

PL 1060 – Licence status report

2023-020186

Summary

The PL1060 licence is located along the southeastern margin of the Halten Terrace, 10 km north of the Hyme field and 10 km northwest from the Draugen platform. The licence was applied for in the APA2019 round with a firm well as the work program. The focus for the licence was to test the presence of hydrocarbon filled reservoirs within the upper Jurassic strata in the hanging wall from the Vingleia fault. The Ginny prospect was chosen as main drilling target and an exploration well was drilled in January-February 2022. The well encountered reservoir sands in the Melke Formation but did not prove hydrocarbons. Neither it did in the underlying reservoirs from the Garn and Ile Formations.

The main conclusions from the 6407/9-13 well are: (1) no presence of Rogn sandstones that could act as a separate reservoir, (2) Melke sandstones are present and most likely lying directly on top of the Garn Formation, which could locally increase the thickness of the reservoir and (3) as the downfaulted Hermine trap (including the Garn and Ile formations) turned out dry, this would increase the risk for these kind of traps to work.

Following the post well studies, the remaining prospectivity within the licence was evaluated. A number of closures were mapped but deemed uneconomic due to the small volumes. The Galtvort discovery was re-evaluated in terms of economy and potential tie back locations. The results showed marginal economy and not worth pursuing at the current stage. Therefore, the partnership decided to drop the licence.

