5 Geology and Lithostratigraphy

5.1 Introduction

The mudlogging services were provided by GeoService GmbH. Lithological descriptions commenced from the start of the 22" section at 206m with the first sample taken at 210m. Hydrocarbon indications are presented in chapter 6 of this report. The lithological descriptions are all based on the daily mudlogging reports and formation evaluation log by GeoService and on information from the previously drilled Mol-GT-01-(S1) and Mol-GT-02 wells.

For completeness, also the descriptions of formations above 206m have been included from well Mol-GT-01.

All formation boundaries are referenced to ground level (mMDBGL).

Final formation tops were picked on the LWD GR log. The wireline data was shifted / stretched to fit the LWD GR.

The stratigraphic scheme utilised in this report follows the Lithostratigraphic scale of Belgium, Geologica Belgica, Vol. 4 (2001), Nr. 1-2 with additional reference from the National Stratigraphic Commission Belgium (https://ncs.naturalsciences.be/meeting-reports/report-2013-06/). Also the 2 papers on Belgian stratigraphy by B. Laenen (2002) were used as reference.

5.2 Ungrouped Pliocene and Miocene formations

0.0 to 191m (+25.0 to -166m/TAW)

This upper interval can be sub-divided in 5 formations, comprising the Mol, Kasterlee, Diest, Berchem and Voort Formation.

Mol Formation *Late Pliocene*

0.0 to 25m (+25 to 0m/TAW)

The top of this formation is taken at ground level. The transition to the underlying Kasterlee Formation is ambiguous and based on expected isopach only. The formation comprises white, pure, coarse and medium fine sand, sometimes lignitic and with some lenses of micaceous clay. The lower part is very slightly glauconitic.

Kasterlee Formation *Zanclean to (early?) Piacenzian*
25 to 35m (0 to -10m/TAW)

The top and the base of the Kasterlee formation are not clearly identifiable and are based on the expected isopach. The formation comprises grey fine micaceous sand, without fossils, slightly glauconitic, with lenses of micaceous clay at the base micaceous fine sand, often very glauconitic, burrowed and mottled at some places, a basal GRAVEL of flints and rare silicified fossils is present.

Diest Formation *Tortonian to early Messinian*
35 to 152m (-10 to -127m/TAW)

The top of the formation is based on the expected isopachs of the above lying formations. The base is taken at the depth in Mol-GT-01, where an increase in Gamma ray and density occurred and correlating with Mol-1.

The formation consists mainly of unconsolidated SAND with some beds of GRAVEL: The sand is grey green to brownish with colourless, milky, rarely reddish quartz grains, fine to medium grained, locally medium to coarse grained, moderately sorted, sub-angular to rounded, locally argillaceous, glauconitic, with ochre brown limonite pebbles. At 90m rare SHELL FRAGMENTS occur. The GRAVEL: is milky, yellowish, rarely reddish, rounded to well rounded.

Dessel Member
135 to 152m (-110.0 to -127m/TAW)

This member occurs locally in the Campine Basin at the base of the Diest Fm and could be identified in MOL-GT-01 based on correlation with Mol-1. The top is at a decrease in GR and density and an overall increase in resistivity.
The member consists of fine sand with GRAVEL at the base: milky, yellowish, rarely reddish, rounded to well-rounded with rare shark teeth.

Berchem Formation *Late Aquitanian to Serravallian*
152 to 181m (-127 to -156m/TAW)

The top of the formation is marked by a sharp increase in Gamma Ray readings, coinciding with an increase in density in Mol-GT-01. These increased levels correspond to the high glauconite content of the sand. Up to 80% of glauconite grains have been observed in the samples. The formation consists entirely of dark green SAND(STONE), predominantly fine, occasionally medium, very glauconitic, slightly argillaceous, rare silica cement and with abundant shell fragments (oysters). The transition to the underlying Voort Fm is somewhat gradual.

Voort Formation *Chattian*
181 to 191m (-156 to -166m/TAW)

The transition from the above lying Berchem Fm is gradational and is taken at a Gamma Ray reading of 70 API in Mol-GT-01. The formation consists of dark green SANDSTONE: friable, fine, well sorted, angular, with an argillaceous matrix, moderately glauconitic, pyritic and it has good visible porosity.

5.3 Rupel Group
191 to 313m (-166 to -288m/TAW)

The Rupel Group comprises the Eigenbilzen and Boom formations. The pick of the top of the group is ambiguous.

Eigenbilzen Formation *Late Rupelian*
191 to 213m (-166 to -188m/TAW)

The boundary with the above lying Voort Fm is hardly distinguishable and not very well defined in the area. In Mol-GT-01 it was taken at a drop in resistivity readings to values staying below 20 ohmm and correlation with Mol-1.

The formation is composed of SANDSTONE: dark green, colourless/clear to milky, yellowish and reddish quartz grains, friable, fine to coarse, moderately sorted, angular to rounded, with an argillaceous matrix, very glauconitic, pyritic and with good visible porosity.

Boom Formation *Early to Middle Rupelian*
213.0 to 313.0m (-188.0 to -288.0m/TAW)

Based on correlation, the Boom Fm can be sub-divided in 4 members, from top to bottom: the Boeretang, Putte, Terhagen en Belsele-Waas Mb. The top of the Boom Fm is taken at a negative drilling break. In Mol-GT-01 an increase in Gamma ray readings and an associated drop in resistivity readings at the start of a cyclic interval was observed.

Boeretang Member
213.0 to 231.5m (-188.0 to -206.5m/TAW)

This member is characterised by a cyclic response of the resistivity in Mol-GT-01, showing the rhythmic change in silt content. The member comprises light grey to beige CLAYSTONE: firm and silty, alternating with grey argillaceous SILTSTONE.

Putte Member
231.5 to 283.5m (-206.5 to -258.5m/TAW)

The Putte Mb is a rather homogeneous unit entirely consisting of light grey to beige CLAYSTONE: firm, silty, sandy, glauconitic, very pyritic and ferruginous with abundant foraminifera and rare ostracods. In the deeper part the claystone becomes light to medium grey, in places brownish, plastic, silty, fine sandy, micaceous and contains foraminifera.

Terhagen Member
283.5 to 303.0 (-258.5 to -278.0m/TAW)

The top of the member is taken at the base of a higher Gamma Ray bed. The member comprises the same lithology as the lower part of the above lying Putte Member: light to medium grey CLAYSTONE: in places brownish, plastic, silty, fine sandy, micaceous with foraminifera.

Belsele-Waas Member
303.0 to 313.0m (-278.0 to -288.0m/TAW)

The top of this member is taken at the start of an interval with overall lower Gamma Ray readings which had higher resistivity readings in Mol-GT-01. The member comprises light to medium grey CLAYSTONE: in places brownish, plastic, silty, fine sandy, micaceous and it contains foraminifera, similar to the above lying Terhagen Mb, but the silt and sand content is higher and increases towards the base.

