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The Central and South-East Asian geodynamic structures manifested in the seismicity and tomography data

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Abstract. Various endogenous, those occurring in the Earth's bowels, and exogenous, for example, impact effects, geological processes characterize the state of the art in geodynamics. In order to solve problems focused on the investigation of the cause-effect relationships of the processes influencing the regional geodynamics, the Earth's Natural Disasters Database (GIS-ENDDB) is being developed. By means of the tools and methods of the GIS-ENDDB, the new global geodynamics structures of complex multi-stage origin are being revealed. In particular, the large-scale seismic lineament (ring and linear) structures and deep (channel-shaped and crack-shaped) ones in Central and South-East Asia, are interpreted by geomorphological and seismological features as elements of a single geodynamic structure of impact origin.

Keywords: Morphostructural elements, geodynamic structures, geophysical anomalies, impact and seismological catalogs.

Introduction

Various endogenous (occurring in the Earth's bowels) and exogenous (for example, impact effects) geological processes change the external and internal appearance of our planet and are associated with the global catastrophic events of its history. These processes characterize the present-day geodynamic situation, and excluding from consideration, at least, one of the factors (for example, exogenous) can lead to incorrect estimates of the state and geodynamic development of some regions. To investigate the cause-effect relationships of processes influencing the regional geodynamics, the Earth's Natural Disasters Database (GIS-ENDDB) [1] is being developed.

1. The information base

The information base of the system contains the data from the impact catalog of the Earth [2], the catalog of volcanoes, seismological data from more than 10 global earthquake catalogs (of the world-wide level), as well as the arrays of measurements of the Earth's heat flux, the detailed surface relief, the gravity field anomalies and the deep tomography. To visualize and to study such data, the methodological base was created employing methods of the physical and mathematical analysis, the geoinformation technologies and the expert approaches to the interpretation of the data.

For the geodynamic studies of Central and South-East Asia, the global seismological catalogs are used: NEIC and Significant (the USGS geophysical service), ISC (the English International Seismic Service ISC) and the integrated Asian catalog COMPLEX. The latter combines the detailed catalogs of the GS RAS (Geophysical Service of RAS) of a number of the Asian and Far Eastern Regions and the catalog of the Chinese seismic network (CSN). As a result, the COMPLEX catalog is 10 times more complete and representative (with $M_{\rm PR} = 3$–3.5) for Central and South-East Asia in comparison with the ISC or CSN catalogs (with $M_{\rm PR} = 4$–4.5).

For constructing the maps of geophysical field anomalies, the "Global marine gravity" data (the gravity field), "The Global Heat Flow Database of the International Heat Flow Commission" (the data of heat flux measurements of the North Dakota University: www.heatflow.und.edu/index2.html), and the 3D model "SL2013sv" (the model of seismic S_V wave tomography for constructing the depth cross sections at depths of 25–700 km [3]) are used.

2. The procedures for revealing deep geodynamic structures

The GIS-ENDDB formalized algorithm for building the global seismicity lineaments on the Earth's Great circle (GC) suggests that on a global level, environmental destruction occurs over segments of the Earth's Great circle if a discontinuity in the consolidated crust overcomes the Moho layer [4]. Based on this algorithm as a support of the earlier obtained data [5], the central-oriented system of global seismic lineaments (Figure 1), including the longest "Afro-Baikal" seismic-lineament, corresponding to the Inland Asian mountain belt [6] of the major earthquakes in the temporal interval of 2,250 years (according to the Significant catalog) has been revealed in Central Asia. The center of the cruciform convergence of this lineaments system is the Pamir-Hindu Kush seismic focal zone (PHZ), a unique, narrowly localized depth area, where several thousand earthquakes occur per year (with a maximum event density at depths of 200–250 km).

Let us remind that here the term "seismic lineament" means the linear, arc-shaped and ring structures detected by the lateral distribution of seismicity of a given magnitude rank, directly or indirectly associated with active faults of the corresponding rank and reflecting the current stress-strain state of the upper layers of the lithosphere.