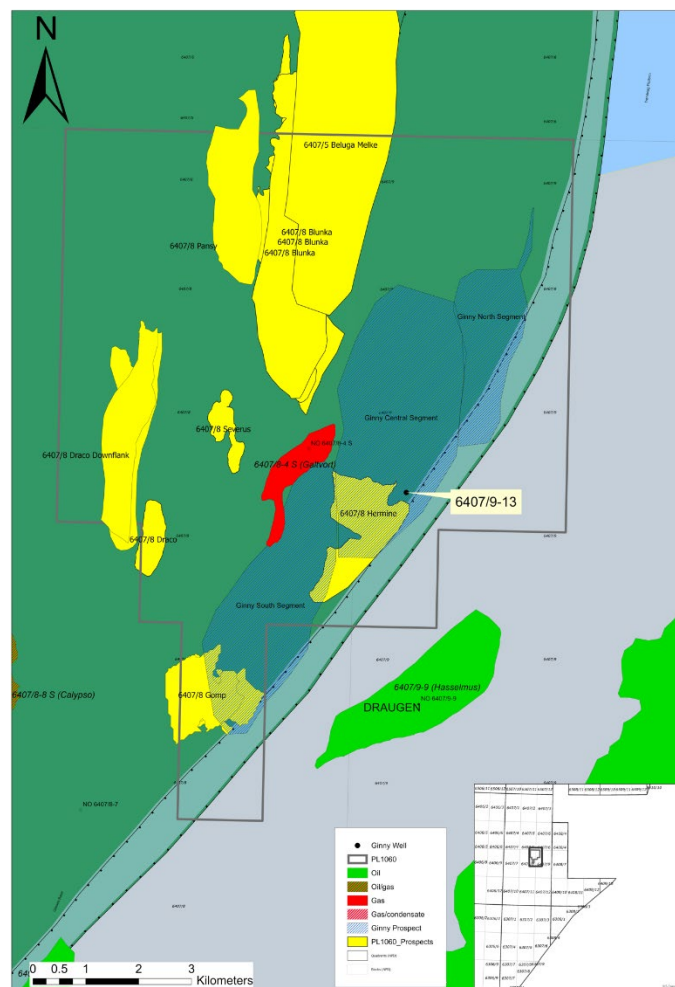


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1 Licence history

<u>Licence:</u>	PL1060	
<u>Awarded:</u>	14.02.2020	
<u>Licence period:</u>	Expires 12.02.2025 Initial period: 5 years	
<u>Licence group:</u>	Equinor Energy AS	31% (Operator)
	OKEA ASA	40%
	Harbour Energy Norge AS	20%
	Longboat Energy Norge AS	9%
<u>Licence area:</u>	88 km ²	
<u>Work programme:</u>	Drill exploration well	- Fulfilled.
	Initial BoK by 14.05.2022	- Applied for 6-month extension due to well operations.
	Extended BoK by 14.10.2022	- Applied for 6-month extension to revise remaining Prospects.
	Extended BoK by 14.05.2023	- Decision made to drop the licence.
<u>Meetings held:</u>		
15.04.2020	EC/MC startup meeting	
01.07.2020	EC/MC meeting	
12.10.2020	EC workmeeting	
16.11.2020	EC/MC meeting	
14.06.2021	EC/MC meeting	
10.11.2021	EC/MC meeting	
21.04.2022	EC/MC workmeeting	
22.06.2022	EC/MC meeting	
25.10.2022	EC/MC meeting	
02.05.2023	EC/MC meeting	
<u>Work performed:</u>		
2020:	Licence start up.	
2020 – 2021:	Well planning	
2022:	Drill exploration well, post well evaluation, identify and mature new prospects	
2023:	Review remaining drilling targets	

Reason for surrender:

The technical evaluation of the Galtvort structure indicated that the NPV based on the in-place volume was not robust enough to pursue a BoK. The volume potential for the remaining structures is evaluated to be too small to defend a new exploration well in the licence. As a result of that, it was unanimously decided to surrender the licence.

2 Database overviews

2.1 Seismic data

Seismic Survey	Vintages	2D/3D	Acquisition	Qual.	NPDID
PGS14005	Full, angle stacks	3D	2014	Very Good	8054
PGS14005	gathers	3D	2014	Very Good	8054

Table 1 List of seismic surveys used in the common licence database.

The PGS14005 dataset was used as primary survey for evaluation of the prospects within the PL1060 licence and planning of the 6407/9-13 well. The gathers were included into the database as well since the operator performed some conditioning in PSPRO as part of the AVO workflow. The outline of seismic data used in the licence was chosen to include nearest offset wells on the Frøya High and along the Vingleia Fault for well tie purposes and depth control (*Figure 1*).

Licence partners also had access to the PGS18M05 dataset, which is the depth migrated product using the underlying data from the PGS14005 dataset. The PGS18M05 was mainly used internally by the operator to very structural interpretations. Due to the amount of structural smoothing, the PGS14005 was the preferred option for evaluation the seismic amplitude responses.

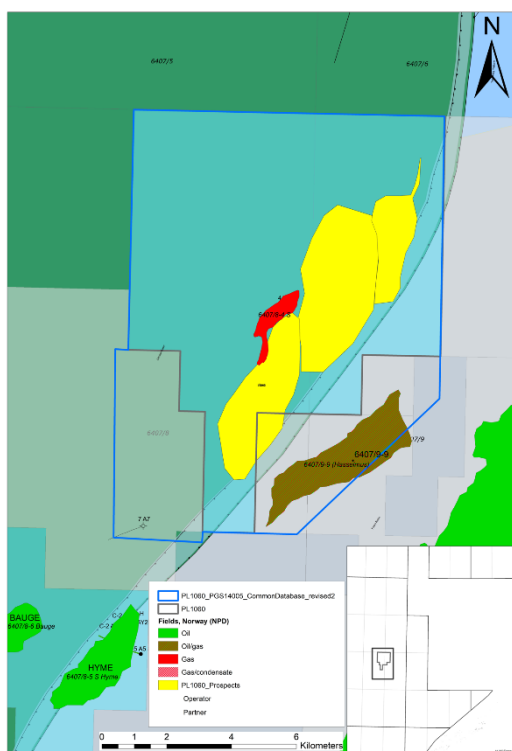


Figure 1 Map showing outline of common seismic database used during the PL1060 licence work.