5.4 Tongeren Group
313.0 to 327.0m (-288.0 to -302.0m/TAW)

The Tongeren Group only comprises the Zelzate Fm which at its turn is only represented by the Ruisbroek Mb.

Zelzate Formation *Early Priabonian to Early Oligocene*
313.0 to 327.0m (-288.0 to -302.0m/TAW)

Ruisbroek Member
313.0 to 327.0m (-288.0 to -302.0m/TAW)
The Zelzate formation is mainly composed of SAND(STONE) with some interbeds of SILT/CLAYSTONE. The top of the formation / member is taken

at a further drop in Gamma ray readings and an increase in resistivity as was seen in Mol-GT-01, associated with the appearance of sand in the cuttings. The sand is green grey, predominately seen as loose quartz, medium, well sorted, sub-rounded, micaceous with abundant glauconite. The unconsolidated nature of the sand is also indicated by the large wash-out seen on the caliper log. The silt/claystone is beige brown, plastic to firm, sandy and it contains Nummulites and shell debris.

5.5 Maldegem Formation

327.0 to 359.0m (-302.0 to -334.0m/TAW) *Late Lutetian to Bartonian*

This formation is not part of a group and can be sub-divided in 4 members based on log correlation, from top to bottom: Zomergem, Onderdale, Asse and Wemmel Mb.

Zomergem Member

327.0 to 329.0 (-302.0 to -304.0m/TAW)

This thin unit is identified based on correlation with Mol-1 and Mol-GT-01 and comprises claystone. It stands out on caliper logs as an interval with much less washout than the above and under lying sand units. The top is marked by an increase in Gamma Ray and coincided with a negative drilling break.

Onderdale Member

329.0 to 340.0m (-304.0 to -315.0m/TAW)

The top of the Onderdale Mb is taken at a drop in Gamma Ray readings and the unit clearly stands out on caliper logs as a highly washed out zone. The member consists of grey SAND(STONE), poorly consolidated, fine grained, well sorted, glauconitic and micaceous.

Asse Member

340.0 to 351.5m (-315.0 to -326.5m/TAW)

As in Mol-GT-01, the top was taken at an increase in Gamma Ray readings and was clearly visible on the caliper log as a unit which was much less sensitive to washing out than the overlying Onderdale Mb. The member consists entirely of CLAYSTONE: greenish to bluish grey, plastic, silty and slightly glauconitic.

Wemmel Member
351.5 to 359.0m (-326.5 to -334.0m/TAW)

The top of the member is picked at a distinct decrease in GR and correlation with Mol-GT-01 en Mol-GT-02 and the presence of sandstone in the cuttings. The member is composed of beige grey SANDSTONE: friable, argillaceous, silty and glauconitic. In the lower part of the unit a sandy CLAYSTONE/SILTSTONE bed is intercalated.

5.6 Zenne Group

359.0 to 384.0m (-334.0 to -359.0m/TAW)

The Zenne Group comprises two formations, from top to bottom, the Lede and Brussel Fm. The top of the group is taken at a further decrease in Gamma Ray readings to values around 60 API and correlation with Mol-GT-01 and Mol-GT-02.

Lede Formation *Middle Lutetian*
359.0 to 372.5m (-334.0 to -347.5m/TAW)

This formation consists of SANDSTONE: beige grey, friable, with colourless/clear quartz, fine to medium, poorly sorted, sub-angular, glauconitic with common Nummulites, calcareous cement and it has good visible porosity in places. A few distinct beds with low ROP were encountered, probably consisting of sandy limestone or calcareous sandstone.

Brussel Formation *Early Lutetian*
372.5 to 384.0m (-347.5 to -359.0m/TAW)

This formation is very similar to the above lying Lede Fm. The top is picked at a decrease of the Gamma Ray readings below 50 API and correlation with Mol-GT-01. The formation consists of SANDSTONE: similar to that of the overlying Lede Fm, argillaceous in places, glauconitic with common Nummulites, calcareous cement and it has good visible porosity in places. One distinct bed with low ROP is visible on the log, probably consisting of sandy limestone or calcareous sandstone at 365 to 366m.

5.7 Ieper Group

384.0 to 480.5m (-359.0 to -455.4m/TAW)

The Ieper Group comprises two formations, from top to bottom the Tielt and Kortrijk formations. The top of the group is taken at an increase in Gamma Ray readings and correlation with Mol-GT-01.

Tielt Formation *Middle to Late Ypresian*
384.0 to 400.5m (-359.0 to -375.5m/TAW)

The Tielt Fm comprises 2 members, from top to bottom the Egem and Kortemark Members.

Egem Member
384.0 to 393.5m (-359.0 to -368.5m/TAW)

This unit consist of sandy SILTSTONE and towards the top fine SANDSTONE: glauconitic and containing foraminifera.

Kortemark Member
393.5 to 400.5m (-368.4 to -375.5m/TAW)

The member consist of SILTSTONE: greenish grey, glauconitic with shell fragments at the base.

Kortrijk Formation *Early and Middle Ypresian*
400.5 to 480.5m (-375.5 to -455.4m/TAW)

The Kortrijk Fm comprises 3 members based on correlation with Mol-GT-01, from top to bottom the Aalbeke, Mons-en-Pévèle and Orchies Mb. The top of the formation is taken at a slight increase in Gamma ray readings.

Aalbeke Member
400.5 to 409.5m (-375.5 to -384.5m/TAW)

This unit comprises entirely light grey CLAYSTONE: in places brownish, plastic, becoming silty towards the top, fine sandy, micaceous, glauconitic. It contains foraminifera and echinoid spines.

Mons-en-Pévèle Member
409.5 to 446.5m (-384.5 to -421.5m/TAW)

The top of the member is marked by a distinct drop in Gamma Ray readings. The member comprises light greenish grey, locally brownish grey SILTSTONE: firm, sandy, argillaceous, micaceous, glauconitic and it contains foraminifera and echinoid spines. The siltstone is interbedded with and grading to argillaceous SANDSTONE and sandy CLAYSTONE: in general the sequence is slightly coarsening upwards.

Orchies Member
446.5 to 480.5m (-421.5 to -455.4m/TAW)

The top of the member is marked by a slight increase in Gamma Ray. The unit consists of light greenish grey SILTSTONE and sandy CLAYSTONE in the upper part, firm to moderately hard, slightly glauconitic, locally calcareous and silty CLAYSTONE in the lower part.

5.8 Landen Group

480.5 to 597.5m (-455.4 to -572.3m/TAW)

The Landen Gp just comprises the Hannut Fm. The top of the group is taken at a distinct drop in Gamma Ray readings to values below 60 API.

Hannut Formation *Early to Middle Thanetian*
480.5 to 597.5m (-455.4 to -572.3m/TAW)

The Hannut Fm can be subdivided in 3 members based on correlation, from top to bottom the Grandglise, Halen and Waterschei Mb.

