate is approximately six times more massive than the Indian Plate and should subduct the Indian Plate, but strangely, this does not happen. In that case, why, when an oceanic and a continental plate collide, they, following the example of continental plates, cannot crumple, break apart, and emerge at the surface in the form of mountains, like the aforementioned plates? Why must one of them, in defiance of Nature and the laws of physics, inevitably dive into the depths of the mantle? Nevertheless, despite such a resounding embarrassment, the geophysical community has been and continues to be widely presented with images of subduction zones taken using the so−called seismic tomography method (seismic "scanning" of the Earth), Fig. 3.,

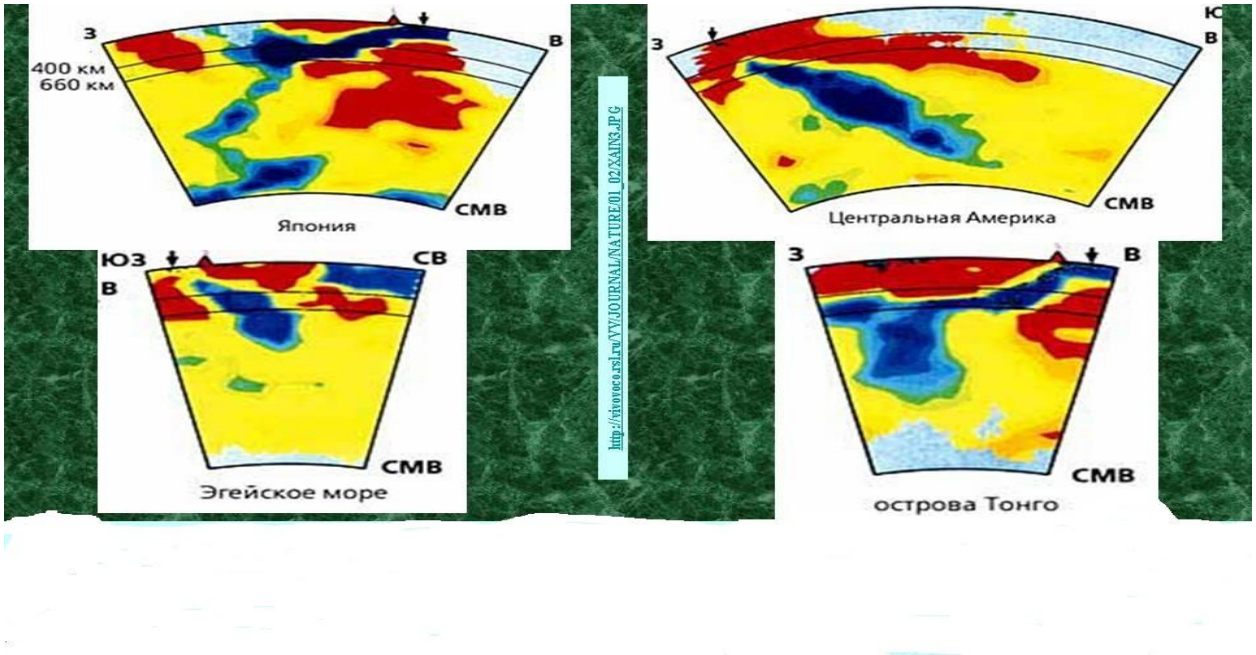


Fig3. Hilst R.D. et al. 1997. https://plate-tectonic.narod.ru/geodinamicsphotoalbum.html, http://vivovoco.rsl.ru/vv/jornal/nature/01_02/xain3.jpg

which allegedly prove the existence of subduction zones and in which an oceanic plate is supposedly clearly visible sinking into the mantle. Is this true? No, because the images show us internal configurations of some kind of shadows, vague and incomprehensible shapes. And most importantly, all of this is based not on scientific calculations, but on assumptions and fantasies, in contrast to the scientific fact that the less dense rock of the oceanic plate cannot in any way dive into the denser mantle, as this contradicts the laws of physics. So what or whom should we believe: the strict laws of science or fantastic ideas based on mystical assumptions? It is obvious that some geophysicists, in an attempt to resolve the inconsistencies that have arisen in the theory of plate tectonics, are trying to pass off wishful thinking as reality, and they do so quite sophistically, trying to confuse the reader. This is in vain, for we know that tomographic images are based not on the speed of wave propagation, but on the anomalies (heterogeneities) of the rock massif, where the speed of wave propagation will vary with every crack, fault, cavity,