The existence of a fault zone corresponding to the "Afro-Baikal" seismic lineament (AB) and control of its seismo-activity by deep-seated activity in the PHZ are now considered to be controversial. This is because the AB crosses a large number of known transverse faults of the sublatitudinal and

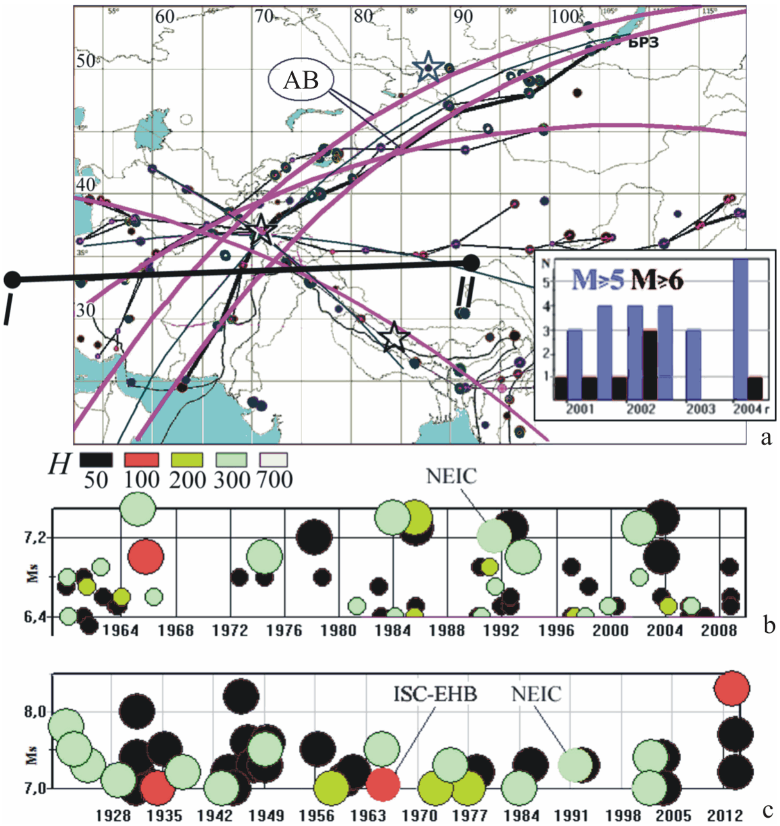


Figure 1. The temporal dependence of large events parameters in the δh-band of the "Afro-Baikal" seismic lineament, including the Pamir-Hindu Kush seismic focal zone: a) the number of events according to the NEIC catalog data for 2001–2004, $M_W \geq 5$ and $M_W \geq 6$ on semi-annual intervals; b) earthquake magnitudes according to ISC-EHB data for 1960–2009, $M_W \geq 6.4$ (one event added from the NEIC); c) earthquake magnitudes according to ISC data for 1920–2013, $M_W \geq 7$ (two events added from the ISC-EHB and the NEIC). AB is "Afro-Baikal" seismic lineament revealed by different methods: arcs — with different $h = L/n_{\min}$ [4]

north-west directions (especially, in the Altai and the Sayan regions). This contradiction is eliminated if we assume the existence of a deep super-crack corresponding to the AB, and the known transverse faults are interpreted as its numerous derivatives in the more brittle upper layer of the Earth's crust.

For studying deep seismogenic structures of the controversial genesis (the centrally oriented lineaments system of the Asian region, the Afro-Baikal interplate border and the Pamir-Hindu Kush "seismic nail" [7]), the procedures for visualizing the deep-seated tomography data as a shaded relief map (by layers with a depth step of 25 km) and its cross-sections (by profiles selected by the user) was developed in the GIS-ENDDB. In addition, the methods of graphical and spatial-temporal analysis of the seismic-geodynamic process characteristics inherited from the GIS-EEDB analysis subsystem [8, 9] are supplemented by their distribution functions in the cross-sections of the user-assigned multi-directional profiles. This allows obtaining information about the dynamics of the seismic regime of the deep structures identified by tomographic and lineamental algorithms, in particular, about a change in time of the total seismic energy released by earthquakes per unit area.

As a result of the use of the tomography imaging procedures, the existence of a deep, unconsolidated fault zone along the "Afro-Baikal" seismic lineament was confirmed (by the linear anomaly of the lower values of the S_V wave velocity field that manifest at depths of 35–80 km). The correlation of the geodynamic regime of the regions of the "Afro-Baikal" deep fault (including the Baikal rift zone (BRZ), the Altai fold region, the PHZ) with the activity of such regions as the Far East and West Pacific subduction zones was confirmed by the distribution of the total energy.

