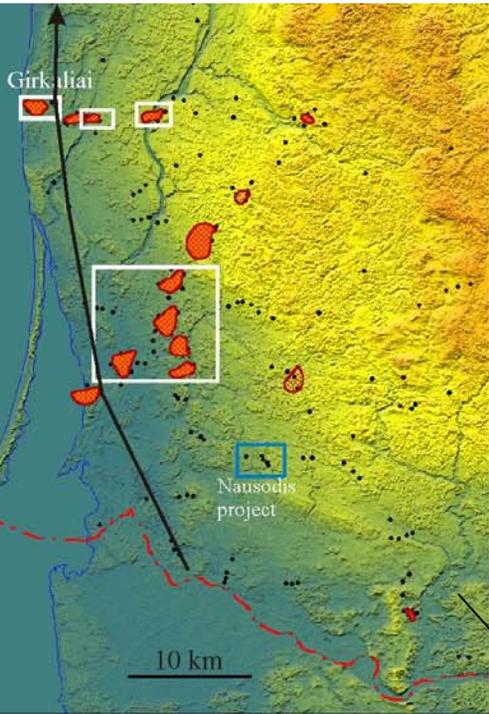
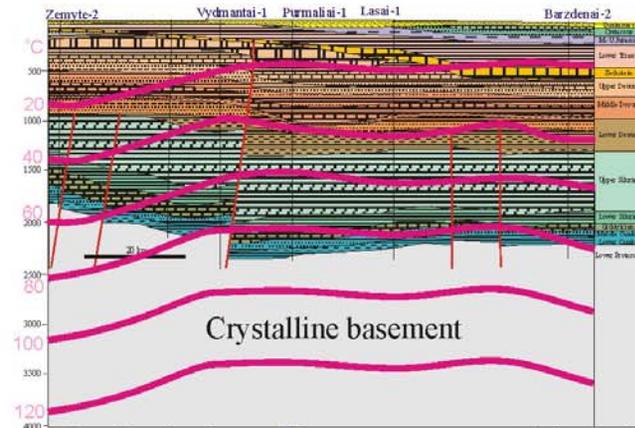


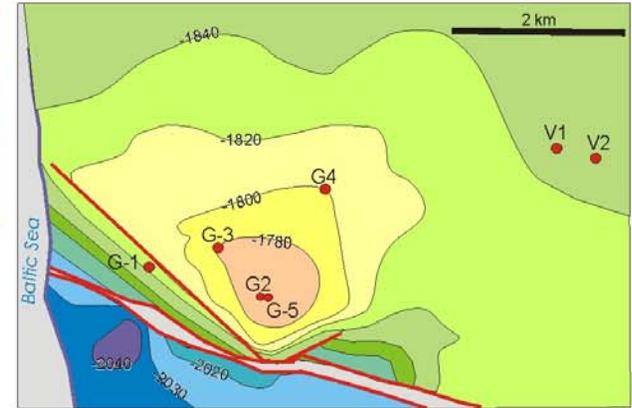
# Application of oil exploration 3D seismic data for imaging potential HDR systems in Lithuania



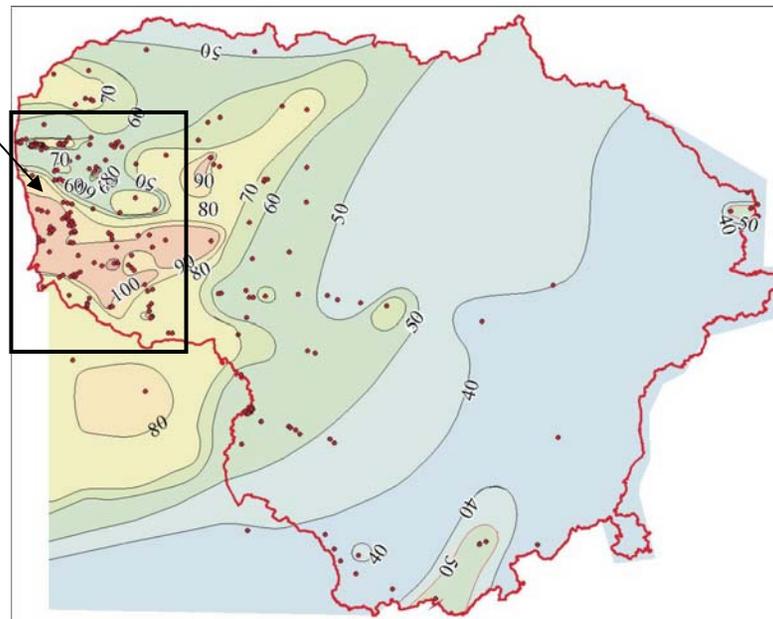
3D seismic survey areas (oil fields and exploration wells)



