

LIELS ORDOVIKA KARBONĀTIEŽU VEIDOJUMS LATVIJAS ŠELFĀ

A LARGE ORDOVICIAN CARBONATE BUILDUP OFFSHORE LATVIA

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Jaunākā Latvijas šelfa seismisko datu pārapsūde atklāja anomāliju, kas varētu būt liela, rifam līdzīga struktūra ordovīkā un ko varētu uzskatīt par potenciālu mērķi ogļūdeņražu izpētei.

A recent revision of seismic data from the Latvian offshore area reveals an anomaly that appears to represent a large Ordovician reef-like structure that may be considered a potential hydrocarbon exploration target.

The main exploration targets for hydrocarbons in Latvia, as well as in the whole Baltic region, are structural closures within the Cambrian sandstone reservoir. In addition there are possibilities for the Ordovician and Silurian carbonate reservoirs offering stratigraphic play types in some areas. However, their definition relies on high-resolution seismic data that are not available in the area so far.

In recent years, a considerable amount of seismic from different parts of the Latvian offshore area have been reprocessed using advanced software. The general purpose was to improve the data quality and resolution and eventually obtain new geological insight. It resulted, among other things, in some additional information on the existence of stratigraphic plays in the area.

the south without any considerable folding and faulting which could provide structural closures. However, numerous carbonate buildups both in Ordovician and Silurian have been identified by seismic in the northern part of the area

Ordovician carbonate reservoirs are actually proven oil-bearing within the northern flank of the Baltic Basin. Gotland is the best reference area, where the Ordovician reefoid structures form reservoirs from which oil has been produced for several decades. These reservoirs are small and shallow, with depths less than 500 m.

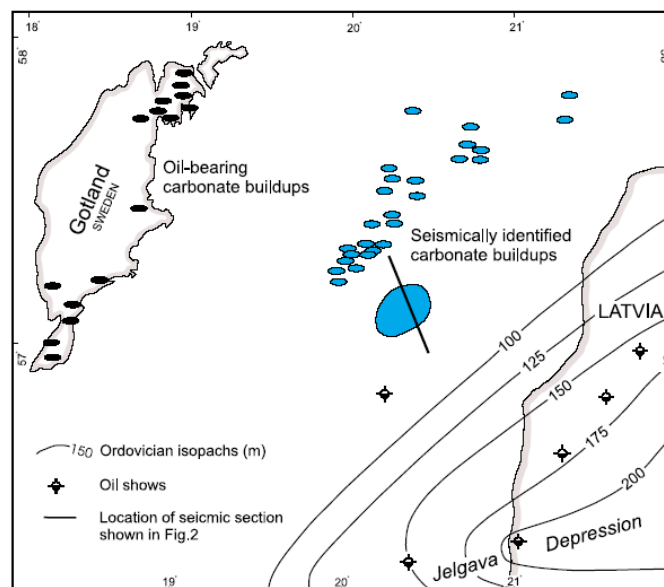
Numerous oil shows and small oil flows have also been registered from Ordovician limestone in exploratory wells drilled in Latvia, both onshore and offshore (see Fig.1).

Regional setting

The area under consideration encompasses central/northern part of the Latvian sector of the Baltic Sea, between the Swedish island of Gotland and Kurzeme peninsula.

Geologically, the area is situated within the northern flank of the Baltic sedimentary basin (the Baltic Syncline). The sedimentary cover rests on the Precambrian basement and consists of predominantly Palaeozoic rocks ranging in age from Cambrian to Devonian with the total thickness up to 2,000 m.

The area was covered by the grid of CDP seismic lines in the course of oil exploration carried out in 1980s. The seismic data indicate a rather simple structural configuration of Lower Palaeozoic strata. They gradually submerge to



1.att. Ordovika karbonātu veidojums Latvijas šelfā.

Fig.1. Ordovician carbonate buildups offshore Latvia.

Ordovician basin features

The available geological data from the region show a gradual transition of the Ordovician facies from shallow water, mostly calcareous deposits in the north-west, to deeper water, substantially muddy sediments in the south-east. In western Latvia, the SW-NE trend was very typical for the facial zones as well as ancient shorelines of the Ordovician basin (Ulste, Gailite, Jakovļeva, 1982). Those can be followed in the same direction off the Latvian coast based on available offshore well data. This general trend is also distinctly reflected in the thickness' distribution of the Ordovician sediments showing the approximate configuration of the basin and its proximal part referred to as the Jelgava depression (see Fig.1).

A variety of carbonate buildups were widely developed on the shallow carbonate shelf within the marginal parts of the Ordovician basin. They were drilled by many oil exploratory wells on Gotland and have also been studied off Gotland by high resolution shallow seismic (Floden, 1980). The known carbonate buildups are of various thickness and horizontal extent reaching dimensions characteristic of barrier reefs in some locations (Tooling, 1998).

Seismic interpretation

The existing seismic data show a similar extensive development of Ordovician carbonate buildups offshore Latvia, between Gotland and the NW Latvian coast.

The belt of Ordovician carbonate buildups exhibiting mounded anomalies on the seismic sections has been mapped along the marginal basin area. They are distributed irregularly within the SW-NE trending zone, with a remarkable increase of abundance to the SW, see Fig. 1. All these carbonate buildups are generally small, not exceeding 1-2 km across, with vertical relief up to 50 m.