Grandglise Member
480.5 to 512.0m (-455.4 to -486.9m/TAW)

This member is composed of SANDSTONE: light greenish grey, friable, fine, well sorted, glauconitic to very glauconitic. In Mol-GT-01 the upper part between 480 and 496m was strongly washed out to more than 40 inch according to the PPC caliper readings. The lower part of the unit is somewhat silty and argillaceous and was only washed out in the coarser grained beds.

Halen Member
512.0 to 567.5m (-486.9 to -542.4m/TAW)

The top of this unit is picked at a slight increase in Gamma Ray readings. This rather uniform member comprises predominantly SILTSTONE: grading to SANDSTONE: light greenish grey, friable to moderately hard, silt, very fine to fine, rare medium, sub-angular, moderately sorted, argillaceous, glauconitic, occasionally pyritic and micaceous and is non to locally moderately calcareous.

Waterschei Member
567.5 to 597.5m (-542.4 to -572.3m/TAW)

The top of the member is taken where the Gamma Ray generally increases. The unit comprise CLAYSTONE: light greenish grey, also light brownish grey, firm to moderately hard, silty in the upper part, calcareous in the lower part, slightly glauconitic at the top, micaceous in places with rare pyrite and rare foraminifera.

5.9 Heers Formation

597.5 to 611.0m (-572.3 to -585.8m/TAW) *Middle to Late Selandian*

The Heers Fm is not part of a group and can be clearly sub-divided into 2 members based on lithology, the Gelinden Mb at the top and the Orp Mb at the base. The top is taken at a drop in Gamma Ray readings and the appearance of marl in the cuttings.

Gelinden Member
597.5 to 608.0m (-572.3 to -582.8m/TAW)

The member comprises light grey MARL, firm, with rare foraminifera and sponge spicules. Minor CHALK is present which is off-white, crumbly and fossiliferous, probably re-worked sediment from the Chalk Group.

Orp Member
608.0 to 611.0m (-582.8 to -585.8m/TAW)

The Orp Mb consists of fine glauconitic SANDSTONE, which is friable, pyritic and calcareous. It has fair visible porosity in places. The unit is characterised by its relative high Gamma Ray readings due to the high glauconite content.

5.10 Chalk (Krijt) Group

611.0 to 899.0m (-585.8 to -873.6m/TAW)

Based upon correlation with Mol-GT-01 and lithology, the Chalk Group is sub-divided from top to bottom into the Houthem, Maastricht, Gulpen and Vaals Formation.

Houthem Formation *Early and Middle Danian*

611.0 to 636.0m (-585.8 to -610.8m/TAW)

The top of the Houthem Fm is picked at a slight decrease in penetration rate and a distinct decrease in GR-readings, along with the occurrence of limestone in the cuttings. In Mol-GT-01, the very top of the formation showed high sonic velocities, possibly representing a hardground.
The formation is rather uniform and consists of LIMESTONE with a grainstone / rudstone texture and is yellowish light grey to beige, firm, occasionally glauconitic, with abundant fossils and has no to rarely good visible porosity. The lower boundary with the Maastricht Fm is ambiguous.

Maastricht Formation *Late Maastrichtian*

636.0 to 711.0 (-610.8 to -685.7m/TAW)

The top is ambiguous. The calcarenites of the Maastricht Fm are very similar to the calcarenites of the Houthem Fm, but the latter does not contain chert. The Maastricht Fm comprises LIMESTONE (Calcarenite) with grainstone texture, yellowish light grey to beige, firm, with abundant fossils, no to poor visible porosity, with layers of CHERT, brownish grey to greyish brown, hard, splintery. At the base a bed of SANDSTONE is present which is light grey, greenish, medium to coarse, sub-rounded to well-rounded and moderately sorted grains, glauconitic. Due to the high glauconite content of the sandstone, the bed shows a high GR response**.**

Gulpen Formation *Late Campanian to Late Maastrichtian*

711.0 to 857.0m (-685.7 to -831.6m/TAW)

The top of the Gulpen Fm is taken at a decrease in Gamma Ray readings, corresponding to a negative drilling break. The lithology observed in the cuttings is rather uniform. The formation down to 810m comprises LIMESTONE (calcarenite): packstone to grainstone, off white, cream, slightly to moderately glauconitic, silicified in the upper part, rare pyrite, fossiliferous, becoming porous with depth. The basal unit between 810 and 857m is composed of LIMESTONE (Calcarenite): packstone to grainstone, off white to greyish white, hard, glauconitic, pyritic, fossiliferous

(foraminifera, sponge spicules), interbedded with CHALK: off white to very light grey, friable, slighty argillaceous, glauconitic, non to moderately porous.

Vaals Formation *Early Campanian to Late Campanian*

857.0 to 897.5m (-831.6 to -872.1m/TAW)

The top of the formation is taken at an increase in Gamma Ray and is marked by a negative drilling break. The formation starts with grey MARL, soft to firm, silty, fossiliferous, with rare glauconite and with increasing beds of SILTSTONE with depth, light grey, firm, glauconitic, marly to calcareous. At the base, a SANDSTONE bed is present, light grey, greenish, fine to medium, angular to sub-rounded, well sorted, very glauconitic. Due to the high content of glauconite, the bed shows a relative high Gamma Ray response.

5.11 Belgian Coal Measures (Steenkoolterrein) Group

897.5 to 3563.7m (-872.1 to -3059.2m/TAW)

The top of the group is based on GR-correlation with well Mol-GT-01 and Mol-GT-02 and picked at a small increase at 897.5m.

The subdivision of the group is entirely based on correlation with wells Mol-GT-01(-S1) and Mol-GT-02 and the same namings are used in these wells.

As in Mol-GT-01(-S1) and Mol-GT-02, the group is subdivided in various sequences, mostly coarsening up. Based on the occurrences of marine claystone beds (very high GR-ray readings), the group was tentatively subdivided in formations and members. As in Mol-GT-01(-S1) and Mol-GT-02, the marine claystone beds were never as such recognized in the cuttings.

The table below shows this subdivision and its correlation to the subdivision to Mol-GT-01(-S1) and Mol-GT-02.

* There is good correlation in numerous intervals.
* The table points to the location of normal faults in Mol-GT-01(-S1) at 2292 and 2875m by jumps in the depth difference between the wells. The stratigraphy of well Mol-GT-02 occurs to be thicker as probably no significant normal faults were intersected.
* Correlation with Mol-GT-02 suggests the presence of a fault in Mol-GT-03 at 2637mD (2404.5 mTVDBGL), cutting out approximately 40m of stratigraphy. However, correlation with Mol-GT-01 does not support this suggestion (see figure above). A fault could also be identified around 1840m MD (-1761m/TAW) cutting out some 40m (S. Bos, pers. comm.)

