An updated map of structural elements in the southern Barents Sea

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Abstract / Introduction

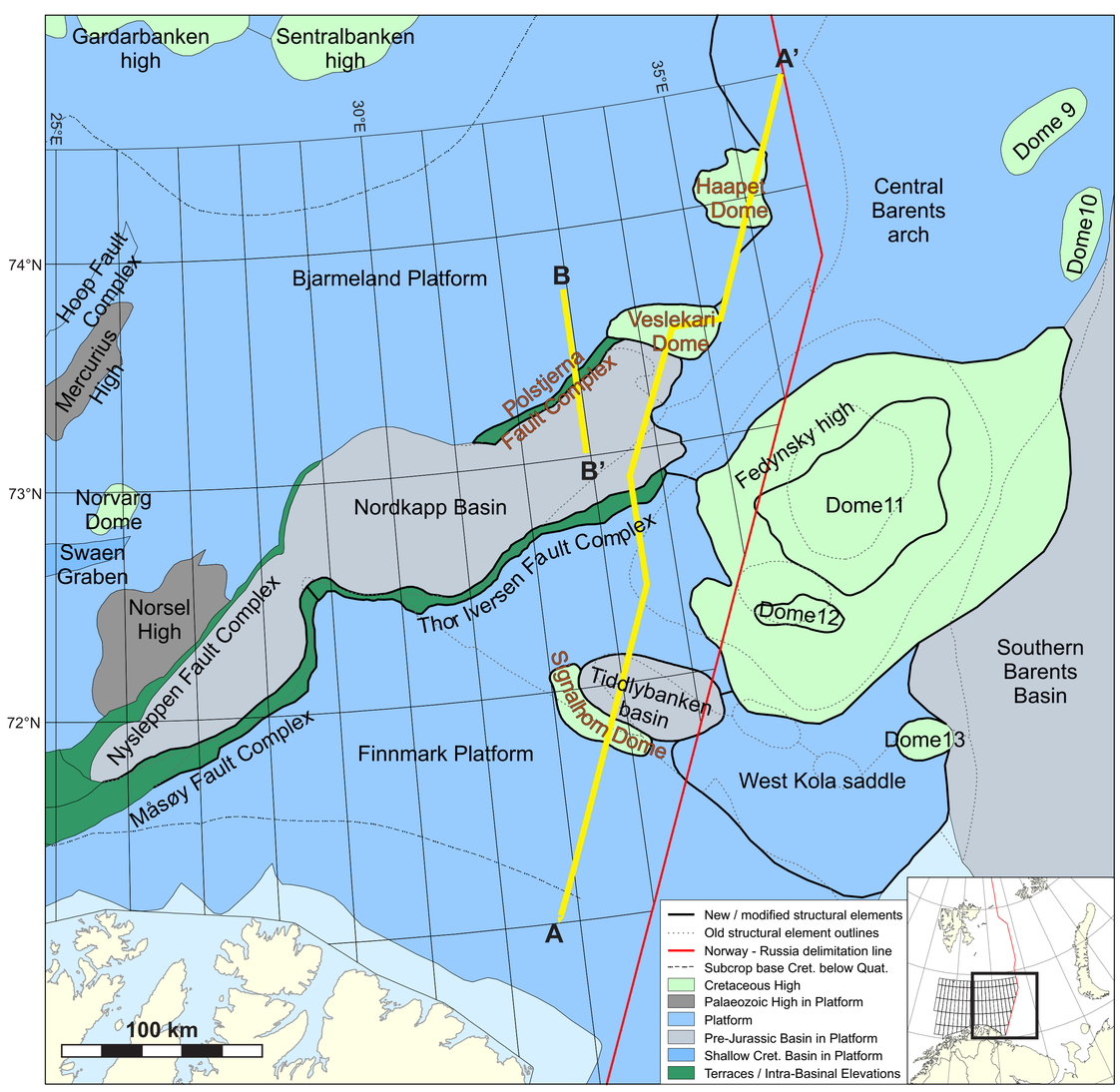
In 2010, after almost 40 years of negotiations, Norway and Russia signed a delimitation agreement in the Barents Sea. Following this the Norwegian Petroleum Directorate (NPD) in 2011 and 2012 acquired more than 18 000 km of 2D-seismic data in the southern part of the formerly disputed area. This area, also known as the Barents Sea southeast, was opened for petroleum activity in 2013, and the NPD seismic data has been made available for the industry. Due to a moratorium on seismic mapping during negotiations with Russia, the geological knowledge of the formerly disputed area was poor compared to the rest of the Norwegian Barents Sea. With the new NPD seismic data available, new geological structures have been revealed and the outline of old structures needs to be revised. Here we present an updated version of the NPD structural element map, with focus on the new area in the eastern part of the southern Norwegian Barents Sea. We will also present new names for the largest of the new structural elements. This is work in progress, and will also continue in the northern Norwegian Barents Sea. The results will gradually be implemented on the NPD FactMaps available online at www.npd.no.