Towards the basin slope, a large mounded anomaly in the Ordovician sequence has been revealed in several seismic lines (an example is shown in Fig. 2, see cover page). Judging from the data currently available, this feature seems to be isometric,

about 15-20 km across. It appears to represent convex, massive body producing a strong intra-Ordovician reflection, with an extensive zone of seismic energy dissipation below it. The anomaly is located at the hinge line of change in the dip gradient which increases towards the basin both at the Ordovician and Pre-Cambrian levels. The basement reflector looks abnormally faulted and undulated under this feature.

Judging by the size, accompanying local tectonic features as well as regional geological setting, the above seismic anomaly could be interpreted as a large carbonate buildup, possibly being a part of a fringing or barrier reef.

As regards the hydrocarbon exploration, the Ordovician reef play is not inconceivable in view of the existence of oil-producible reefoid structures in Gotland. Although a major risk is present both regarding the reservoir quality and hydrocarbon charge, it could be compensated by large dimensions of the prospect making it quite promising for further exploration.

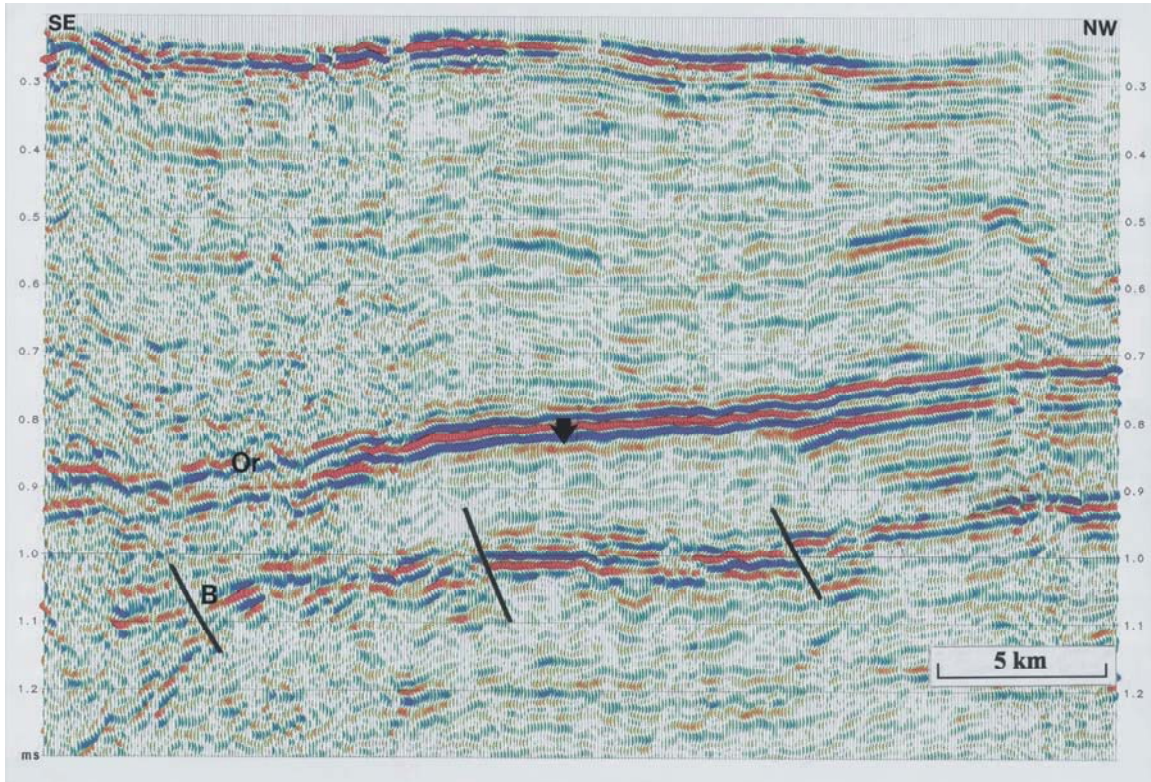
Kopsavilkums

Baltijas jūras Latvijas sektorā starp Kurzemes pussalu un Gotlandi 80-tajos gados veikti KDzP seismiskie pētījumi ar mērķi meklēt perspektīvos naftas objektus. Pētījumu rezultātā rajona ziemeļu daļā atklātas Gotlandes tipa rifveida struktūras, kas veidojušās ordovika sedimentācijas baseina seklūdens zonā. Šādu struktūru ir daudz, bet to izmēri ir nelieli.

Šī rajona seismisko datu pārapsrādes rezultātā, kas veikti, izmantojot mūsdienu programmu nodrošinājumu, atklāta liela rifveida anomālija. Tā ir masīvs lēcai līdzīgs veidojums, kas dod spēcīgu atstarojumu no virsmas un intensīvu seismiskās enerģijas izkliedi paguļošajos iežos. Spriežot pēc atrašanās vietas ordovika sedimentācijas baseinā, kā arī pēc lokāliem tektoniskiem apstākļiem un anomālijas izmēriem, tā varētu būt aplieces vai barjerrifa fragments. Tā kā Gotlandē ir atrastas naftu saturošas rifveida struktūras, šo iespējamo rifu Latvijas šelfā var uzskatīt par perspektīvu naftas objektu.

References

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Seismic section showing a possible Ordovician carbonate buildup.
Reflectors: Or - Top Ordovician, B - Basement. Location is shown in Fig. 1.