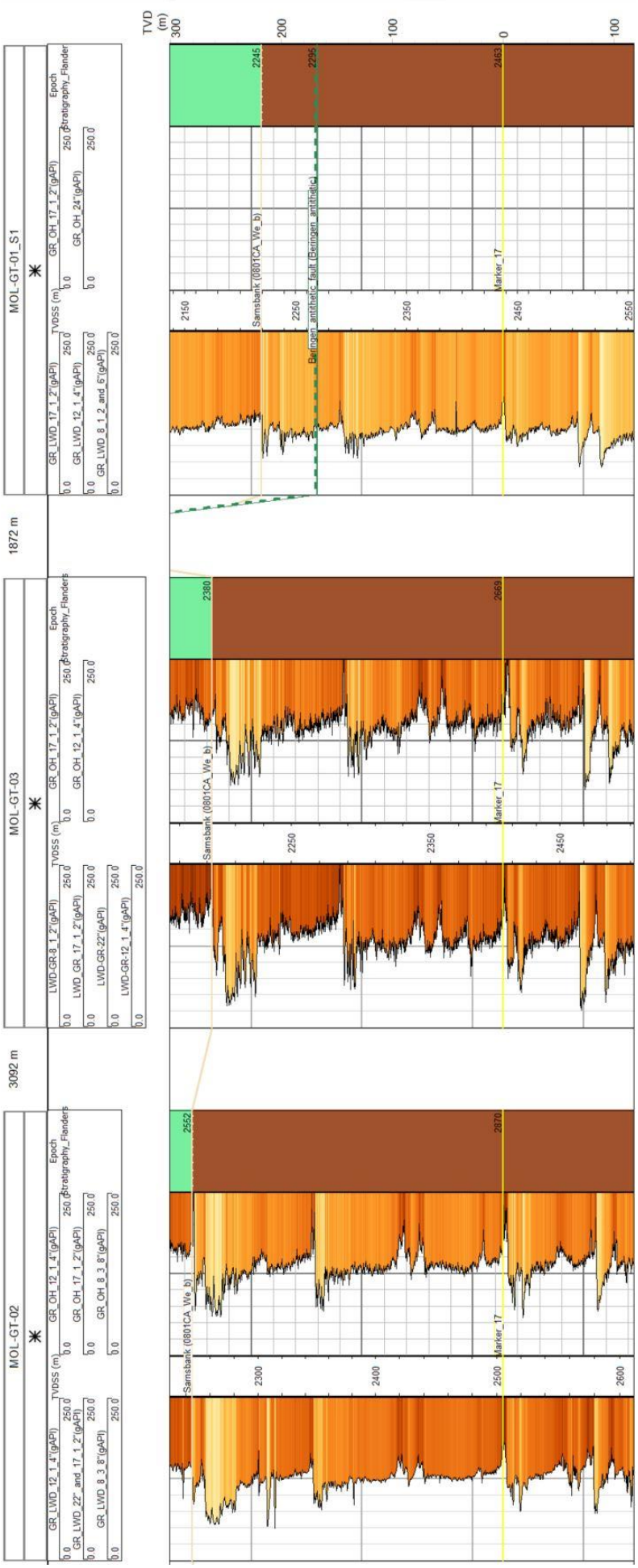
MOL-GT-01_S1
MOL-GT-03
MOL-GT-02
1872 m
3092 m
TVD (m)
Samsbank (0801CA_We_b)
Marker_17
Beringen_antithetic_fault (Beringen_antithetic)
Epoch Stratigraphy_Flanders

Table 3: Sequence Stratigraphy Steenkolenterrein Group of the Mol-GT wells.

Mol-GT-01-S1 (Near Vertical Well)						
Fm	Mb	Sequence	Depth interval (mMDBGL)	Depth interval (mMDBGL)	Thickness	Note
Charleroi Fm		Interbeds without obvious large scale fining up or coarsening up.	901.0	1550.0	**649.0**	Alternation occurs to be quite at random.
		Coarsening Upward sequence	1550.0	1606.6	**56.6**	
Chatelet Fm	Flo rifloux Mb	**Coarsening Upward sequence**	1606.6	1717	**110.4**	
		Interbeds with no clear pattern	1717	1913	**196**	Locally up to 40% of coal.
		Coarsening Upward sequence	1913.0	1948.0	**35.0**	No significant coal.
		Marine claystone bed	1948.0	1954.0	**6.0**	Marine claystone bed
		General coarsening upward	1954.0	2015.0	**61.0**	Significant quantity of coal (50%) in the very bottom.
	Ransart Mb	Finefrau Nebenbank	2015.0	2019.5	**4.5**	Marine claystone bed.
		Finefrau Nebenbank Sandstone	2019.5	2042	**22.5**	SANDSTONE: white to off white, hard, predominantly fine to occasionally medium grained, well cemented with silica, locally slightly dolomitic (and not micaceous).
		Fining upward sequence	2042.0	2080.0	**38.0**	
		Coarsening upward sequence	2080.0	2104.5	**24.5**	
		Coarsening upward sequence	2104.5	2130.0	**25.5**	
Andenne Fm		Coarsening Upward sequence	2130.0	2240.5	**110.5**	5% of coal in the top
		Samsbank?	2240.5	2245.5	**5.0**	Marine claystone bed?
		Coarsening Upward sequence	2245.5	2314.0	**68.5**	No significant coal **(~30m of the sequence is faulted out at 2292m)**
		Marine claystone bed	2314.0	2319.5	**5.5**	Marine claystone bed
		Coarsening Upward sequence	2319.5	2379.0	**59.5**	No significant coal
		Marine claystone bed	2379.0	2387.0	**8.0**	Marine claystone bed
		Coarsening Upward sequence	2387.0	2398.0	**11.0**	No significant coal
		Marine claystone bed	2398.0	2402.0	**4.0**	Marine claystone bed
		WeakCoarsening Up sequence	2402.0	2461.0	**59.0**	
		Marine claystone bed	2461.0	2465.0	**4.0**	Marine claystone bed
		Coarsening Upward sequence	2465.0	2524.5	**59.5**	20% coal in the top.
		Marine claystone bed	2524.5	2530.5	**6.0**	Marine claystone bed
		Coarsening Upward sequence	2530.5	2550.0	**19.5**	10% coal in the top.
		Coarsening Upward sequence	2550.0	2632.5	**82.5**	No significant coal.
		Marine claystone bed	2632.5	2634.5	**2.0**	Marine claystone bed
		Coarsening Upward sequence	2634.5	2667.0	**32.5**	No significant coal.
		Coarsening Upward sequence	2667.0	2678.5	**11.5**	No significant coal.
		Coarsening Upward sequence	2678.5	2687.5	**9.0**	2m coal bed at 2678.5-2680.5m
		Coarsening Upward sequence	2687.5	2722.0	**34.5**	Up to 25% coal in the top
		Interbeds with no clear pattern	2722.0	2740.0	**18.0**	
		Coarsening Upward sequence	2740.0	2798.0	**58.0**	
		Interbeds with no clear pattern	2798.0	2855.0	**57.0**	
		Coarsening Upward sequence	2855.0	2890.5	**35.5**	**(~60m of the sequence is faulted out at 2875m)**
		Prominent Sandstone bed.	2890.5	2896.0	**5.5**	
		Fining upwards sequence	2896.0	2936.0	**40.0**	
		Predominant Clay-Siltstone Sequence	2936	3098.5	**162.5**	
Chokier Fm		Claystone sequence with very high GR	3098.5	3109.5	**11.0**	