2.2 Well data

Wellbore Name	Completion Year	Drilling Operator	Discovery	Original Licence	Content	AgeAtTd	Npdid
6406/12-1 S	1991	Den norske stats oljeselskap a.s		157	DRY	MIDDLE JURASSIC	1711
6406/12-2	1995	Den norske stats oljeselskap a.s		157	DRY	MIDDLE JURASSIC	2640
6406/12-3 A	2014	VNG Norge AS	6406/12-3 A (Bue)	586	OIL	MIDDLE JURASSIC	7432
6406/12-3 B	2014	VNG Norge AS	6406/12-3 S Fenja	586	OIL/GAS	LATE JURASSIC	7464
6406/12-3 S	2014	VNG Norge AS	6406/12-3 S Fenja	586	OIL/GAS	LATE JURASSIC	7322
6406/12-4 A	2015	VNG Norge AS		586	DRY	JURASSIC	7774
6406/12-4 S	2015	VNG Norge AS	6406/12-4 S (Boomerang)	586	OIL	LATE JURASSIC	7721
6406/12-5 S	2015	VNG Norge AS		586	DRY	LATE JURASSIC	7787
6407/10-1	1987	Norsk Hydro Produksjon AS		132	GAS SHOWS	LATE TRIASSIC	1054
6407/10-2	1990	Norsk Hydro Produksjon AS		132	SHOWS	EARLY JURASSIC	1497
6407/10-5	2015	A/S Norske Shell		793	DRY	LATE JURASSIC	7763
6407/12-1	1999	A/S Norske Shell	6407/9-1 Draugen	176	OIL	MIDDLE JURASSIC	3781
6407/5-2 S	2011	OMV (Norge) AS	6407/5-2 S (Cortina)	471	GAS	EARLY JURASSIC	6648
6407/6-6	2008	StatoilHydro ASA	6407/6-6 (Gamma)	312	GAS	EARLY JURASSIC	5636
6407/6-7 S	2009	StatoilHydro Petroleum AS	6407/6-7 S (Harepus)	312	GAS	EARLY JURASSIC	6100
6407/8-1	1992	BP Norway Limited U.A.		158	SHOWS	MIDDLE JURASSIC	1859
6407/8-4 A	2008	StatoilHydro Petroleum AS	6407/8-4 A	348	GAS	EARLY JURASSIC	5814
6407/8-4 S	2008	StatoilHydro Petroleum AS	6407/8-4 S (Galtvort)	348	GAS	EARLY JURASSIC	5813
6407/8-5 A	2009	StatoilHydro Petroleum AS	6407/8-5 A	348	OIL	EARLY JURASSIC	6153
6407/8-5 S	2009	StatoilHydro Petroleum AS	6407/8-5 S Hyme	348	OIL	TRIASSIC	6110
6407/8-6	2013	Statoil Petroleum AS	6407/8-6 Bauge	348 B	OIL	LATE TRIASSIC	7265
6407/8-6 A	2013	Statoil Petroleum AS	6407/8-6 Bauge	348 B	OIL	LATE TRIASSIC	7266
6407/8-7	2015	Statoil Petroleum AS		348 C	DRY	EARLY JURASSIC	7684

6407/9-1	1984	A/S Norske Shell	6407/9-1 Draugen	093	OIL	LATE TRIASSIC	133
6407/9-13	2022	Equinor Energy AS		1060	DRY	EARLY JURASSIC	9446
6407/9-2	1985	A/S Norske Shell	6407/9-1 Draugen	093	OIL	EARLY JURASSIC	449
6407/9-3	1985	A/S Norske Shell	6407/9-1 Draugen	093	OIL	EARLY JURASSIC	469
6407/9-4	1985	A/S Norske Shell	6407/9-1 Draugen	093	OIL	EARLY JURASSIC	480
6407/9-5	1985	A/S Norske Shell	6407/9-1 Draugen	093	OIL	MIDDLE JURASSIC	492
6407/9-6	1986	A/S Norske Shell	6407/9-1 Draugen	093	OIL	EARLY JURASSIC	871
6407/9-9	1999	A/S Norske Shell	6407/9-9 (Hasselmus)	093	OIL/GAS	EARLY JURASSIC	1990

Table 2 Listing of wellbores incl. NPDID for well results included in this status report.