Results

Four new structural elements have been defined in the Barents Sea southeast. The descriptions follow the same procedure as used when the main structural features of the Barents Sea were defined in NPD-Bulletin No.6 (Gabrielsen et al., 1990). Due to lack of named bathymetrical features, the new names follow the tradition previously used in the southern Norwegian Barents Sea of naming structural elements after vessels used for polar research (often Norwegian sealers). The formal names and descriptions for the four new structural elements have been reviewed and accepted by the Norwegian Committee on Stratigraphy.

The four new structural elements, described below, are:

- **Haapet Dome**
- **Veslekari Dome**
- **Signalhorn Dome**
- **Polstjerna Fault Complex**



Other revisions, modifications and additions to the NPD structural element map (available at the NPD FactMaps at www.npd.no as of end 2014) are:

Måsøy Fault Complex: Previously incompletely represented on the NPD map. Extended northeasterly and north as described in Gabrielsen et al. (1990, 1992).

Thor Iversen Fault Complex: Formally defined and described in NPD-Bulletin No.6 (Gabrielsen et al., 1990), but has been missing on the NPD map.

Nordkapp Basin: Adjusted based on new and modified neighbouring structural elements. The eastern limit has been extended based on the representation of the basin at base Cretaceous level.

Bjarmeland Platform: Adjusted based on new and modified neighbouring structural elements. Eastward limit moved somewhat westwards based on the expression at base Cretaceous level.

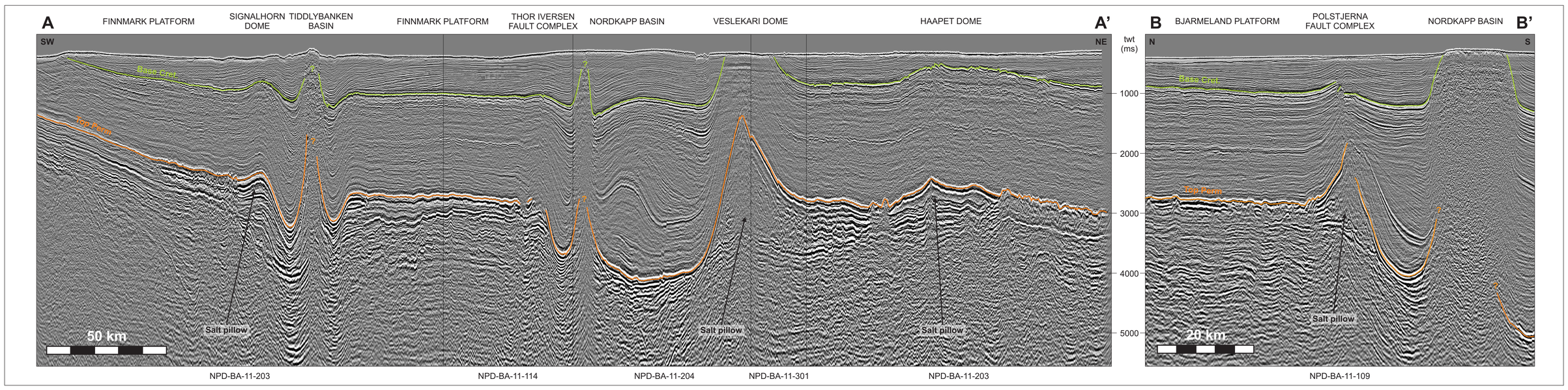
Finnmark Platform: Adjusted based on new and modified neighbouring structural elements. Extended norteastwards to be limited in the NE by the Fedynsky High and a structural nose between the Fedynsky High and the Nordkapp Basin.