3. Relative correlation of the spatially distant large earthquakes

Earlier [10], according to the graph of the total seismic energy, a correlation was found in the amount of the energy released in the Baikal region and the subduction zone of the Far East and Japan from 1945 to 2000. The maxima of the seismic activity of the Baikal rift zone are 1–4 years ahead of the bursts of activity of the West Pacific subduction zone, which indicates to the interregional interrelation of the processes communicating through the triggering mechanism. Another example of such an interrelation is the coincidence in time of the Tokachi-oki earthquake (25.9.2003, $M_W = 8.3$ in the zone of the West Pacific subduction), the Chui one (27.9.2003, $M_W = 7.3$, which occurred after 2 days at a distance of 4300 km in the Altai region) and the preceding North Tibetan event (November 14, 2001, $M_W = 8.1$ in the mountains of the central Kunlun [11]) (Figure 2). The probability of a simple coincidence in time for such major events is very small, since events with a magnitude exceeding 7.5 occur only 3–7 times per year around the whole world. The other facts of the "roll-call" of earthquakes that are remote from each other were also revealed for the BRZ and the Far Eastern subduction zone (see Figure 2). There are also signs of a possible influence of the preparation processes of the Sumatra-Adaman mega-earthquake (26.12.2004, $M_W = 9.1$) on the above-listed events in Tibet, near the Hokkaido island and the Altai region [11].

To quantify the degree of the correlation between events in remote areas, an algorithm for calculating the correlation coefficient K_{COR} was implemented in the GIS-ENDDB assuming setting of the three parameters:

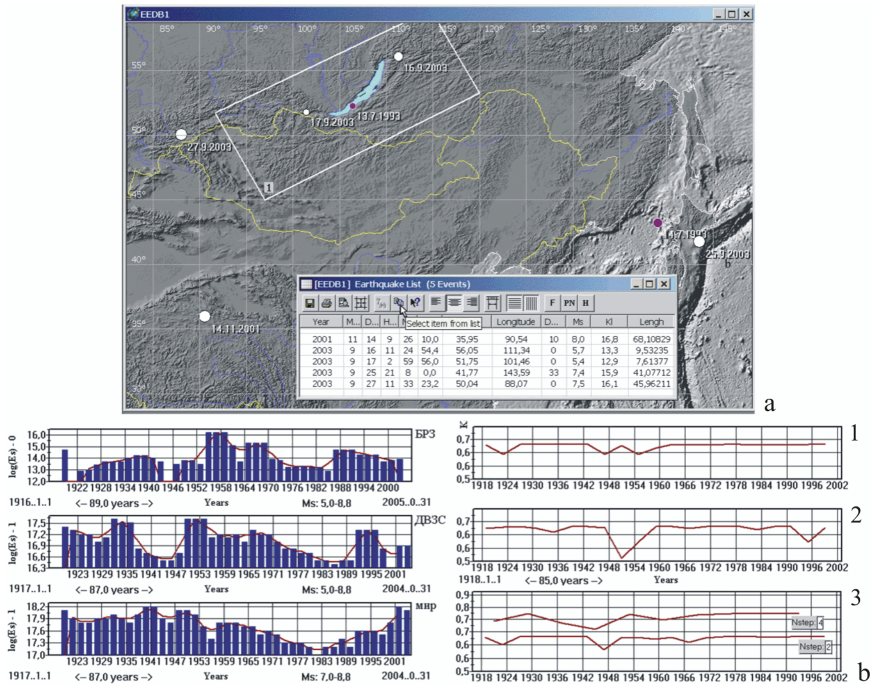


Figure 2. The correlation of earthquakes in Central Asia, the Baikal rift zone and the Far East subduction zone: a) the location of the epicenters of the three strongest earthquakes of Central and East Asia in 2001–2003, and two accompanying Baikal events (white circles), and of two chronologically related events of 1993 (dark circles); b) histograms of the number of earthquakes in the Baikal rift zone (BRZ), the Far East subduction zone (FESZ) and the whole world (on the left) and the correlation coefficient K_{COR} between them (on the right): 1 — between BRZ and the FESZ, 2 — between the FESZ and the world, and 3 — between BRZ and the world (with calculation step 4 and 2)

- averaging range N_{AVG} (the number of columns for calculating the average energy of 1st and 2nd graphs),
- the number of columns N_{POINT} for calculating the coefficient,
- the step N_{STEP} of calculating the coefficient $K_{\mathrm{COR},j}$, $j = 1, \dots, m/N_{\mathrm{STEP}}$ ($N_{\mathrm{STEP}} = N_{\mathrm{POINT}}$ if no overlapping of the calculation windows is accepted).

