Salt Domes of the East Part of the North Caspian Depression and their Oil-Gas Prospects

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(Geologiya Nefti i Gaza, no. 11, p. 2–5, 1992)

The salt domes of the east part of the North Caspian depression are uneven in their development. In some areas they are very small and are separated by broad troughs, whereas in other areas they are very large and separated by much smaller inter-dome zones. Zones and areas with different degree of penetration into the overlying rocks are clearly defined. The largest domes are found in the central part of the depression and along the north border zone. The smallest are on the east border. In the central and south border zones the salt bodies either pierce all the way to the surface (Inder, Kusanbai) or to the pre-Pliocene surface (Miyaly, Sankebay-Krugly).

Several structural zones are recognized in the study area: Chelkar, Khobdin, Sagiz, Inder-Zaural, Emba, Dossor, Kulsaryn, Kenkiyak, and Agniyaz. See figure 1.

The Chelkar zone is a structural step on the surface of the basement between the Sol-Iletsa and Khobdin blocks. Depth to basement ranges from 7-8 km on the north to 12 km on the south. Depth to the base of the salt is 6-8 km.

The domes tend to be elongate in an east-west direction on the north, reflecting the presence of faults. On the south they have various orientations. Jurassic rocks are common at the crests and Cretaceous on the flanks.

The Khobdin zone is bounded by three faults, giving it a triangular outline. Depth to basement is 12-14 km, and to the base of the salt it is 8-9 km. At the crests of the salt domes at the surface or on the pre-Pliocene surface are generally Jurassic rocks - rarely Triassic or Permian. On the flanks are Lower, and in part Upper Cretaceous rocks.

In the Inder-Zaural zone the surface of the basement is at 15-16 km, and the base of the salt is at a depth of 10-11 km. The domes here are embryonic-piercement or piercing of the diapir type. Some are giant domes. They generally penetrate to the pre-Pliocene surface, rarely to the surface. The salt appears to be thicker here than it is to the north and northeast. Triassic and Jurassic rocks are present at the crests of these domes, and Lower Cretaceous on the flanks.

On the surface of the basement the Sagiz zone is a gentle, northeast-trending depression that has an amplitude of 1-2 km. It is bounded along its borders by regional faults. Depth to basement is 12-14 km. The top of the salt is at depths of 5-7 km. This zone is relatively mobile at the present time; the domes are growing. These growing domes or their sectors have a northeast trend, the same as the regional faults.

The domes of the Sagiz zone are small due to the evaporite not being thick in the first place. Their trend is a reflection of the close proximity of the Ural fold system on the east. The domes here do not penetrate the overlying Mesozoic sediments. Triassic and Jurassic rocks are present at the crests of the domes and Lower Cretaceous on the flanks. Salt tectonics begin to attenuate in this zone.

In the Emba zone the sub-salt surface rises gently toward the east. The surface of the basement is at a depth of 7-10 km. This zone is characterized by yet greater attenuation of salt tectonics. The domes are small, and the inter-dome area is several times larger that the domes themselves. This is due to the salt being thinner and passing into gypsum-anhydrite units.

Lower Cretaceous and Jurassic rocks, rarely Triassic rocks, are present at the crests of the domes of the Emba zone. The salt cores are at a depth of 200-500 m. Small rudimentary salt highs occur in the central parts of some inter-dome troughs.

Depth to basement is 10-13 km in the Dossor zone, and the base of the salt is at 5-8 km. The domes have a northeast trend, Permo-Triassic or Permian rocks at the crest, and have central grabens.

Within the Kulsaryn zone depth to basement is 9-12 km, and to the sub-salt surface 4-7 km. Both large and small domes are present, and they have various orientations. A central graben is generally present above the large domes. Intensity of salt tectonic weakens from northwest to southeast.

In the Kenkiyak zone the crystalline basement is at a depth of 8-11 km, and the sub-salt base is at 3.5-6 km. Small salt domes here have a generally north-south trend. On the surface this zone is bounded by north-south-trending faults.