thrust, or fault, and the wave will encounter a large number of such anomalies. No one disputes that getting a seismic tomography of a volcanic chamber, this small and isolated high-temperature object located at an insignificant depth of 5-6 km from the Earth's surface, is currently not a big problem, but getting a picture of an object with an area of several thousand cubic kilometers at a depth of several hundred kilometers is a completely different matter, because seismic tomography directly it depends on the step between the seismic receivers and the points of wave excitation and the parameters of the mountain range, which significantly affect the resolution of the image obtained, as well as on the presence of fluids, temperature gradients, pressure, density and fracturing of rocks, various inclusions, faults and other defects of the mountain range, which together form such a mosaic and a vague panorama of bouncing seismic wave vectors, which a dozen independent interpreters of the same tomographic panorama will produce completely different versions of the object they describe. One will say one thing, the second will say another, and the third will say the opposite of the other two. And this is quite understandable and understandable, because the change in the velocities of seismic waves in a significant range and depth of the studied mountain range, with an area of several tens and even hundreds of thousands of square kilometers with numerous anomalies in the rocks turns out to be so unpredictable that the outline of a geological object is an unsolvable puzzle from the arsenal of fortune-telling on coffee grounds. Unfortunately, modern tomographic images of subduction zones, Fig.3, provided by proponents of plate theory do not fit into the scientific explanation of their origin and contradict the laws of science. Consequently, we can conclude that subduction zones are a geophysical myth. Let's move on: scientists from Rice University in Houston [80] have shown that a tectonic plate "floating" in the asthenosphere behaves like an ice floe on a river during a flood, the movement vector and speed of which are determined solely by the energy of the water flow. To put it mildly, this is not entirely accurate. What is the error in modern geophysics regarding plate tectonics and the authors of the aforementioned study? It lies in the failure to adhere to the fundamental principles of science. What is the theory of Plate Tectonics based on? On the assertion of the "buoyancy" of plates and the resulting Archimedean forces. But... do we have the right to apply Archimedes' law to solid bodies that are not in gases and liquids, but in the "strong embrace" of a solid rock mass? No, we do not, because Archimedes' law is applicable and works only in liquids and gases, and there are no exceptions to Archimedes' law. But why do some theorists of plate tectonics make such an obvious mistake, "making the plates float" as if they were in a container filled with liquid? We don't understand? This is absolute geophysical nonsense, because the asthenosphere is a solid body! Let's imagine a slab with a specific gravity of the rock $\gamma 1 = X$ t/m³ resting on a solid asthenosphere with approximately the same specific gravity $\gamma 2 = X$ t/m³ (in the boundary region, due to diffusion processes, the specific density of the slab and the asthenosphere should be the same, $\gamma 1 = \gamma 2$). Will an Archimedes' force be generated in this case? No! Further, the scientists draw the following conclusion: *"The global mantle flow remains a type of whole‐mantle convection, with the flow of plates and the asthenosphere from the mid‐ocean ridge balanced by a broader return flow in the lower mantle,"* which, again, is an unsubstantiated assertion, since an analysis of