The curve K_{COR} reflecting the correlation between the averaged graphs of the total seismic energy released in the Baikal region and in the Far East subduction zone for the entire period of instrumental observations (1917–2004) shows the stability of the value K_{COR} equal to 0.6–0.7 (even with a minimum calculation step of 2 columns).

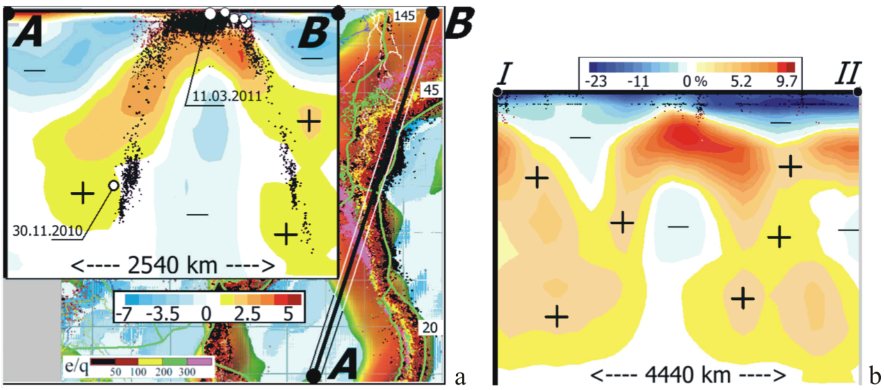


Figure 3. The structures of "pushing" and "immersion" in tomographic cross-sections (the perturbations in % to the base S_V velocity [3] are indicated on the color scale): a) the subduction of the Pacific plate in the region of the Kuril-Marian structural angle (the "Izu-Marian" channel on the left and the "Kuril" channel on the right) along the profile AB passing through the Tohoku earthquake (11.03.2011), the white circles display the largest earthquakes in the region ($M_W \geq 8$, the ISC-GEM catalog) and the deep event with $M_W = 7.4$ (30.11.2010); in the background map on the right there is a tomography map at $H = 250$ km; b) structures of the immersion in profile I-II (Figure 1a) of the PHZ-Himalayas area (the two merging pairs: "Persian" and "Kabul", "Mid-Tibet" and "Tibetan-2" channels). The depth of cross-sections is 700 km

The reason for the existence of a correlation dependence between the activity of various geodynamic structures was assumed to be the formation on the eve of the strongest events on the territory between them of a single regional stress field in the lithosphere (to the depths reaching the asthenosphere) [10, 11]. However, as a result of the research with the use of tomography data, another explanation has been put forward: all time-related events belong to a single geotectonic formation of greater scale covering the entire depth range of the upper mantle.

The fact that geodynamic regions that are so different in their manifestation (and similar only in terms of presenting associated deep-focus mantle events) belong to a single geotectonic formation, could be confirmed by a correlation between the crustal and the deep-focus earthquakes within this formation.

4. The mutual correlation of deep- and shallow-focus earthquakes

Many seismologists have repeatedly noted the correlation of the crustal and deep-focus earthquakes: "The important features of the relationship between the deep focus and small focus strong earthquakes are, first of all, the fact that the crustal earthquakes are preceded by increasing the deep seismic activity, and, second, the occurrence of a strong push after deep seismic activation" [12, 13].

Let us consider the activity of the "Afro-Baikal" seismic lineament, which includes the seismic focal area of the PHZ, in terms of the relationship between the strongest deep and the crustal events. As the time-distribution of earthquakes shows, all the major events ($M_W \geq 7$) along the seismic lineament line are preceded by equally large deep earthquakes in the PHZ. For example, one and a half year before the Chui event, two deep-focus earthquakes occurred in the PHZ (3.3.2002: with $M_W = 7$ and 7.4) at depths $H = 209$ and 225 km (see Figure 1b), after which until 2004 there was observed a seismic activity quiescence in the PHZ (see Figure 1a). Let us note that on the eve of the Chui event, which is "paired" with the Tokachi-oki earthquake, two deep-focus events took place under the Primorye coast and the Okhotsk Sea (28.06.2002 and 17.11.2002: with $M_W = 7.3$) at depths $H = 566$ and 459 km. On the eve of the last strongest earthquake in Asia region: December 7, 2015 in Tajikistan ($M_W = 7.2$) there also occurred a deep focus event in the PHZ (26.10.2015, $M_W = 7.5$) at a depth of $H = 213$ km.