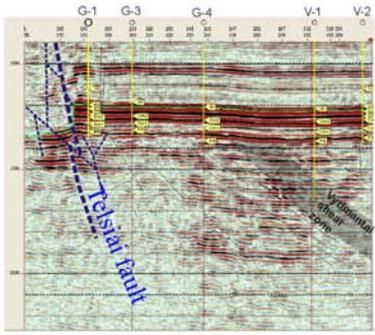
Geological profile across west Lithuania. Temperature distribution is indicated. Seismic line is shown on the left figure.



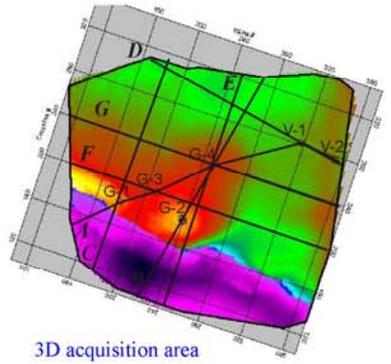
Geological profile and structural map of top of Cambrian of Girkaliai area



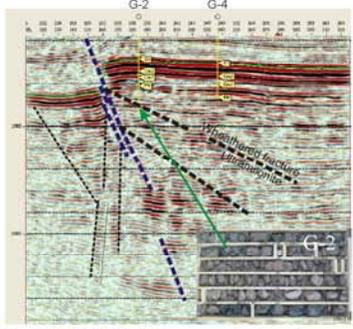
Heat flow map, mW/m2



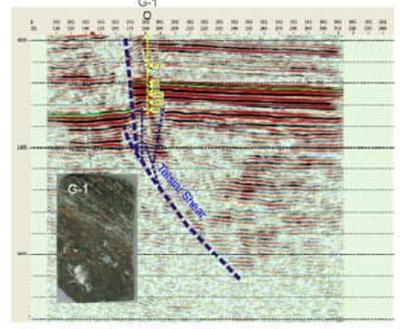
**Profile A.** The main feature is the Vydmantai shear zone dissected by well V-1. It is represented by fractured cataclites. The paralleling structures induce strong seismic anisotropy in the hosting rocks.



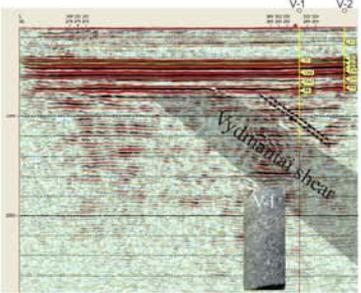
**3D acquisition area**  
Depths of S11n reflector



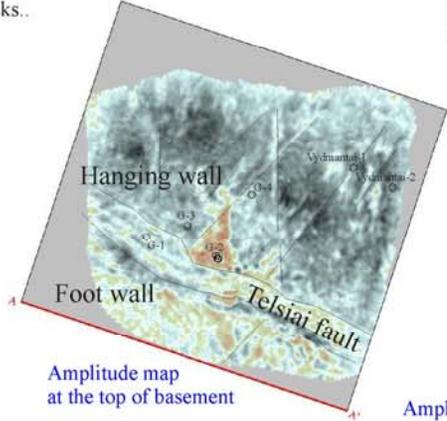
**Profile B.** Well G-2 crossed strongly fractured utramylonitic weathered zone at depth 2315 m (photo). It correlates with low angle reflector. A complex geometry of Telsiai fault is seen.



