NEW DATA ON DEEP STRUCTURE OF SURKHANDARYA DEPRESSION ACCORDING TO THE RESULTS OF SEISMOLOGICAL MEWE RESEARCH

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Abstract

In this paper some results of the regional seismic survey works are given using a method of exchange waves of earthquakes (MEWE) which has been carried out with the purpose of studying of a surface of the basement, thickness of the Mesozoic-Cainozoic complex, deep boundaries in the earth's crust and the upper mantle for separation of oil-gas premising complexes and zones of possible oil and gas accumulation in the Surkhan-Darya hollow. The complex surface conditions (presence of a cultural zone, a mountain frame, a various relief) essentially complicate to carry out here traditional seismic prospecting with explosive or not explosive sources. Therefore at a choice of a method of regional researches the preference has been given to a method of exchange waves of earthquakes as ecologically-friendly and comparatively inexpensive method of exploration. Tasks were solved by processing and interpretation the MEWE's regional profiles which intersect the Surkhan-Darya hollow in sub latitudinal direction with combination of all apriority information received earlier.

Keywords

Surkhandarya depression, seismic exploration, Uzbekistan, Central Asia

1. Introduction

The bowels of Uzbekistan contain oil and gas. Mainly, it pertains to Usturt, Ghissar, Surkhan-Darya, Fergana and Bukhara-Khivan regions where more than 200 deposits of hydro-carbonic raw materials are concentrated. At the present time the increment of reserves and extraction of hydrocarbons are connected with the development of deeper horizons. Thence is the increased interest in a deep structure of the earth's crust. The given consideration dictates necessity of directed regional seismic survey works in the Surkhan-Darya hollow (Fig. 1).

Features of a geologic-tectonic structure of the Surkhan-Darya region cause certain problems in the interpretation of the geological-geophysical material. For example materials of seismic prospecting CDP, electro investigations and deep drilling for various objective and subjective reasons not always meet the requirements put forward to study the deep structure of the earth's crust. The complex geological and seismological conditions create serious obstacles due to which observations are mainly focused on local sites (profiles of CDP do not exceed in length 8-10km). It affects the quality and informative completeness of geophysical material. As is known, the bottom parts of a sedimentary cover are not obviously possible to follow up on CDP's data, to say nothing of the folded basis.

Fig. 1: Central Asia

The results of seismological observations of MEWE partly fill an available gap and suggest look ink at a deep structure of the earth's crust of the Surkhan-Darya region under a little bit other angles.

2. Surkhandarya Depression

The Surkhandarya depression is distinguished by the extreme dislocation of Mesozoic-Cainozoic deposits (Tal-Virsky, 1982) that can be found in the studies of A. Abidov (1981), V. Vasyliev (1958), T.N. Dalimov, G.Kh. Dikkenstein (1963), V.A. Petrushevsky (1951), D.P. Rezvoy (1964), O.A. Ryzhkov (1959), N.P.Tuaev (1934), V.E. Khain (1962-1965) etc. The peculiarities of the geological and tectonic structure of the Surkhandarya depression affect adversely on different interpretation of the geological and geophysical material provided by some researchers. For instance the common-depth-point (CDP) seismic exploration materials, gravimetry and magnetics, electrical exploration, commercial geophysics and deep drilling do not always meet the requirements which satisfy the demand for studying the deep structure of earth's crust. On the one hand it is due to the geological observations on local section (CDP profiles have mostly the length of nearly 8-10 km); on the other hand, it depends on the quality and information aspect of the geophysical materials where the lower horizons of sedimentary cover are not traced not to mention the folded basement.

In addition, the volume of geophysical information on the earth's crust of the region is very scarce having the scattered profiles MEWE (predominately of small length). The exception is the profile of deep seismic sounding of Farab-Babatag. In order to fill partly a gap we have used new data of seismic exploration MEWE.

Improvement is along the lines of inter-correlated profiles. One of them is sub-latitudinal regional profile I-I (OTF-2 Sherabad-Zarabag having the length 87 km) (Fig.2). The profile under study is located in the southern part of the Surkhandarya depression and intersects South-Korsagli, South-Aktau, Zindan, Ismailtepa, Kushtepa and Maidan structure framed by dislocation with a break in continuity. The results of the interpretation as well as time section obtained (Fig.3) have allowed to reveal and trace the main exchange-forming boundaries inside earth's crust.