3 Well Results

The 6407/9-13 targeted the Ginny and Hermine prospects which are upper and middle Jurassic in age. A vertical well was planned to verify the presence of reservoir and hydrocarbons in the upper Jurassic strata and to test presence of hydrocarbons in in the Garn and Ile formations. The structure was a downfaulted and trap seal posed a major risk in finding a commercial hydrocarbon accumulation. The main phase to be expected was oil. The potential presence of upper Jurassic sands was evaluated on AVO volumes.

In the primary target in the Melke Formation, sandstone rocks totalling 27 metres were encountered, with very good reservoir quality. The well did not encounter reservoir rocks belonging to the Rogn Formation.

In the secondary exploration target, the well encountered sandstone rocks totalling 76 metres in the Garn Formation and sandstone rocks totalling 17 metres in the Ile Formation. The reservoir rocks in both formations are of good to very good reservoir quality.

The well was dry, without traces of petroleum.

Data acquisition included acquisition of a standard log suite on wireline including gamma ray, resistivity, density-neutron and sonic. Pressure data was acquired and in addition both an nMRI and Image logs were run.

Post well studies (geochemistry, biostratigraphy and routine and special core analyses) were carried out with focus to better understand the age of the upper Jurassic sandstones and presence of weak shows.

Post well seismic interpretations (*Figure 2*) show that the lack of sandstones in the 6407/9-13 well has implications for the neighbouring Ginny segments of the Ginny prospect (see next section)

The trap container for the additional Melke Sandstones is different from the Rogn interval and seems to be closely linked to the Garn Formation. The main interpretation is that the lower Melke sands in Ginny might lie conformably on top of the Garn Formation. This has some implication for the age of the reservoir in Southern segment of the Galtvort discovery where increased thickness of the Melke sandstones can be expected.

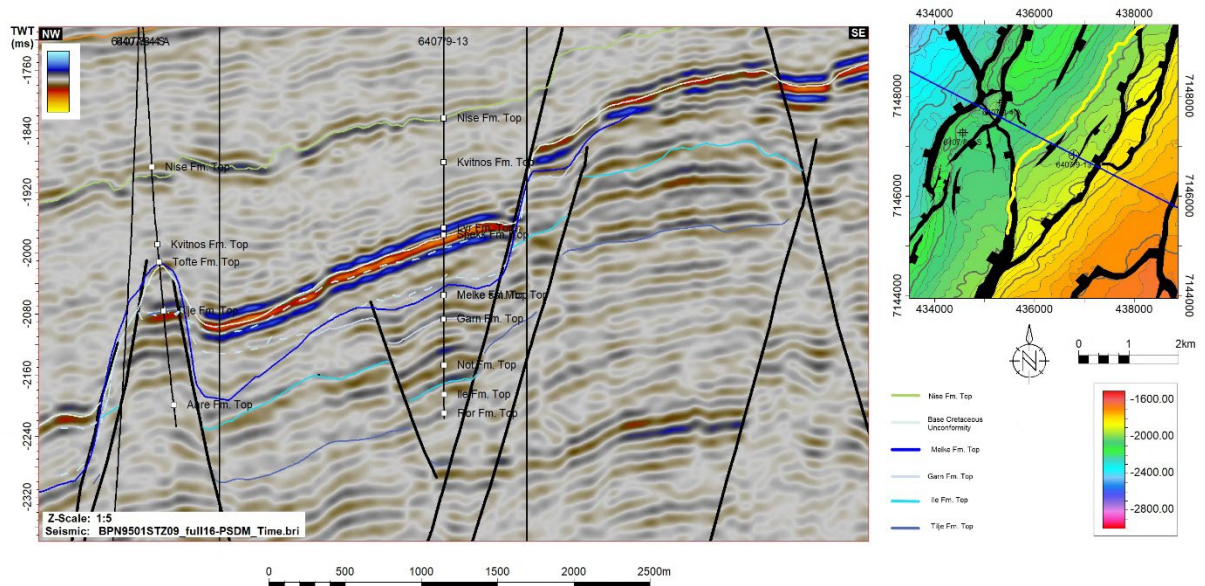


Figure 2 Seismic section across the 6407/9-13 (Ginny and Hermine prospects) with final stratigraphy interpretation. For illustration and sharing purposes, the PGS data was replaced by the released dataset BPN9501.