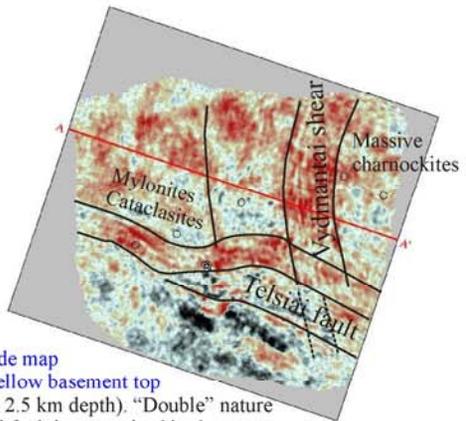
**Profile C.** Inclined Telsiai fault. Photo shows milonitised granulite. In the lower part the calcite punctuates the tachilite (fault activation during the platform stage)



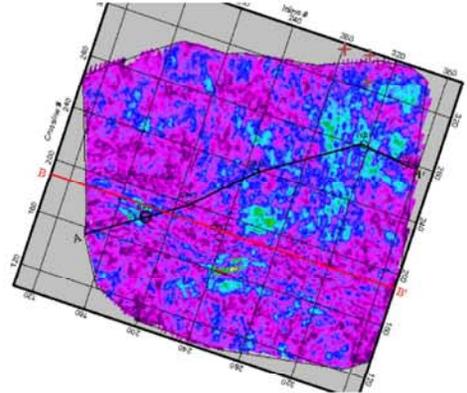
**Profile D.** Crosses Vydmantai geothermal wells. Vydmantai Shear is identified. Also, some paralleling features are visible that correlate with brecciated zones in well V-1. Photo shows cataclisite from Vydmantai Shear.



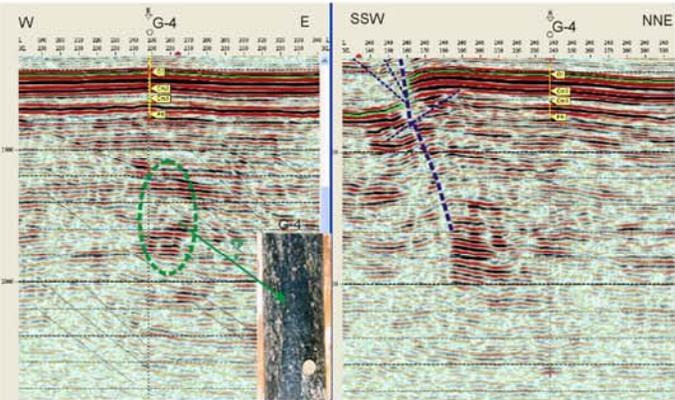
**Amplitude map at the top of basement**



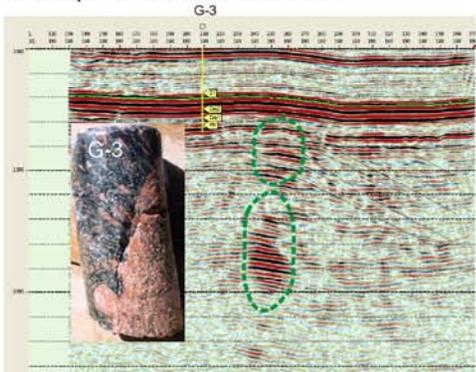
**Amplitude map 500 m below basement top** (roughly 2.5 km depth). "Double" nature of Telsiai fault is recognised in the east (subvertical and inclined to the north features). Vydmantai shear is clear. Anisotropic fabric is evident to the west.