There are areas of exchange-forming boundaries in the time section which are confined to Moho-surface, low consolidated crust and crystalline basement. Moho-surface – the surface between earth's crust and upper mantle and one of the two interregional surfaces it is traced on the profile MEWE in a fragmentary way in the form of separate seismic refraction wave areas. In the western part of the profile it is fixed at the point $\Delta tps\text{-}s = 4.9$ sec (Pk – 40 Zarabag). Its eastern continuation is smooth at first and then starting from point 30, it is

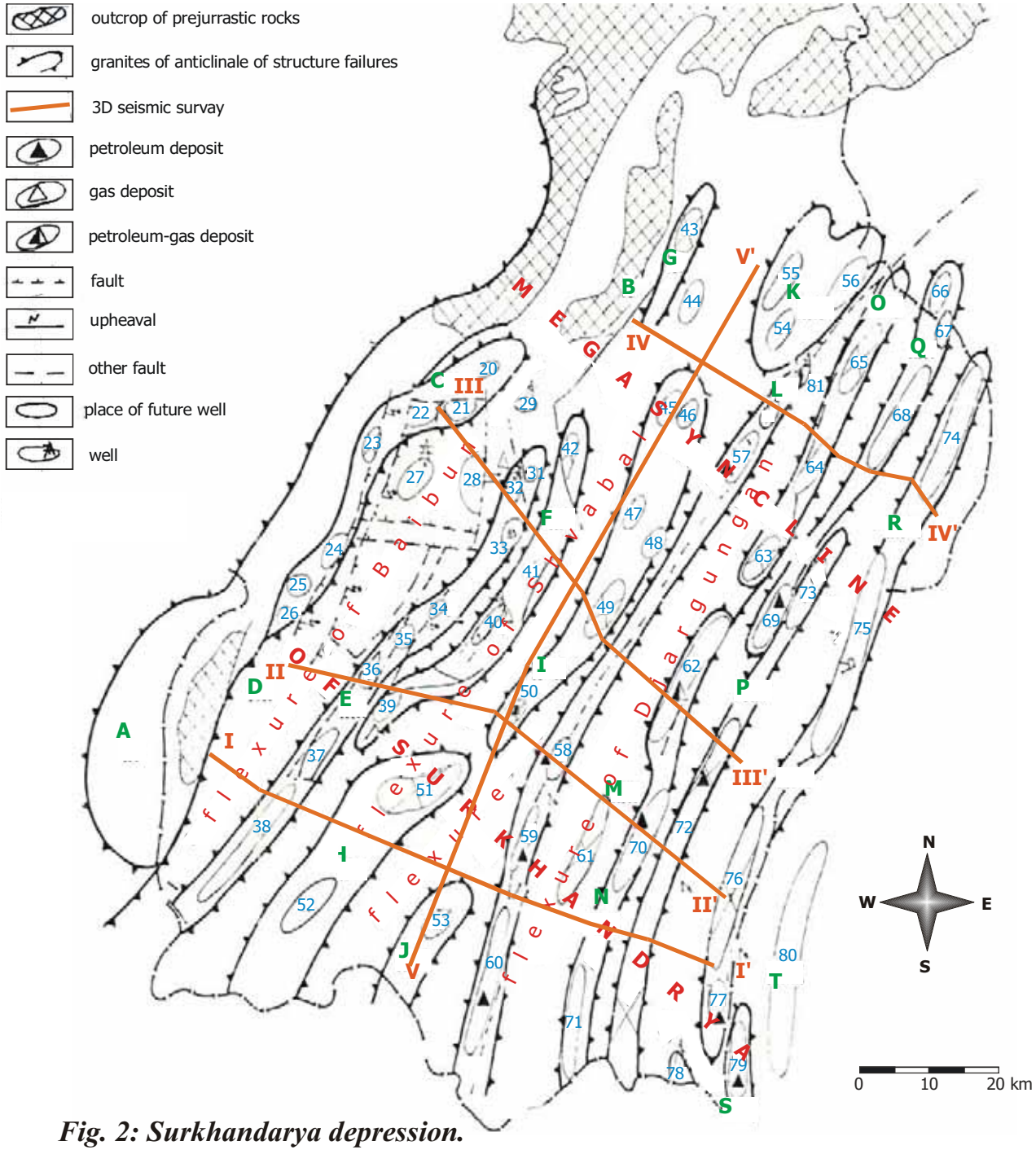

Fig. 2: Surkhandarya depression.