4 Prospect update report

The remaining prospectivity in the PL1060 licence is described below and illustrated in the different TWT structural maps (Figure 3). The aggregated volumes are summarised at the end of this chapter (Table 3). The structures in the PL1060 licence are eroded within the upper Jurassic. The level of erosion goes in some places down to the Åre Formation. Amplitude anomaly maps extracted below the base of the Spekk Formation, which overlies the eroded structures, indicate areas with hydrocarbon accumulations. When mapping the stratigraphy further down along the structure, where no erosion has occurred, these anomalies are not resolved. As a result, the accumulations that can be supported by geophysical evaluation are rather small, and an increase of the column further down will also increase the risk of the prospect.

Ginny prospect

The Ginny structure was subdivided into 3 segments (North, Central and South) within the same stratigraphic interval. Following recalibration of the AVO dataset to the observations made in the 6407/9-13 well leads to the conclusion that Rogn aged reservoir is most likely not present in both neighbouring segments. It was decided not to pursue these segments.

Galtvort extension

The presence of a thicker Melke sandstone downflank Galtvort initially lead to the hypothesis that additional reservoir can be encountered downflank the Galtvort discovery well (6407/8-4 S). Top sand was subsequently mapped out on the AVO volumes to evaluate whether these could result in a larger gross rock container for the discovery. A volume comparison only indicated a minor increase of the volumes based on this new mapping exercise.

Blunka prospect

The Blunka prospect is defined as a downfaulted structure with the Ile and Tilje formations as main reservoirs. The prospect is located towards the northeast of the Galtvort structure. The gross rock container has potential for a large hydrocarbon column. Near the crest, this column would be dependent on fault seal (membrane) against the Galtvort structure. Fault seal studies do not support for this. In addition, the regional pore pressure data show that the structures drilled within the licence and further north (6407/8-4 S, 6407/9-13, 6407/6-7 S and 6407/6-6) are near hydrostatic. This implies that faults are quite open. The seismic data furthermore does not support the presence of a large column. A weak hydrocarbon effect is observed near the crest of the Tilje Formation. This corresponds to a small area of the structure which is less depended on fault seal.

Gomp prospect

The Gomp prospect is an analogue structure like the Hermine structure with the Garn, Ile and Tilje formations as main reservoir levels. The structure is mapped out as a faulted 4-way closure. A larger column relies on fault seal against the main Vingleia Fault. No depth conform AVO effects are observed.

Severus prospect

Severus is a small Ile prospect located to the west of the Galtvort discovery. The trap can be defined as a small 4-way closure with a depth conform amplitude anomaly. The volumes are mainly driven by this anomaly and are small.

Draco prospect

Draco is a horst block located to the west of the Galtvort discovery, and close to the PL1060 licence boundary. The reservoir is most likely Åre Formation, possibly with Tilje Formation preserved on top of the structure. There is an AVO-anomaly conformant to the structure as well as possible flat spots. As most of the volume is located in the Åre Formation, the low net to gross of the reservoir strongly reduces the potential volume in this structure.

Draco Downflank

The Draco Downflank prospect is defined as a downflank block (3 way fault closure) west of the Draco structure itself. A weak amplitude effect is present at the crest which is defined as a small four-way closure. Presence of a larger column required to have some volumes, is however not supported by the seismic data.

Pansy prospect

The Pansy structure is a narrow horst block structure, located west of the Blunka prospect. It's most likely stratigraphy is the Åre Formation and potentially lower parts of the Tilje Formation. The structure shows some brighter amplitudes near the base Spekk Formation.

Beluga prospect

Beluga was defined as upper Jurassic prospect in a half-graben north of the Blunka structure. Approximately 20 % of the volumes were in the PL1060 licence.