Mol-GT-02 (Deviated Well)						
Sequence	Depth interval (mMDBGL)	Depth interval (mMDBGL)	Depth interval (mTVDBGL)	Depth interval (mTVDBGL)	Vertical Thickness	Note
Interbeds without obvious large scale fining up or coarsening up.	906.0	1684.0	902.7	1568.6	**665.9**	
Coarsening Upward sequence	1684	1730	1568.6	1605.6	**37.0**	
Coarsening Upward sequence	1730.0	1773.5	1605.6	1641.0	**35.4**	
Interbeds with no clear pattern	1773.5	1816.0	1641.0	1675.5	**34.5**	
Coarsening Upward Sequence	1816.0	1994.0	1675.5	1820.5	**145.0**	
Interbeds with no clear pattern	1994.0	2021.0	1820.5	1841.6	**21.1**	
Coarsening Upward Sequence	2021	2066	1841.6	1876.6	35.0	
Interbeds with no clear pattern	2066.0	2115.0	1876.6	1915.3	**38.7**	Up to 60% coal in the top
Coarsening Upward Sequence	2115.0	2169.0	1915.3	1958.5	**43.2**	
Marine claystone bed	2169.0	2170.5	1958.5	1959.7	**1.2**	Marine claystone bed
Interbeds with no clear pattern	2170.5	2204.5	1959.7	1986.8	**27.1**	Significant quantity of coal (up to 55% in a 5m sample in the top
Coarsening Upward sequence	2204.5	2272.0	1986.8	2040.6	**53.8**	
Finefrau Nebenbank	2272.0	2275.0	2040.6	2042.9	**2.4**	Marine claystone bed
Finefrau Nebenbank Sandstone	2275	2303.5	2042.937	2065.6	**22.7**	as fining upward sequence
Fining upward sequence	2303.5	2315.0	2065.6	2074.8	**9.2**	
Interbeds with no clear pattern	2315.0	2399.5	2074.8	2144.3	**69.5**	
Coarsening Upward sequence	2399.5	2550.0	2144.3	2268.8	**124.5**	
Samsbank	2550.0	2551.5	2268.8	2270.0	**1.2**	Marine claystone bed
Coarsening Upward sequence	2551.5	2672.5	2270.0	2369.4	**99.4**	
Marine claystone bed	2672.5	2676.0	2369.4	2372.3	**2.9**	Marine claystone bed
Coarsening Upward sequence	2676.0	2761.5	2372.3	2443.5	**71.2**	
Marine claystone bed	2761.5	2772.5	2443.5	2452.4	**8.9**	Marine claystone bed
Thin Coarsening Upward sequence	2772.5	2782.5	2452.4	2460.5	**8.1**	
Marine claystone bed	2782.5	2788.0	2460.5	2465.0	**4.4**	Marine claystone bed
Weak Coarsening Upward sequence	2788.0	2868.5	2465.0	2529.8	**64.8**	
Marine claystone bed	2868.5	2873.0	2529.8	2533.4	**3.7**	Marine claystone bed
Coarsening Upward sequence	2873.0	2955.5	2533.4	2599.7	**66.3**	Coal bed at 2877m
Marine claystone bed	2955.5	2962.5	2599.7	2605.2	**5.4**	Marine claystone bed
2x thin Coarsening Upward sequence	2962.5	2992.5	2605.2	2628.1	**22.9**	
Weak Coarsening Upward sequence	2992.5	3087.5	2628.1	2702.1	**74.0**	2 coal beds in top
Marine claystone bed	3087.5	3090.0	2702.1	2704.9	**2.8**	Marine claystone bed
Coarsening Upward sequence	3090.0	3135.0	2704.9	2740.1	**35.2**	No significant coal.
Coarsening Upward sequence	3135.0	3147.0	2740.1	2750.6	**10.5**	No significant coal.
Coarsening Upward sequence	3147.0	3223.0	2750.6	2809.6	**59.0**	2.4m coal bed at top
Marine claystone bed	3223.0	3226.0	2809.6	2811.9	**2.3**	Marine claystone bed
General Coarsening Up sequence / Interbeds with no clear pattern of mostly claystone and siltstone	3226.0	3305.0	2811.9	2871.7	**59.8**	
Interbeds with no clear pattern of mostly siltstone and sandstone	3305.0	3369.0	2871.7	2924.2	**52.5**	
Coarsening Upward sequence	3369.0	3455.0	2924.2	2996.0	**71.8**	
Interbeds with no clear pattern of mostly siltstone and sandstone	3455.0	3487.0	2996.0	3023.1	**27.1**	
"Prominent Sandstone Bed"	3487.0	3490.0	3023.1	3025.6	**2.5**	
"Fining Upward Sequence"	3490.0	3543.0	3025.6	3071.5	**45.9**	
Predominant Clay-Siltstone Sequence	3543	3710	3071.5	3224.4	**152.9**	
Claystone sequence with very high GR	3710.0	3723.0	3224.4	3236.6	**12.2**	