A Surkhantau ridge

B Derbent zone of anticline uplifts
(20– Berdibai, 21– Kafrunsai, 22 – Boisun, 23 – Derbent, 24 – Baglydara, 25 Yaryksia, 26 - Karabag)

C Boisun trough
(27 Kyzylkia, – 28 Shirkak, – 29 Khodzaipak)

D Aktash –Gadjak zone of anticline uplifts
(31 – Dashchigas, 32 Gadjak, – 33 West Boyangara, 34 – Yangihayot, 35 – West Yangihayot, 36 – Liyalakan, 37 – Maidan, 38 - Aktash)

F Beshkyz-Akkapchigai zone of anticline uplifts
(39 – Beshkyz, 40 – Kyagni-sai, 41 – East Boyangara, 42 - Akkapchigai)

G Sankhardak
(43 - Sankhardak)

H Karakurt – Istara zone of anticline uplifts
(51 – Istara, 52 – Karakurt)

I Ashirhan – East.Batash zone of anticline uplifts
(45 West.Batash, – 46 East.Batash, – Kyzyltepe, 48 – Urtakuduk, 49 Akdjar, 50 - Ashirhan)

J Angorskaya
(53 - Angor)

K Yurchi-Pakhtaabad zone of anticline uplifts
(54 – Yurchi, 55 – Hitoyan, 56 - Pakhtaabad)

L Uchkyzyl-Mirshadi zone of anticline uplifts
(57 Mirshadi, – 58 Jabair, – Khaidak, – 59 Uchkyzyl)

M Jarkurganskya
(61 - Jarkurgan)

N Lyalmikar-Jayranhaninskaya zone of anticline uplifts
(62 Lyalmikar, – 70 okaity, 71 - Jayranhana)

O Kattabash-Koshchekinskay zone of anticline uplifts
(63 – Koshcheka, 64 Bokaty, 65 - Kattabash)

P Aktau-Radjabmarhurskaya zone of anticline uplifts
(72 Aktau, 73 - Radjabmarhur)

Q Zarkosa – Karsaglinskaya zone of anticline uplifts
(74 Zarkosa, – 75 Sharcha, – Dasman 76 aga, 77 Korsagly)

R Amudarya-Karasyrtskaya zone of anticline uplifts
(78 Karasyrt, - 79 Amudarya)

S Tuyuntauskya
(80-Tuyuntau)