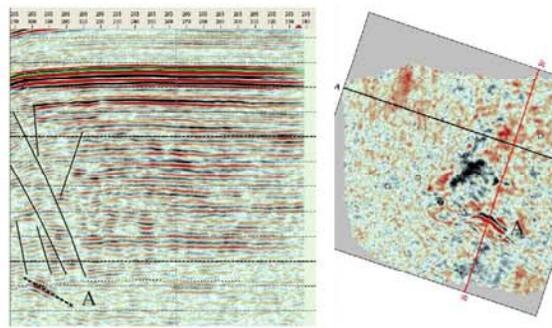
**Seismic reflection strength map**



**Profiles E, G.** Crosses well G-4 at two different directions. They reveal reflection anisotropy. A strong reflection body is crossed that is traced from well G-2 to well G-4. Its nature remains uncertain, but those wells show specific high-angle



**Profile F.** Well G-3 penetrated milonites (angle 40°) (photo). Their anisotropic fabric is well seen on the seismic profile. It is cut by later-stage massive granites. To the east of well G3



**Seismic section and amplitude map, 1.1 km below the basement top.** Telsiai fault is well identified. A strong reflector is traced at the depth 3.5 km that has similar features to low-

## CONCLUSIONS

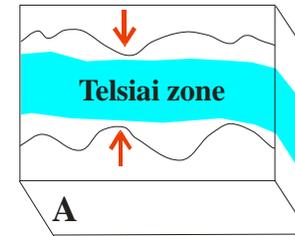
Oil exploration 3D seismic data provide an effective tool for imaging the potential HDR systems in the crystalline basement to the depths of 3.5-4 km.

Several stages of the structuring were identified in the Girkaliai area. The earliest milonitisation took place under granulite facies conditions during N-S crustal accretion stage. It was superimposed by cataclasis that induced strong structural anisotropy, well recognised in the seismic data, likely related to the crustal shortening W-E. Some major fracture zones were formed during this stage. It was followed by formation of low-angle tectonic zones characterised by intense brecciation. These two latter stages provide the major tectonic framework for developing potential EGS.

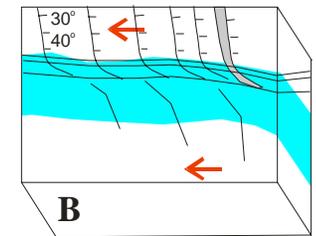
During the platform stage the Telsiai fault was recurrently reactivated.

The Girkaliai experiment shows that oil exploration seismic data can be effectively used in other west Lithuanian areas as the first step for identification of the potential EGS sites.

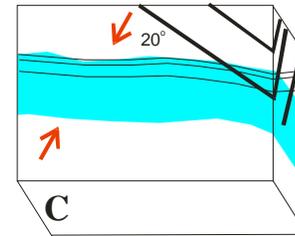
### MAJOR STAGE OF STRUCTURING OF GIRKALIAI AREA



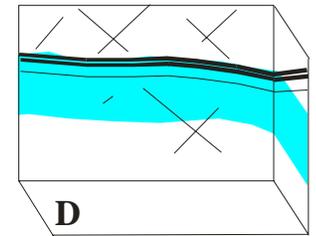
Crustal accretion stage. Establishment of large-scale Telsiai Zone.



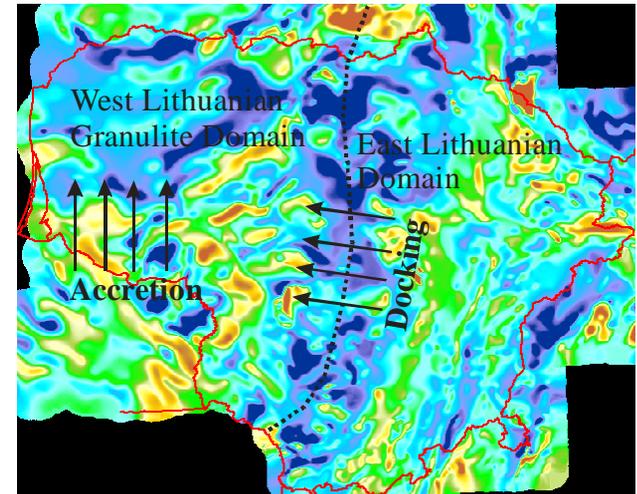
Collision of East Lithuanian Domain and West Lithuanian Domain. W-E crustal shortening (e.g. Vydmantai Shear).



Development of low-angle shear zones (e.g. G-2 zone)



Recurrent reactivation of the Telsiai fault during platform stage. Formation of small-scale faults.



Magnetic field map of Lithuania