Mol-GT-03 (Deviated Well)						
Sequence	Depth interval (mMDBGL)	Depth interval (mMDBGL)	Depth interval (mTVDBGL)	Depth interval (mTVDBGL)	Vertical Thickness	Note
Interbeds without obvious large scale fining up or coarsening up.	897.5	1545.0	897.1	1525.9	**628.8**	
Coarsening Upward sequence	1545.0	1572.0	1525.9	1550.6	**24.7**	
Coarsening Upward sequence	1572.0	1615.5	1550.6	1590.0	**39.4**	
Interbeds with no clear pattern	1615.5	1674.5	1590.0	1642.7	**52.7**	
Coarsening Upward Sequence	1674.5	1726.0	1642.7	1688.1	**45.4**	
Interbeds with no clear pattern	1726.0	1752.0	1688.1	1710.8	**22.7**	
Coarsening Upward Sequence	1752.0	1783.5	1710.8	1738.1	**27.2**	
Coarsening Upward Sequence	1783.5	1824.7	1738.1	1773.3	**35.2**	
Coarsening Upward Sequence	1824.7	1891.0	1773.3	1829.2	**55.9**	
Interbeds with no clear pattern	1891.0	1984.0	1829.2	1904.3	**75.1**	4m coal bed in the top
Coarsening Upward Sequence	1984.0	2030.0	1904.3	1941.6	**37.3**	
Marine claystone bed	2030.0	2031.0	1941.6	1942.4	**0.8**	Marine claystone bed
Coarsening Upward Sequence	2031.0	2092.0	1942.4	1993.4	**51.0**	
Finefrau Nebenbank	2092.0	2094.5	1993.4	1994.6	**1.2**	Marine claystone bed
Beds with no clear pattern of mainly claystone and siltstone.	2094.5	2117.2	1994.6	2014.0	**19.4**	???
Finefrau Nebenbank Sandstone	2117.2	2144.5	2014.0	2036.6	**22.6**	SANDSTONE: white to off white, hard, predominantly fine to occasionally medium grained, well cemented with silica.
Interbeds with no clear pattern	2144.5	2185.0	2036.6	2069.9	**33.3**	Not clear due to casing
Coarsening Upward sequence	2185.0	2213.0	2069.9	2092.6	**22.7**	
Coarsening Upward sequence	2213.0	2238.0	2092.6	2112.5	**19.9**	
Coarsening Upward sequence	2238.0	2380.0	2112.5	2218.3	**105.8**	
Samsbank	2380.0	2381.0	2218.3	2219.0	**0.7**	Marine claystone bed
Coarsening Upward sequence	2381.0	2506.5	2219.0	2309.3	**90.3**	**3m coal bed in the top**
Marine claystone bed	2506.5	2508.0	2309.3	2310.4	**1.1**	Marine claystone bed
3x Coarsening Upward Sequence	2508	2604.0	2310.4	2380.2	69.8	
Marine claystone bed	2604.0	2672.0	2380.2	2383.5	**3.3**	Marine claystone bed
Coarsening Upward sequence	2608.5	2667.5	2383.5	2426.3	**42.8**	**Fault at 2637m; ~40m cut out**
Marine claystone bed	2667.5	2672.0	2426.3	2429.5	**3.2**	Marine claystone bed
Coarsening Upward sequence	2672.0	2758.8	2429.5	2491.9	**62.3**	
Marine claystone bed	2758.8	2760.0	2491.9	2492.7	**0.9**	Marine claystone bed
Thin Coarsening Upward sequence	2760.0	2777.0	2492.7	2505.0	**12.3**	
Marine claystone bed	2777.0	2779.0	2505.0	2506.4	**1.4**	Marine claystone bed
Thin Coarsening Upward sequence	2779.0	2789.0	2506.4	2513.7	**7.3**	
Coarsening Upward sequence	2789	2883	2513.7	2583.7	**70.0**	Thin coal bed at top
Marine claystone bed	2883.0	2885.3	2583.7	2585.5	**1.8**	Marine claystone bed
Coarsening Upward sequence	2885.3	2916.7	2585.5	2609.5	**24.1**	
Fining Upward sequence	2916.7	2957.0	2609.5	2640.3	**30.7**	
General Coarsening Upward sequence	2957.0	3041.8	2640.3	2704.4	**64.1**	
Interbeds with no clear pattern of mostly siltstone and sandstone	3041.8	3161.5	2704.4	2792.5	**88.1**	
Interbeds with no clear pattern of mostly siltstone and claystone	3161.5	3244.0	2792.5	2853.5	**61.0**	
Coarsening Up sequence	3244.0	3266.0	2853.5	2868.9	**15.4**	
Fining Upward Sequence	3266.0	3397.7	2868.9	2911.1	**42.2**	
Thin Fining Upward sequence	3322.0	3334.7	2911.1	2920.6	**9.5**	
Alternating Fining Up - Coarsening Up sequences	3334.7	3395.7	2920.6	2964.9	**44.3**	
Marine claystone bed	3395.7	3397.7	2964.9	2966.3	**1.4**	Marine claystone bed
Several weak Fining / Coarsening Upward Sequences	3397.7	3424.0	2966.3	2984.9	**73.7**	
Marine claystone bed	3324.0	3426.3	2984.9	2986.5	**1.6**	Marine claystone bed
Generally Fining Upward Sequence	3426.3	3479.0	2986.5	3023.5	**37.0**	
Thin Fining Upward Sequence	3479.0	3497.0	3023.5	3036.3	**12.8**	
Clay-Siltstone Sequence without clear trend	3497.0	3548.0	3036.3	3072.9	**36.6**	
Claystone sequence with very high GR	3548.0	3563.7	3072.9	3084.2	**11.3**	

Charleroi Formation *Late Upper Bashkirian; upper Westphalian A to B*
897.5 to 1615.5m (-872.1 to -1565.0m/TAW)

The Charleroi Fm consists of an alternation, mainly between siltstone, claystone, sandstone and coal. Generally, lithologies tend to grade to each other.

The CLAYSTONE is medium to dark grey to brownish grey, firm to moderately hard, occasionally sub-fissile, silty, micro-micaceous, slightly carbonaceous and with fine plant remains and silty, locally grading to siltstone.

The SILTSTONE is medium to brownish grey, moderately hard to hard, occasionally sub-fissile, micro-micaceous, generally carbonaceous, argillaceous, sandy, occasionally grading to sandstone.

The SANDSTONE is light to medium grey to brownish grey, hard, very fine to fine occasionally medium, well sorted, sub-rounded to rounded, argillaceous, slightly calcareous, micaceous, with carbonaceous laminations and locally coal particles, locally silica cemented with poor to fair visible porosity.

The COAL is black, brittle, has vitreous lustre and is present in beds that never exceed a few meter in thickness.

In the Charleroi Formation, based on the density data a total of 50 inferred coal beds were observed for a total thickness of 40m of coal. This is 6.4% of the thickness of the formation. The average thickness of the coal beds is 0.8m. The maximum thickness is at 952.0-954.6m (2.6m). Most coal layers yield drilling gas of about 10x above the background gas.

The base of the Charleroi Fm corresponds to the Wasserfall marine band. The marine band is not clearly visible on the GR-logs or in the cuttings.

Châtelet Formation *Early Upper Bashkirian; Lower Westphalian A*
1615.5 to 2381.0m (-1565.0 to -2194.0m/TAW)

Based on the occurrence of the Finefrau Nebenbank, a marine band, the Châtelet Formation was subdivided in the Floriffoux Member and the Ransart Member.

Floriffoux Member
1615.5 to 2117.2m (-1565.0 to -1989.0m/TAW)

The sequences are predominantly coarsening up and are composed of claystone, siltstone and sandstone grading to each other. Only traces to 5%

of coal were reported from the cuttings.

The CLAYSTONE is dark grey to brownish grey to locally black, firm to hard, locally fissile, occasionally micro-micaceous, locally carbonaceous, silty, grading to siltstone.