Tiddlybanken basin: Outline adjusted to represent the expression of the basin at base Cretaceous level. Most of the old eastern part is now part of the West Kola saddle.

«West Kola saddle»: The name is adopted from Johansen et al. (1992), with the outline based roughly from the depth map of the near base Cretaceous reflector from the same publication. The outline has been adjusted to fit between neighbouring structural elements. The West Kola saddle has no formal or informal norwegian definition.

«Central Barents arch»: Adjusted based on new and modified neighbouring structural elements. The Central Barents arch has no formal or informal norwegian definition.

«Fedynsky high»: The outline of the Fedynsky high has on the russian side been adjusted to approximately fit the outline of the structure at near base Cretaceous level as presented by Johansen et al. (1992), taking into account structural spill in the south. On the norwegian side the structure is defined by a contour where the base Cretaceous reflector corresponds roughly to the outline from the russian side. «Dome 11» and «Dome 12» have been adjusted to the outline of where the base Cretaceous subcrops below the Quaternary on the northern and southern parts of the Fedynsky high respectively (Harrison et al., 2011). The Fedynsky high has no formal or informal norwegian definition. After Norway and Russia signed the delimitation agreement the russian name has been adopted to reflect that most of the structure now lies on the russian side.



Signalhorn Dome

Norwegian: Signalhorndomen.

References: New definition.

Rank: Formal.

Name: Named after the Norwegian sealer "Signalhorn", built in 1914, used for expeditions in the Arctic and for oil exploration on Svalbard in the 1960's and 1970'ies.

Type section: Seismic line NPD-BA-11-203.

Reference level: Base Cretaceous.

Description: The Signalhorn Dome is located at the western and southwestern rim of the Tiddlybanken basin between 71°40'N and 72°05'N, and 32°E and 33°20'E on the Finnmark Platform. At base Cretaceous level the dome has an elongated elliptical shape in map view, approximately 60 km long and 15 km wide. A rim syncline is observed southwest of the dome, in addition to the Tiddlybanken basin to the northeast. The structure is a large low relief dome with a core formed by a salt pillow. A structural closure is defined at all levels (Upper Paleozoic to Cretaceous) above the evaporites.

Age: The evaporites are interpreted to be of Carboniferous to Early Permian age, covered by Permian carbonates. Thinning of the Upper Triassic, Jurassic and lowermost Cretaceous successions over the dome demonstrates pre-Cretaceous doming, probably starting during the Triassic. The preserved part of the rest of the Cretaceous successions shows parallel reflection pattern and is also domed. The Quaternary erosional unconformity truncates the Cretaceous successions at the crest of the dome. The late reactivation of the structure is probably of Paleogene age, but might also be younger.

Genesis: The structure probably started to develop in response to salt withdrawal during the Triassic to Early Cretaceous. The main doming is probably related to a regional tectonic event during the Paleogene.

Veslekari Dome

Norwegian: Veslekaridomen.

References: New definition.

Rank: Formal.

Name: Named after the Norwegian sealer "Veslekari", built in 1918, and used amongst others by the American oceanographer and polar scientist Louise A. Boyd.