As Figure 1c shows, for the whole period of instrumental observations in the AB-band, according to the most complete global ISC catalog, the largest deep events (or their series on the left in the graph) are followed by equally strong crustal events (at $H \leq 50$ km). An exception was a deep event on March 14, 1965 ($M_W = 7.5$, $H = 208$ km), which was not followed by a strong crust event. However, on this case it is possible to be an omission, because a missing event is present in the ISC-EHB catalog: 13.11.1965 ($M_W = 7.0$, $H = 51$ km) in the Urumqi area (China), which is also confined to the AB. The second exception of the above-described rule was the crustal event of 19.08.1992 ($M_W = 7.3$, $H = 27$ km) to the west of the city of Bishkek, on the eve of which there was no corresponding deep event of the seismic focal zone PHZ in the ISC catalog. However, the required event was registered in the NEIC catalog: 14.07.1991 ($M_W = 7.2$, $H = 212$ km). Finally, a couple of the last crustal events of the graph (see Figure 1c): earthquakes in Pakistan: 24.09.2013 ($M_W = 7.7$, $H = 16$ km) and 28.09.2013 ($M_W = 7.2$, $H = 19$ km), before which there was no deep events with $H \geq 100$ km. However, the above crustal events were preceded by the strongest earthquake of the upper mantle, also confined to the AB: 16.04.2013 ($M_W = 8.3$, $H = 63$ km), and according to the NEIC catalog its depth is $H = 82$ km.

According to Figure 1b, one more regularity of time distribution of the strongest deep earthquakes ($M_W \geq 7$, $H = 200$–300 km) of the Pamir-Hindu Kush seismic focal zone (using the ISC-EHB data) can be revealed: their periodicity with a period of 9–11 years. We would like to note that the ISC-EHB catalog is the most purified and refined in depth as compared to all available world catalogs.

It is assumed that such a periodicity can be associated with a cosmogenic factor (11-year cycle of the solar activity), with which, for example, 9–15-year cycles of the increased activity of magmatic volcanoes are correlated. Susceptibility of the activity of the deep earthquakes (reaching the depths of the asthenospheric layer) to the same factors as volcanic activity; as well as a narrow localization of these earthquakes (forming the so-called "seismic nails" [7, 13] and slabs) and the regular transfer of deformations from them to the crustal earthquakes allows us to assume the confinement of the deep-focus earthquakes to deep cracks and channels, along which a subvertical movement of the "more fragile" lithospheric material is. These deep structures should have special rheological properties that cause their increased seismic activity and support the triggering mechanism of the stress transfer to the upper layers of the lithosphere with their subsequent propagation along regional faults. The tomography data confirm the presence of similar structural formations (in particular, deep channels) in the mantle, reaching depths from 400 to 700 km.

We would like to note that here the term "channel" means the cylindrical or funnel-shaped positive S_V anomalies (orthogonal or skew-oriented to the surface) directed to the interior of the mantle, whose width and intensity usually decrease with depth that can be associated with the flow of a going inland compressed lithospheric material (or its movement conserved in the past).

5. The deep tomographic structures in the lithosphere and asthenosphere

It is known that in subduction zones, "a part of the oceanic lithosphere (predominantly the mantle rocks) is moved beneath the continents" [14]. The tomography data [3] included in the GIS-ENDDB program also fix the processes of subduction (including an immersion) of the lithospheric masses up to depths of 700 km as the structures of increased S_V wave velocities (see Figure 3).

The process of subduction (pushing) is inclined (see Figure 3) with smoothing at different depths. For example, for the Indian plate (under the Eurasian plate), the depth of the pushing structures does not exceed the upper 250 km of the section (see Figure 3b), for the Pacific plate under the Eurasian plate (see Figure 3a) is in the strip of depths H = 250–400 km, extending at a smoothing up to 1000–1500 km horizontally.

The immersion processes have a subvertical character and begin, respectively, from depths of 250–300 km in the case of the interaction of continental plates, and 100–150 km in the case of the subduction of the oceanic plate under the continental plate (see Figure 3). Overcoming the level H = 300–400 km along relatively narrow channels, the lithospheric masses below this level form closed reservoirs (of increased S-wave velocities) or layers of a limited extent (see Figure 3).