The SILTSTONE is brownish grey to grey, friable to moderately hard, micro-micaceous, locally carbonaceous, locally sandy, argillaceous, grading to claystone.

The SANDSTONE is off white to light grey to light brownish grey, friable to hard, very fine to fine grained, well sorted, well cemented with silica or dolomitic cement, locally micaceous, sub rounded to rounded, poor visible porosity, silty, grading to siltstone with rare pyrite.

The COAL is black, brittle and has a vitreous lustre.

Only minor coal seams are present approximately at 1606, 1715, 1727, 1733, 1891, 1900, 1913, 2098 and 2116m. I.e. a total of about 10 bed with an average thickness of less than 0.5m The maximum thickness is at 1912.1-1913.4m (1.3m). Most coal layers yield drilling gas of about 10x above the background gas.

The base of the Floriffoux Member coincides with a marine claystone bed on top of the *Finefrau Nebenbank*. The marine clay bed could not be distinguished in the cuttings and also on the GR readings, its presence is not clear.

Ransart Member

2117.2 to 2381.0m (-1989.0 to – 2194.0m/TAW)

The interval 2117.2 – 2144.5m is a 22.6m thick sandstone bed, known as the *Finefrau Nebenbank* sandstone bed. This is a correlatable interval, which might be a beach sand (typical blocky nature), compared to fluvial sandstones above (fining upward trends) and prograding delta front sandstones below (coarsening upward).
The sandstone is white to off white, hard, predominantly fine to occasionally medium grained, well cemented with silica, with poor visible porosity, rare pyrite. No mudlosses were experienced while drilling this bed with a 1.35sg. (In Mol-GT-02 mudlosses of 4 m^3/hr were experienced while drilling the sandstone with a 1.38sg mud).

The rest of the Ransart Member comprises siltstone dominated sequences. As in the Floriffoux Member, the sequences are composed of siltstone and sandstone grading to each other with minor claystone. Apart from an about

0.2m coal seam at 2163m, only traces of coal occur.

Andenne Formation *latest Serpukhovian to early Bashkirian (Chokierian or Alportian to Yeadonian, based on goniatite zonation) or Namurian B-C*

2381.0 to 3548.0m (-2194.0 to -3047.9 mTAW)

As in the overlying other intervals of the Belgian Coal Measures Group, the sequences are composed of claystone, siltstone and locally sandstone grading to each other. Most sequences are coarsening upwards. Traces of coal occur throughout, but only locally some higher percentages were observed in the top (sandy) part of some of the sequences. The lithologies are equal to those of the overlying Châtelet Formation. The top of the formation is marked by an approximately 3m thick coal bed, which appeared to be severly washed out and yielded a 1.5% gas show. In the rest of the formation there are only few coal seams at: 2681, 2685. 2944, 2946 and 3249m.

From detailed GR correlation with wells Mol-GT-01 and Mol-GT-02 a fault was interpreted by the authors at 2637m. The fault cuts out approximately 40m of stratigraphy.

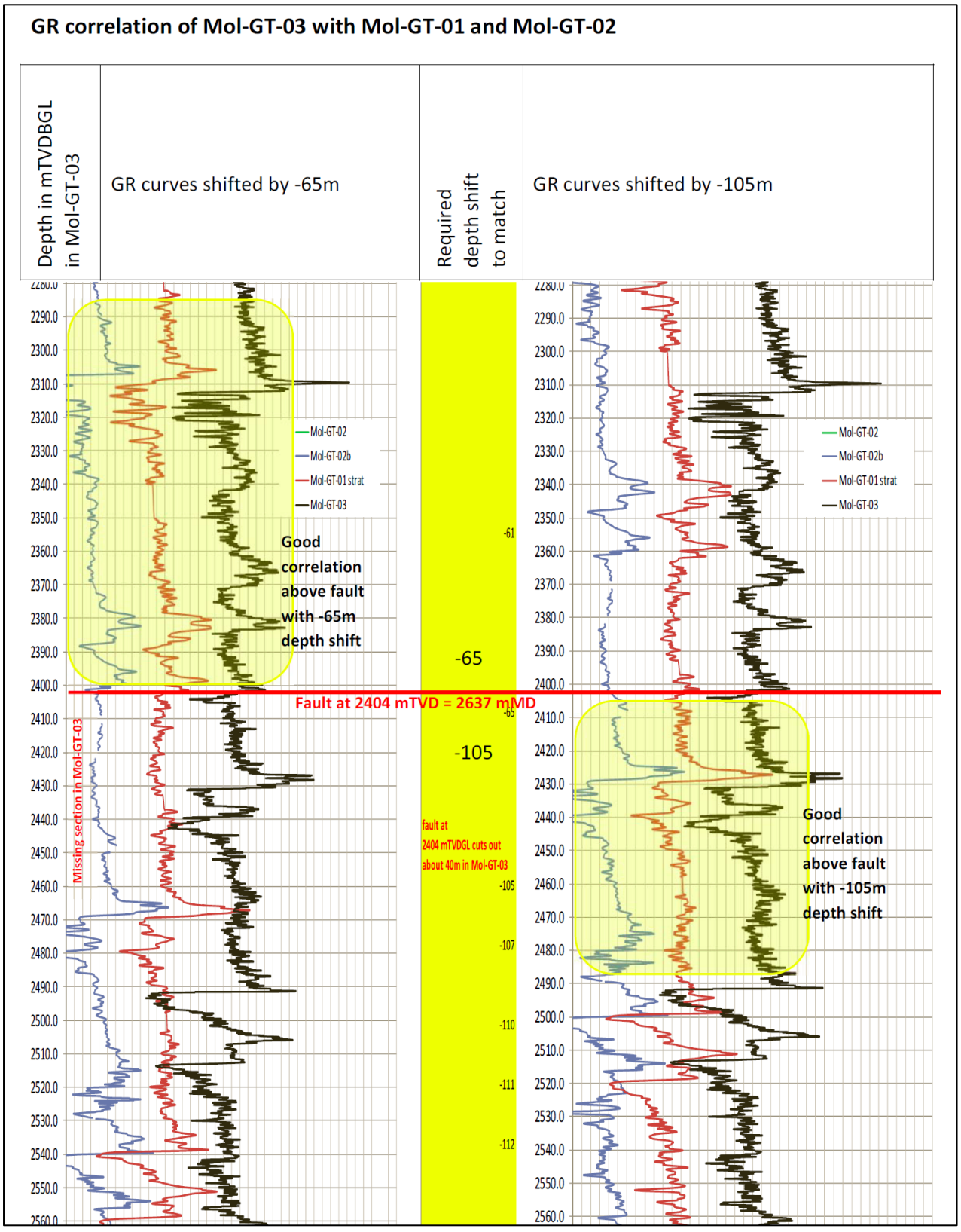

Figure 9: GR correlation on fault at 2637mD

Chokier Formation *Alportian to Arnsbergian*

3548.0 to 3563.7m (-3047.9 to -3059.2m/TAW)

The top of the Chokier Formation in marked by a distinct increase in GR-readings. GR readings in the Chokier Formation are generally above 200 API.