Type section: Seismic line NPD-BA-11-204.

Reference level: Base Cretaceous.

Description: The Veslekari Dome is located at the rim of the northeastern part of the Nordkapp Basin around 73°30'N, 34°30'E. At base Cretaceous level the dome has an elliptical shape in map view, and is approximately 50 km long and 25 km wide. Rim synclines are observed north and southeast of the dome, in addition to the Nordkapp Basin to the southwest. The Veslekari Dome is characterized by a gravity low. The Quaternary erosional unconformity truncates much of the dome, with erosion down to the Lower-Triassic at the crest and to the Cretaceous along the margins of the dome. A structural closure is defined at underlying levels (Upper Paleozoic to lowermost Triassic) above a salt pillow which makes up the core of the dome.

Age: The evaporites are interpreted to be of Carboniferous to Early Permian age, covered by Permian carbonates. No thinning of the Triassic, Jurassic and preserved Cretaceous successions over the dome demonstrates post-Cretaceous doming, probably during the Paleogene.

Genesis: Doming probably occurred in response to salt withdrawal during a Paleogene regional tectonic event.

Haapet Dome

Norwegian: Haapetdomen.

References: New definition.

Rank: Formal.

Name: Named after the sloop "Haapet", a sailing boat used by the Norwegian geologist Balthazar Mathias Keilhau during the first real scientific expedition to Svalbard in 1827.

Type section: Seismic line NPD-BA-11-203.

Reference level: Base Cretaceous.

Description: The Haapet Dome is situated at the easternmost part of the Bjarmeland Platform between 74°15'N and 73°50'N, and 35°10'E and 36°30'E. At base Cretaceous level, the dome has an irregular circular shape in map view, with a diameter of approximately 40 km. No rim synclines are observed. The structure is a large low relief salt-cored dome, overlying a former Paleozoic graben. Quaternary erosion has removed most of the Cretaceous and younger strata. A structural closure is defined at all levels (Upper Paleozoic to lowermost Cretaceous) above the evaporites.

Age: The evaporites are interpreted to be of Carboniferous to Early Permian age, covered by Permian carbonates. No thinning of the Triassic and Jurassic successions over the dome is observed. Thinning of the preserved lower Cretaceous succession, however, demonstrates lower Cretaceous and possibly younger doming.

Genesis: The structure probably developed in response to salt withdrawal initiated or triggered by a regional tectonic event during the Early Cretaceous. Possible later doming is probably related to a regional Paleogene tectonic event.

Polstjerna Fault Complex

Norwegian: Polstjernaforkastningskomplekset.

References: New definition.

Rank: Formal.

Name: Named after the Norwegian sealer "Polstjerna", built in 1949, which also were used for scientific expeditions around Svalbard.

Type section: Seismic line NPD-BA-11-109.

Reference level: Base Cretaceous.

Description: The Polstjerna Fault Complex represents the structural division between the Bjarmeland Platform and the northeastern segment of the Nordkapp Basin between 73°06'N, 31°15'E and 73°30'N, 33°40'E. In the east the fault complex extends into the Veslekari Dome, and in the west it terminates at 31°15'E. The Polstjerna Fault Complex has an overall ENE-WSW orientation, composed of faults with significant dip-slip components on some of them. The zone affected by faulting widens upwards from the Paleozoic into the Mesozoic part of the succession. Maximum documented fault displacement occurs at Lower to Middle Triassic and deeper levels. A large elongated underlying salt pillow is associated with most of the fault complex except for the westernmost part.

Age: Faulting activity occurred from middle Triassic to Cretaceous times. Due to Quaternary erosion of Cretaceous and younger sediments, possible later faulting activity can not be ruled out.

Genesis: The Polstjerna Fault Complex is composed of faults with significant dip-slip components, and as such is basically an extensional feature. Salt migration towards the fault complex, and subsequent growth of a large elongated salt pillow, have played an important role in the development of much of the complex.

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