seismic wave propagation has shown that there are no global mantle flows in the planet's interior. The theory of geosynclines and our model have demonstrated the existence of a single, interconnected system of continuous movements of large−scale tectonic plates during vertical displacements, which are caused by the influence of unevenly distributed specific density of rock formations due to forces arising in the process of Isostasy, the presence of faults and other geological disturbances in the Earth's crust, as well as by the large amount of fluids in the Earth's interior, which, due to their physical nature, always tend to create domes in the mountain massif. We explain the absence of significant horizontal displacements in our model by the fact that the temperature parameter ß does not have a noticeable effect on the specific gravity of the rock γ and by the absence of sufficiently powerful forces capable of causing their horizontal movement. However, such forces capable of moving tectonic plates horizontally can easily arise if we imagine that our planet is expanding [81]. This process has been ongoing for millions of years, and it is the volumetric growth of the Earth's crust that causes the mutual movement of tectonic plates. Consequently, this state of affairs in plate tectonics theory raises questions about the functioning of the mechanism of the horizontal vector of tectonic plate movement, which require resolution. But that's not all. Despite the lack of important objective data on the structure of the planet's interior, modern seismology continues to refer to mythical elastic stresses arising in the rocks of the Earth's crust and mantle in subduction zones. It is in this vein that the article [82] speaks, echoing the scientists of the Institute of Physics of the Earth of the Russian Academy of Sciences, who explained the cause of the deep-focus earthquake by the impact of the subduction zone that occurred on May 24, 2013 under the Sea of Okhotsk, near the western coast of the Kamchatka Peninsula, at a depth of about 609 km. with magnitude MW = 8.3: - *"The cause of the occurrence of deep-focus earthquakes in this area is the immersion of the Pacific Plate into the Earth's mantle. The Pacific Plate subducts under the Kuril–Kamchatka island arc along the line of the deep−sea trench at an average speed of 1.5 cm/year and then descends into the Earth's interior. The phase transition of the Earth's mantle material, which occurs at a depth of about 670 kilometers, hinders the further descent of the plate, leading to its deformation and the accumulation of stresses that are released as a result of deep focus earthquakes,"* - the scientific institution's website reports. Why didn't scientists from the Institute of Physics of the Earth and other geophysicists around the world, when explaining subduction zones, ask themselves a simple question: what would such a process look like from the perspective of classical mechanics, and what is this fantastic force that arises at a depth of 670 km and is capable of preventing the super massive Pacific Plate from sinking into the mantle — after all, it's very much like a contest between a fly and an elephant. Let us consider the situation from the perspective of the scientific reliability of the event described by scientists regarding the IFZ, not from the standpoint of the theory of subduction zones — which cannot be verified in terms of scientific reality, as it is based on indirect methods of studying the deep interior of the Earth — but from the perspective of classical mechanics, which we can trust 100 % because the entire process of the motion of physical bodies has been well studied, is easy to verify, and is fully provable. Thus, from the point of view of kinematics, the movement of

tectonic plates can be described by the laws of motion of bodies across the sphere of the Earth, where, according to the classical theory of plates, forces act in subduction zones: 1) the force of pressure from the Spreading zone of the mid-oceanic ridge (ridge-push); 2) the force of dragging a part of the plate plunging into the mantle under the influence of its weight (slab-pull); 3) the friction force of the sinking plate due to subduction adhesion; 4) the buoyancy force of the plate; 5) the force of bending the plate during immersion (bend-resistance); 6) the force of rolling back due to viscous adhesion to the asthenosphere (roll-back); 7) the force of "suction" of the advancing plate in contact with the subducted plate (sucking in). It is obvious that, from the perspective of classical mechanics, each force contributes to the overall force vector, and the Earth's crust is viewed as a mosaic of plates of different sizes that move relative to each other. However, according to the laws of theoretical mechanics, when the motion of a body slows down or stops, an inertial force must arise, because inertia is the tendency of moving bodies to remain in motion until a force (or forces) appears that causes a change in the body's velocity. This follows from the fundamental principle described by I. Newton in his first law of motion. It follows from this that the cause of inertial forces is the acceleration of a body, which is caused by the action of uncompensated forces acting on the body and possessing integral properties: a) a force is a measure of the mechanical action of other bodies on a given material body, and forces are the result of the interaction of bodies; b) forces can exist only in pairs, and the nature of the forces in each such pair is the same; c) any force acting on a body has its source in another body. d) No other forces are introduced or used in classical mechanics, and mechanics does not allow for the possibility of forces arising independently, without interacting bodies. From the principles described above, it will follow that, given a uniform rate of subduction of the Pacific Plate in the subduction zone, its acceleration a will be equal to 0. Due to the action of a pair of uncompensated forces, one of which (the primary force) was formed at the moment of the phase transition of the Earth's mantle material, and the second force is the inertial force of the plate, as a reaction force to the action of the primary force, the plate will acquire acceleration. Here, it is necessary to emphasize that the primary force is not a real force, but a hypothetical one introduced into the theory of plate subduction by geophysicists, based on the assumption that a phase transition occurs at a depth of 670 km in the rocks of the subducting plate and the mantle, as scientists — geophysicists from the IFZ claim. The magnitude of the hypothetical force generated as a result of the phase transition at a depth of 670 km (R) must be equal to or greater than the inertial force of the plate (F): $R \geq F$. Let's calculate the inertial force of the slab, F, which, according to classical mechanics, will be equal to the product of the slab's acceleration (a) and its mass (m): $F = a \bullet m$