As Figure 3a shows, the Great East Japan earthquake (Tohoku, 11.03.2011, $M_W = 9.0$) is near the “Izu-Marian” channel (the process of pushing up to 400 km and subsequent immersion at $H \geq 400$ km), in which a deep earthquake occurred 3 months before the Tohoku (30.11.2010, $M_W = 7.1$, $H = 494$ km). The dates of these earthquakes are shown in Figure 3a. In the “Japanese” channel (orthogonal to the “Izu-Marian” and the “Kuril” ones), which reflects the process of pushing the masses under the Sea of Japan (up to $H = 650$ km), on the eve of the Tohoku there also occurred a deep earthquake 18.02.2010, $M_W = 6.9$ (a year before the Tohoku) at a depth of 577 km. Let us note that the intersection area of the “Japanese” channel with the plane of cross-section is located to the right and below from the Tohoku as the form of a positive high-speed anomaly.

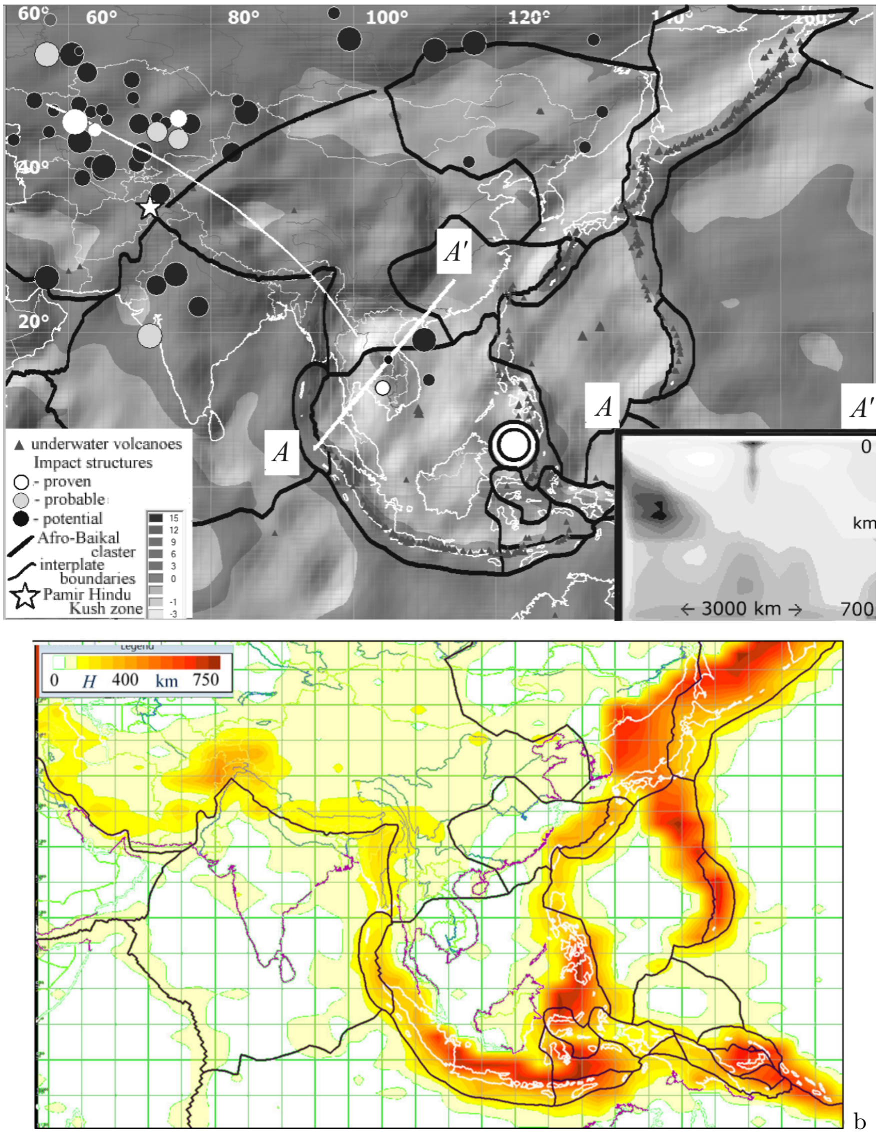
Consequently, deep events, even occurring at depths of $H \geq 400$ km, can indeed transfer stresses and deformations (in the environment restructuring process) to the upper (including crustal) levels of the mantle along the channels with special rheological properties. This is one of the ways to explain the correlation of the stress fields between the crustal and the mantle layers, which unites remote events into a single geodynamic system.

