Geophysical Methods in Tracing Palaeozoic Suture Zones Within the Lithosphere of Uzbekistan

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The complexity of the region involved in the tectonic assemblage between the Central Asian Orogenic Belt and the tectonic blocks which were subsequently amalgamated from the south, probably involved multi-phase subduction/accretion of various micro-continents, fragments of oceanic islands. The development and amalgamation of these orogenic domains are related to subduction-accretion processes within the Palaeo-Asian Ocean from early Neoproterozoic to late Palaeozoic times. During and after the accretions and collisions, numerous intramontane basins formed in a variety of tectonic settings. Thus the Central Asia region comprises a complex tectonic mosaic of subduction-related complexes, island arcs, ophiolitic assemblages and terranes of Precambrian crystalline basement.
Schematic tectonics of the Area
Paleozoic Southern Tien Shan fall into 2 pieces having a different origin. Northern from them is presented by Bukantau - Kokshaal belt and to it correspond northern mountains of Kyzyl-Kum's, Nurata mountains, Turkestan - Alay system to the south from the Fergana depression and the Fergana range limiting it from the east. By deep Talas-Fergana fault crossing Tien Shan, active from the end the Paleozoic, there was shear displacement, which amplitude on displacement of various Paleozoic objects is equal to 120-180 kilometers.
Late Carboniferous suture zone of Turkestan Ocean
To the south from longitudinal valley of the river Zeravshan is located another one, Zeravshan - Eastern - Alay belt of Hercynides. It outcrops now in southern Kyzyl-Kum’s mountains (Kuldjuktau, Zirabulak - Ziaetdin mountains) is stretch forward to the east in Zeravshan and Hissar Mountains, Karategin and up to East Alay where it is lost under overthrusts of the Alpine Pamir. The Kyzyl-Kum block occupies a position in the angle between the meridional structures of the Urals and the latitudinal structures of Tien Shan, and the above structural features of Kyzyl-Kum appear to result from disharmonious folding due to compression of that angle.
Geological map of Uzbekistan
Magnetic field map of Uzbekistan
Deep seismic sounding profiles in Uzbekistan
Geological-geophysical interpretation of Romitan - Darbazatau deep seismic profile. 1 - component of the anomalous gravitational field, 2 - anomalous magnetic field, 3 - crustal blocks, 4 - faults
Geological-geophysical interpretation of Farab - Tamdybulak deep seismic profile.

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Some cross-sections
Ancient buried sutures form zones of weakness in the lithosphere of the inner parts of the continents, and along them often occurs unloading of intraplate stresses. Before occurrence in 1976 and 1984 of Gazli earthquakes on northwest continuation Southern Tien - Shan, the site of two Karatag 1907 earthquakes in spurs of Hissar mountains with $M=7.4$ and 7.3. was considered as the western border between seismic active orogen and practically aseismic Turan plate. Largest of earthquakes known in limits of this suture zone, has taken place in 1902 in Kashgar, on border of Tadjikistan and China, and has magnitude $M=7.8$. In the same place in 1955 and 1985 there were earthquakes with $M=7.1$ and 7.0, accordingly. To large earthquakes belong Khait 1949 ($M=7.4$), occurred on territory of Tadjikistan.
Map of earthquakes epicenters distribution
Axes of gravity anomalies and their gradients in the Turan plate with location of strong earthquake epicenters. 1 - epicenter of earthquakes with M > 7; 2 - border of the Republic of Uzbekistan; 3 - city; 4 - axis of positive gravity anomalies; 5 - axis of negative gravity anomalies, 6 - gradients of gravity anomalies; 7 - Mangishlak - Bukhara - Gissar suture zone modified from Volvovsky et al. (1966), Bakirov (1970), Natal’in, Şengör (2005).
Scheme of geotectonic zonality of South Tien-Shan
1 - suture of Turkestan ocean; 2 - suture of Gissar ocean; 3 - DSS profiles; 4 - ophiolites; 5 - granitoids, 8 - oil fields; 9 - gas fields; 10 - magnet fields anomalies.
For the Central Asia region the largest excitatory center of seismic activity are deep-focus (70-300 km) Pamir-Hindu Kush earthquakes. The spatial placement of focuses in the area with width 100-150 km and length 700 km, high level of seismicity and repeatability of events and compact localization of focuses.

Leonov N.N. found that deep-focus earthquakes of Afghanistan in the epicentral area are manifested slightly, intensity increasing at the distance where the role of the deep fault zones as a screen preventing the passage of seismic waves is insignificant.

We made an attempt to check this assumption using records of Uzbek seismic stations and ISC – ANSS catalogues.
Pamir-Hindu Kush earthquakes - ISC catalogue (2008-2014) and location of basic Uzbekistan seismic stations.
Pathway of Pamir-Hindu Kush earthquakes waves and location of Uzbekistan seismic stations used
Typical records - seismic stations Tashkent and Charvak
Typical records - seismic stations Samarkand and Djizak
Typical records - stations Ferghana, Andijan, Namangan
Typical records - stations Nurota, Tamdy and Gazli
Dependence of arrival time of Pn and Sn waves from hypocentral distance

- **FGN**
- **AND**
- **NMG**
- **DJZ**
Dependence of arrival time of Pn and Sn waves from hypocentral distance
Conclusion

An integrated model of the physical properties and lithosphere structures displays distinct features that are related to tectonic history of the study area. Linear positive magnetic anomalies reflect the position of associated faults, which define the location of palaeosubduction zones. These zones are recognized on crustal DSS profiles and potential fields, crossing orogenic part of Southern Tien Shan and partly Amy Darya basin. Southern Tien Shan microcontinent is sandwiched between subducting from the Vendian to the Late Carboniferous the Turkestan oceanic basin and closed in Carboniferous - Permian the Gissar Ocean. The role of the our suture zones as a screen preventing the passage of seismic waves from deep foci Pamir Hyndukush earthquakes is insignificant.

Finally, the synthesis of all the available data and especially the discrepancy between geological data and the geophysical data demonstrates the need of combining geological and geophysical methods to decipher in details tectonic history of the study of the region.
THANK YOU
FOR ATTENTION