The area of the Pacific Plate (P) is approximately 103,300,000 km2. With an average plate thickness (H) of ~10 km, its volume (W) will be:

$W = P \bullet H = 1.03 \bullet 10^{8}\text{км}^{2} \bullet 10\text{км} = 1.03 \bullet 10^{9}\text{км}^{3} = 1.03 \bullet 10^{18}\text{м}^{3}$.

Then the mass of the Pacific plate will be equal to the product of its volume and the specific gravity of basalt (γ): $m = W \bullet \gamma = 1.03 \bullet 10^{18}\text{м}^{3} \bullet 3000\ \text{кг/м}^{3} = 3.09\text{м}^{3} \bullet 10^{21}\text{кг}$.

At an average plate velocity of 7.5 cm/year, the plate's acceleration is a = V/t, where V is the plate's velocity and t is the time in seconds per year: $t = 3.154 \times 10^7$ s. Therefore, the acceleration will be: $a = 0.075\text{м}./ 3.154 \cdot 10^7\text{c}. = 2.38 \cdot 10^{-9}\text{м}/\text{c}^2$.

In this case, the inertial force of the slab will be:

$F = a \cdot m = 3.09 \cdot 10^{21} \cdot 2.38 \cdot 10^{-9} = \underline{\mathbf{7.35 \cdot 10^{12}\text{H}}}$.

It is known that several forces are applied to the Pacific Plate Fig. 20, and each of them imparts to the body the acceleration it would impart in the absence of other forces (the superposition principle). Therefore, when calculating the body's acceleration, we replaced all the forces acting on it with a resultant force — the vector sum of the acting forces. As we can see in Fig. 4, the motion vectors of the Pacific Plate have approximately the same north‑western direction.