6. The global geodynamic structure of the Asian South-East coast

Considering the heterogeneity of the rheological properties of the upper mantle and the still greater heterogeneity of the core layer, which are revealed in tomography data, the question arises of how to explain the time-correlation and the “roll-call” of remote earthquakes related to different geodynamic situations. As was mentioned above, this phenomenon could be explained if all temporal correlating events belong to a single geotectonic formation.

In particular, the recent studies using seismic tomography data included in the GIS-ENDDB have made it possible to identify the inter-regional Ω-shaped structure at a depth of $H = 125$ km (Figure 4a) and deeper. This structure includes the Baikal rift zone, the Altai fold region, the Pamir-Hindu Kush, Sunda, West Pacific and Far East seismic focal zones and the Taiwan-Philippine arc, i.e., regions associated with the previously identified temporal correlation of seismicity.

The structure is characterized by a strict symmetry, revealed in the configuration of plate boundaries (supplemented with AB in Figure 4a), in the distribution of seismicity and underwater volcanoes, in the anomalies of a gravitational field, and in the distribution of maximum magnitudes and maximum depths of the earthquakes (see Figure 4b).



a

b

Figure 4. The interregional Ω-shaped structure: a) in the tomography map at $H = 125$ km; AB is the "Afro-Baikal" seismic lineament; in the inserted picture: the tomography cross-section along the AA′-profile; b) in the anomalies of $H_{\max}$, the maximum depth of earthquakes per unit area ($2 \times 3°$)

At the same time, as the vertical tomographic cross-sections show, the seismicity along the perimeter and axis of the Ω-shaped South Asian structure (SAS), to which refer 47 % of all earthquakes of the Earth (according to the ISC), is associated with an active process of pushing the lithospheric masses from the neighboring plates (on average, to a depth of 400 km) to its center (see Figure 4b). The channels, most seismoactive and maximal in depth (up to 600–700 km deep), are located at opposite points of the turn of branches of the Ω-shaped structure and on lateral wings of its branches, consisting of chains of the coastal or the island arcs. The deep channels are directed toward the center of these arcs.

In the velocity anomalies of the ring part of the Ω-shaped structure (named "Sunda-Marian" giableme [15]), the typical signs of a double shock structure are revealed: two "high density" centers, an anomalous "loose" ring around these centers, a single bank around them and an intermediate central ridge, characteristic of axially symmetric craters of a double impact [1] (see Figure 4a). One of the revealed centers is fixed by tomography data as a deep nail-shaped formation under the Indochina Peninsula, probably, characterizing the penetrating impact of a superfast impactor [1, 16, 17] (see Figure 4a) and the second one is at the center of the Philippine Sea.

The characteristic butterfly-shaped configuration of the lateral distribution of the East Asian Tektite belt (0.793 Ma) [18] can also indicate to the impact origin of the same-centered Ω-shaped structure, as well as the connection of the majority of the impact structures of the region to the arc going from its center (Figure 4a). In particular, this arc includes the proven "Zhamanshin" impact crater also containing tektites of the impact origin, the Indochina nail structure and different centers of the Australasian Tektites belt assumed by different authors: "Tonle Sap", "Qui Nhon", "Savannakhet", etc. [2]. All these structures can be associated with a single impact event and represent a trajectory of the comet rain that formed an arc-shaped trace in the process of Earth's rotation.

The fact that the SAS currently exists as a single geodynamic formation is indicated by the above-mentioned correlation of seismicity between its opposite edges. Its unity could be also confirmed by the correlation between the crustal and the deep-focus earthquakes within this structure.

Indeed, according to the GIS-ENDDB data, within the SAS structure, a one-to-one correlation was found between all the deep ($M_W \geq 8$) and the crustal ($M_W \geq 7$) events (in the catalog NEIC) over 12 years (2002–2013) with a delay of ≤ 1.5 years.