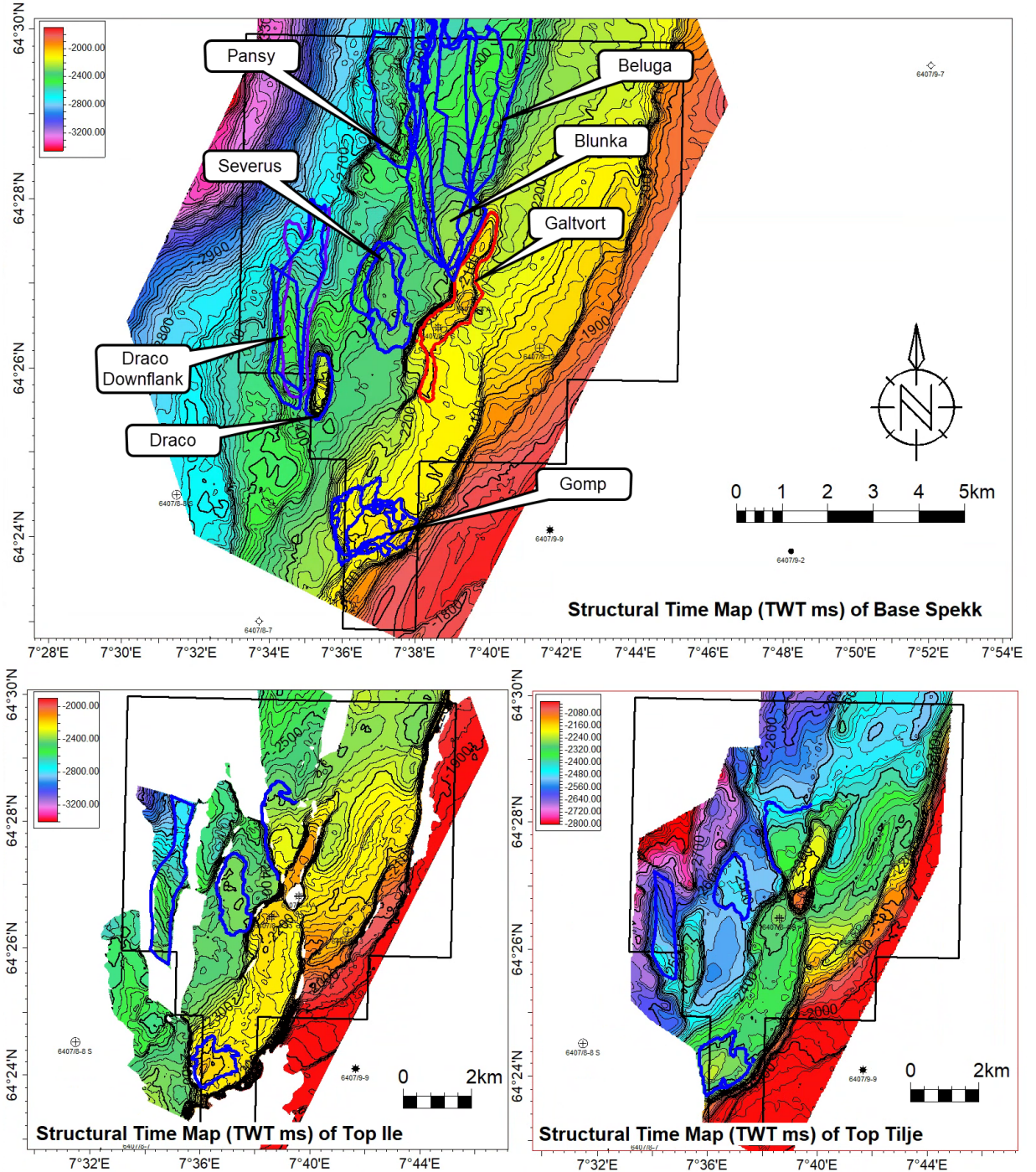


Figure 3 Structural maps of the Base Spekk, Top Ile and Top Tilje formations (ms TWT) showing the remaining prospectivity within the PL1060 licence.