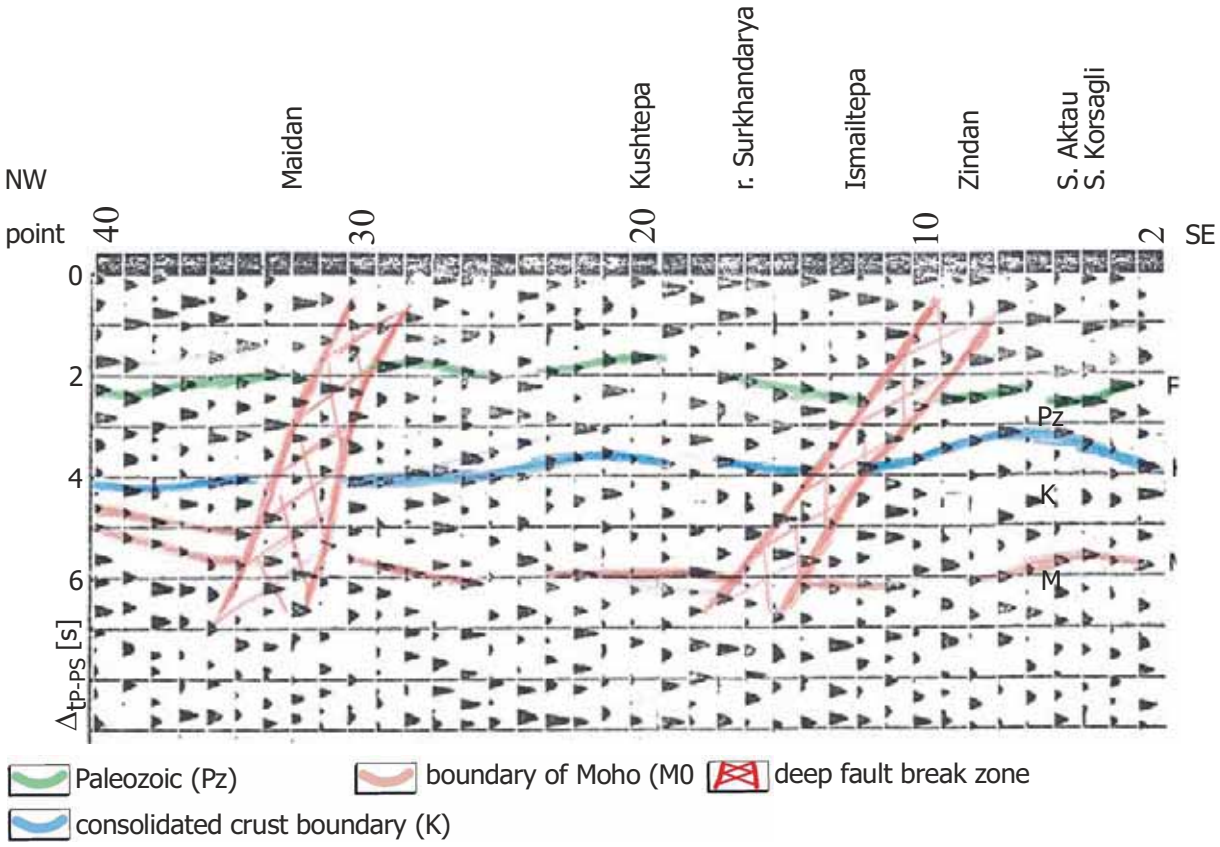

Fig. 3: Sub-latitudinal regional seismic profile I - I′.

sharply submerged (Δtps-s = 6.2 sec). Further exchange-forming boundary discontinues (point 15-18). It is explained by the fact that there might be a zone of tectonic splitting. This statement is conformed by deformation of upper lying layers.

The second exchange-forming surface is the boundary between the upper-sedimentary metamorphic and lower-consolidated crust which is traced along Δtps-s = 3.05-4.05 sec. In outline, the surface occurs in an unsupportive manner with respect to underlying boundary, where amplitudes of vertical shifts are negligible. The exception is the eastern part of the profile (point 2-12) where this value confined to the system of Aktau uplifts is equated to time interval 0.05 sec. In the lower sections of consolidated crust, as per research, the exchange-forming areas are not found which is not contrary to the peculiarities of occurrence of Moho-surface. The third exchange-forming boundary is confined to the roof of Paleozoic basement (Δtps-s = 1.85-2.8 sec), which is characterized by the presence of uplifts and thrusts with considerable vertical shifts (Δtps-s = 1 sec). For instance, in the east in the area point 6 – 16 there occurs a thrust which corresponds to a really Surkhandarya depression, where there are maximum values Δtps-s. The axial part of the thrust is complicated by dislocation with a break in continuity being traced up to Moho-boundary. Near to Khaudag and within its reaches (point 16-25) Δtps-s has maximum, but in the axial part – not more than 1.85 sec. The westward surface under study is of more smooth nature; along with uplifts there occur thrusts as well but with lesser values in amplitudes. In an area of Shurat structure (point-28-32) there is a tract where exchange-forming boundaries are not found which show the presence of deep fault.

The intermittence of the exchange-forming areas in our case is of regular nature showing the presence of tectonic zones of splitting-the dipping angles of the faults ≈ 20°. Thus the deep faults according to geophysical data dissect earth's crust up to Moho-surface and the structure of the crust is of block-stratified nature.

Conclusion

This article devoted to deep structure of the Surkhandarya depression. There are considerate results of the seismological research of MEWE along latitudinal profile, which crossing axe of Surkhandarya depression. As a result of interpretation and analysis of time section MEWE on profile OTF-2 Sherabad-Zarabag there have been distinguished exchange-forming areas allocated to the known geophysical and geological boundaries. In particular boundaries of the exchange-forming areas connected with surfaces of Mohorovichich, the bottom part of the consolidated crust and a roof of the Paleozoic folded basement are determined. Along with it the revealed sites where axes of phase synchronism are traced uncertainly that in our opinion is connected with a site of deep faults. It is established that the distinguished deep faults break through the earth's crust, down to a mantle under a corner reaching 20°.

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