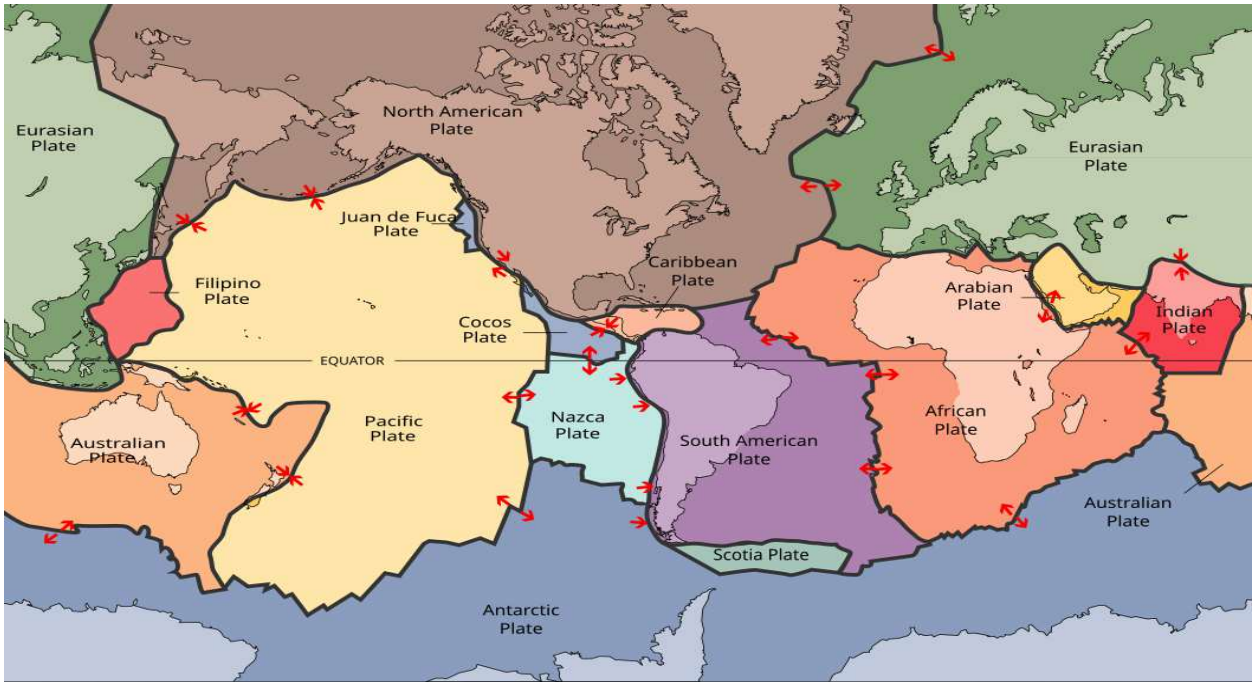


Рис.4. Map:USGS Description:Scott Nash, Tectonic plates.png

Since pressure is a physical quantity equal to the force acting on a unit area of a surface, perpendicular to that surface, i.e., 1 Pa = 1 N/m², the inertial force is 7.35×10^{12} N. It generates a reaction force that will be equivalent to the pressure at the contact point between the continental and oceanic plates, amounting to 7.35 TPa. As you can see, this makes the tectonic plate subduction hypothesis scientifically insignificant, since the tensile and compressive strength of basalt is approximately 60–400 MPa, which is millions of times lower (!!!) It is less than the inertial force of the Pacific Plate that we calculated, and even if such a force appears at the moment of the phase transition, the sudden increase in pressure in the subduction zone will lead to the sublimation of the rocks of the plate and the mantle. Naturally, we understand that the inertia force of plate $7.35 \cdot 10^{12}$H, based on the presence of various kinds of mid-ocean obstacles and hooks, should be reduced at least twice, but even if we reduce the inertia force not by 2 times, but by 100 times, this correction will not significantly affect the result of the process because The strength of basalt ~ 60-400 MPa cannot be countered by the enormous force of 7.35 TPa. A few more important nuances should be noted here: When calculating the inertial force

based on its mass, we did not include in the calculation the part of the plate that has already submerged to a depth of 670 km in several subduction zones in the western part of the Pacific Ocean (the Japanese Islands, the Kuril Islands, Kamchatka, and the Aleutian Islands), which would constitute a significant portion of the plate's mass and substantially increase the inertial force. Moreover, the laws of mechanics tell us that the bending moment (M = F • L) at the site of the fracture between the subducting plate and the continental plate. It is easier to break the oceanic plate or bend it several times than to force it into the stronger rock of the mantle; Fig. 5.



Fig. 5. Folds in rocks formed when they encounter layers of more resistant rock. A Practical Guide to Introductory Geology. Copyright © 2020 by Siobhan McGoldrick, https://pressbooks.openeducationalberta.ca/practicalgeology/chapter/10-2-folding/

Based on the fact we described above — that the ambient temperature does not have a significant impact on the "buoyancy" of tectonic plates — it follows that the bulk of the convection energy is spent not on the horizontal movement of the plates, but on their vertical movement (expansion, upwelling) towards the Earth's surface. The calculations given in the article completely negated the mechanism of plate pushing (ridge-push) and plate retraction (slab pull) legitimized by geophysicists and the subsequent processes of subduction following these mechanisms, and showed that modern interpretations of this mechanism do not correspond to the fundamental laws of mechanics and physics. Based on the conclusions drawn, we can assume that the process of tectonic plate movement along a horizontal vector and the seismic activity induced by these movements are hidden in the features of other hypotheses and ideas, for example, in the hypotheses of an Expanding Earth and Geosynclines. This demonstrates the need not to reject the reasonable ideas contained in these hypotheses, but to combine their scientific provisions with the theory of plate tectonics.

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