In the table, all the events are divided into groups, within which a deep earthquake (or a series of them) is shown above the line, and a near-time crustal event with $M_W \geq 8$ is under the line. Only the latter two events in the table (with depths of 583 km and 609 km) are not associated with a subsequent event in the Earth's crust. The reason for this can be the

The correlation of the deep events ($M_W \geq 7$, $H \geq 100$ km) and the crustal events ($M_W \geq 8$, $M_W \leq 50$ km) within the SAS over 12 years (with the addition of the Chui earthquake, September 27, 2003)

Year	Month	Day	Hour	Min	Sec	Lat	Long	Depth	M_W
2002	3	3	12	8	7.8	36.43	70.44	209	7.0
2002	3	3	12	8	19.7	36.50	70.48	225	7.4
2002	9	27	11	33	25.1	50.04	87.81	16	7.3
2002	6	28	17	19	30.3	43.75	130.67	566	7.3
2002	11	17	4	53	53.5	47.82	146.21	459	7.3
2003	9	25	19	50	6.4	41.81	143.91	27	8.3
2004	7	25	14	35	19.1	−2.43	103.98	582	7.3
2004	12	26	0	58	53.5	3.29	95.98	30	9.0
2005	2	5	12	23	18.9	5.29	123.34	525	7.1
2005	3	2	10	42	12.2	−6.53	129.93	201	7.1
2005	3	28	16	9	36.5	2.08	97.11	30	8.6
2007	8	1	17	8	51.4	−15.60	167.68	120	7.2
2007	8	8	17	5	4.9	−5.86	107.42	280	7.5
2007	9	12	11	10	26.8	−4.44	101.37	34	8.5
2010	7	23	22	8	11.2	6.72	123.41	607	7.3
2010	7	23	22	51	12.4	6.49	123.47	585	7.6
2010	7	23	23	15	10.2	6.78	123.26	640	7.4
2011	3	11	5	46	24.1	38.30	142.37	29	9.0
2011	12	14	5	4	59.3	−7.56	146.80	140	7.1
2012	4	11	8	38	36.7	2.33	93.06	20	8.6
2012	8	14	2	59	38.5	49.80	145.06	583	7.7
2013	5	24	5	4 4	49.6	54.87	153.28	609	8.3

fact that they are confined to the lithospheric masses, which, according to the tomography data, are separated from the main part of the lithosphere and immersed in the medium of the transition layer. Thus, it is very likely that within the Ω-shaped structure, the deep events occurring at depths of $H \geq 100$ km (and even $H \geq 400$ km) transfer the stresses and deformations to the upper (crustal) levels through a viscoelastic (characterized by increased S_V wave velocities) symmetric system of immersed in depth slabs and channels that frame this structure along the perimeter. The revealed seismic correlation not only allows one to consider the SAS as a single geodynamic formation, but also to make predictive estimates in accord with this correlation pattern.

For example, according to the table, on the eve of the largest in the region Tohoku earthquake chain (including the major event with $M_W = 9.0$ and its twenty aftershocks with $M_W = 7.0$ in 2011), less than 8 months before it, a triple largest multi-earthquake occurred in the geographical center of the ring part of the SAS (Moro Bay, Mindanao, Philippines) at an abnormally large depth of 585–640 km. According to this observation (as well as to the above-revealed correlation between the deep and the surface events), the recent major deep earthquake of the South Asian structure (the last one in the current year: 10.1.2017, $M_W = 7.3$), also occurred in the geographical center of the ring (in the Sea of Celebes) at an abnormal depth of 627 km (a large white circle in Figure 4b), can also become a precursor of a strong crustal event of the region. The latter should be expected within 0.5–1.5 years, i.e., in 2017 or in the first half of 2018. The recent earthquake of 17.07.2017 with $M_W = 7.7$ near the Commander Islands did not exceed the expected energy level $M_W \geq 8$ as well as the event of 23.01.2018 ($M_W = 7.9$; Gulf of Alaska).

Conclusion

This paper represents an example of the expert approach in the recent studies of the tectonics and seismicity development of the Asian and Far East regions, between which the time-correlation of seismicity was noted. Simultaneous consideration of the data of geophysical observations, remote sensing of the Earth, results of the data analysis of the catastrophic events (development of the major seismicity, distribution of volcanoes and the post-impact structures) is used to discover new geodynamic structures. As a result, the interregional Ω-shaped structure, including the Baikal rift zone, the Altai fold region, the seismic focal zones of Pamir-Hindu-Kush, Sunda, West Pacific and Far Eastern, as well as the Taiwan-Philippine arc, was revealed by geomorphologic and geophysical features (including, the tilt of the tomographic deep "channels" to the axis of the structure).

According to the detected regularities of its seismo-geodynamic development (within the structure, a time-correlation between the depth ($M_W \geq 8$) and the core ($M_W \geq 7$) events is revealed), the last major deep earthquake (10.1.2017, $M_W = 7.3$) of the Ω-shaped South Asian structure occurred at a depth of 627 km can become a precursor of a strong crustal event within this structure.

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