Discovery/ Prospect/ Lead name ¹	D/ P/ L ²	Case (Oil/ Gas/ Oil&Gas) ³	Unrisked recoverable resources ⁴						Probability of discovery ⁵ (0,00 - 1,00)	Resources in acreage applied for [%] ⁶ (0,0 - 100,0)	Reservoir		Nearest relevant infrastructure ⁸	
			Oil [10 ⁶ Sm ³] (>0,00)			Gas [10 ⁶ Sm ³] (>0,00)					Litho-/ Chrono- stratigraphic level ⁷	Reservoir depth [m MSL] (>0)	Name	Km (>0)
			Low (P90)	Base (Mean)	High (P10)	Low (P90)	Base (Mean)	High (P10)						
Galtvort	D	Gas	0.14	0.16	0.17	1.14	1.27	1.39		100.0	Garn, Tofte & Tille fms / E - M Jurassic	2010	Draugen	12
Severus	P	Oil	0.05	0.10	0.15	0.01	0.02	0.03	0.09	100.0	Ile Fm / M Jurassic	2510	Draugen	14
		Gas	0.00	0.01	0.01	0.03	0.05	0.08	0.43	100.0	Ile Fm / M Jurassic	2511	Draugen	14
Draco	P	Oil	0.33	0.56	0.82	0.06	0.11	0.16	0.26	90.0	Are Fm. / E Jurassic	2245	Draugen	12
		Gas	0.02	0.04	0.07	0.11	0.22	0.34	0.26	90.0	Are Fm. / E Jurassic	2245	Draugen	12
Draco Downflank	P	Oil	0.20	0.95	2.00	0.06	0.30	0.62	0.26	90.0	Garn, Ile & Tille fms / E - M Jurassic	2420	Draugen	13
Draco Downflank	P	Gas	0.00	0.01	0.01	0.03	0.05	0.07	0.00	90.0	Garn, Ile & Tille fms / E - M Jurassic	2420	Draugen	13
Draco Downflank	P	Oil&Gas	0.20	0.95	2.00	0.03	0.05	0.07	0.19	90.0	Garn, Ile & Tille fms / E - M Jurassic	2420	Draugen	13
Gomp	P	Oil	0.60	2.08	4.00	0.10	0.39	0.76	0.21	89.0	Garn, Ile & Tille fms / E - M Jurassic	2067	Draugen	9
		Gas	0.05	0.23	0.52	0.51	2.61	5.75	0.11	89.0	Garn, Ile & Tille fms / E - M Jurassic	2067	Draugen	9
Blunka	P	Gas	1.93	5.52	10.13	0.36	1.05	1.87	0.03	100.0	Ile, Tille and Are fms / E - M Jurassic	2290	Draugen	13
		Oil	0.13	0.36	0.66	1.44	4.00	7.27	0.08	100.0	Ile, Tille and Are fms / E - M Jurassic	2290	Draugen	13
Pansy S	P	Oil	0.11	0.71	1.45	0.03	0.22	0.45	0.23	90.0	Grey beds, Are & Tille fms / Triassic - E Jurassic	2525	Draugen	14
		Gas	0.01	0.03	0.05	0.09	0.51	1.03	0.35	90.0	Grey beds, Are & Tille fms / Triassic - E Jurassic	2525	Draugen	14

Table 3 Resource overview within the PL1060 licence.

5 Technical evaluation

An evaluation was done on the Galtvort discovery was carried out with tie-back solution to Hyme or the recently sanctioned Hasselmus development. The economy on the showed that the volumes within Galtvort are too low to have robust economy and additional volumes are needed to secure a development.

6 Conclusion

The workprogram for the PL1060 licence has been completed with the drilling of an exploration well on the Ginny and Hermine prospects. The 6407/9-13 well was dry and the remaining prospectivity within the licence was evaluated. Two additional prospects were created (Pansy S and Draco Downflank), but with limited resources. The results from the Hermine prospects indicated that drilling downfaulted traps that rely on membrane seal pose a risk in the area.

At current stage the prospect portfolio within the licence has too high risk/low volume to drill a second exploration well. Therefore, the partnership decided to drop the licence.