The formation comprises claystone similar to that of the overlying formations, but is darker. Also calcite was reported in the cuttings descriptions of the mudloggers.

5.12 Souvré Formation

Pendleian to Arnsbergian

3563.7 to 3643.0m (-3059.2 to -3116.6m/TAW)

This formation is not part of a group and represents the transition from the clastic Belgian Coal Measures Group to the Dinantian limestones.

The top of the formation is picked on GR-correlation with wells Mol-GT-01 and Mol-GT-02 at a distinct drop from GR-reading above 300 API to GR-readings of 170-210 API. Generally GR readings are highly variable with one peak up to 470 API.

The formation comprises mainly CLAYSTONE: dark grey, moderately hard to hard, fissile, micro-micaceous, locally micro-pyritic.

Thin white to off white argillaceous limestone beds are present.

Also traces of CALCITE were reported.

5.13 Carboniferous Limestone (Kolenkalk) Group

Mol-GT-03:	3643.0 to Total Depth at 4480.0m (-3116.6 to TD at -3795.7m/TAW)
Mol-GT-03-S1:	Kick-Off-Point at 4308.0m to 4672.5m (-3641.8 to -3984.5m/TAW)

The Kolenkalk Gp was be subdivided in the Goeree, Loenhout, Velp / Steentje-Turnhout, Vesdre and Pont d'Arcole formations based on log correlation and cuttings description.

The transition from the Souvré to the Goeree Formation is transitional in areas of lower slope deposits. The top of group is taken by correlation with Mol-GT-01-S1 and Mol-GT-02 and coinciding with the point where Gamma Ray readings remain significantly lower than the overlying beds and with a significant increase in limestone

in the cuttings. The overall sonic velocity values increase in the Kolenkalk Gp compared to the overlying Souvré Fm.

The mudloggers cuttings descriptions do not allow to understand the texture of the limestones in terms of a Dunham classification (mudstone, wackestone, packstone, grainstone), but were generally described on basis of their crystallinity.

Goeree Formation *Brigantian to Ansbergian*
Mol-GT-03: 3643.0 to 3712.5m (-3116.6 to -3166.8m/TAW)

The Goeree Fm consists of limestone interbedded with mostly thin claystone beds.

LIMESTONE: light to medium grey, moderately hard, micro-crystalline.
and
CLAYSTONE: dark grey, hard, calcareous, siliceous, trace of pyrite.
with traces of crystalline CALCITE.

The overall matrix porosity of the Goeree Formation, estimated from a DTC-RHOB crossplot is low with an average of 3%.

Loenhout Formation *Early Brigantian to Holkerian*
Mol-GT-03: 3712.5 to 4288.0m (-3166.8 to -3624.0m/TAW)

The top of the formation is taken at the start of a longer interval with low Gamma Ray readings of about 20 API average. Density and sonic reading do not show variation.

The mudloggers describe the Loenhout formation as “micro to fine crystalline” predominantly off white to light grey LIMESTONE.

Thin claystone beds occur throughout, but are more frequent from 3823 to 3960m and from 4068 to 4103m. The latter interval reveals high concentrations of Uranium on the Spectral GR-log (4075 and 4110m wireline loggers depth).

The CLAYSTONE is described as: dark grey to black, platy, moderately hard to hard, micromicaceous. Traces of CALCITE were recorded throught the entire Loenhout Formation. From 3730 to 3810m traces to 20% CHERT was observed: black, very hard, splintery.

The overall matrix porosity of the Loenhout Formation, estimated from a DTC-RHOB crossplot is low with an average of 2%.

Velp Formation *Late Arundian*
Mol-GT-03: 4290.0 to ?m (-3625.8 to ?m/TAW)
Mol-GT-03-S1: Kick-Off-Point at 4308.0 to 4410.5m (-3641.9 to -3735.8m/TAW)

The top of the Velp Formation (in Mol-GT-03) was picked at the base of a small GR-peak, roughly coninciding where the mudlogger desciptions show the limestone to become darker in color.

The formation comprises LIMESTONE: mostly medium to dark grey, moderately hard to hard, micro to fine crystalline, with trace of thin calcite veins, with locally thin streaks of CLAYSTONE: black, firm to hard, fissile and locally traces of CHERT: black, very hard, splintery / angular fracture.

While drilling, a strong left hand walk tendency was experienced from 4250m onwards, which persisted up to about 4400m, at which depth the azimuth had turned left from 174° to 140°. This was despite downlinking three times to the rotary steerable tool to instruct the tool to steer more and more right. This could possibly be caused by a fault zone forcing the bit to follow the fracture zone, or due to a tool failure, which eventually at 4480m led to a twist-off at the rotary steering tool.

Steentje-Turnhout Formation *Early Arundian to Chadian*
Mol-GT-03: ?m to Total Depth at 4480.0m (? to -3795.7m/TAW)
Mol-GT-03-S1: 4410.5 to 4569.0m (-3738.8 to -3886.0m/TAW)

The top of the formation is not clear.

Lithologies are very similar to that of the overlying Velp Formation: i.e. LIMESTONE: light to dark grey, moderately hard, micro to fine crystalline, with trace of thin calcite veins with locally thin streaks of CLAYSTONE: dark grey, firm to hard, fissile, locally pritic and locally traces of CHERT: black, very hard, splintery / angular fracture.

Vesdre Formation *Early Molinacian to Ivorian*
Mol-GT-03-S1: 4569.0 to 4654.0 (-3886.0 to -3966.8m/TAW)

The top of the formation is not recognizable on the GR-logs, but is identifiable by slightly higher density and higher sonic velocities, indicating a more dolomitic lithology. Also the calicimetries confirm this.

The formation comprises DOLOMITIC LIMESTONE and DOLOMITE: light to dark grey, locally off white, moderately hard to hard, with locally very thin streaks of CLAYSTONE: dark grey to black, firm to hard, micro-micaceous, trace of pyrite. Thin beds of ANHYDRITE / ANHYDRITIC DOLOMITE are inferred from locally very high density readings.

Pont d'Arcole Formation *Hasterian*

Mol-GT-03-S1: 4654.0 to 4672.5m (-3966.8 to -3984.5m/TAW)

The top is picked at an increase in GR-readings. This only 18 mTV thick formation is composed of CLAYSTONE: dark grey to black, pyritic with some generally thin interbeds of LIMESTONE: light to dark grey occasionally off white, hard.

5.14 Bosscheveld Formation

Hasterian

Mol-GT-03-S1: 4672.5 to 4747.5m (-3984.5 to -4057.0m/TAW)

This formation is not part of a group and represents the transition from the silici-clastics of the Devonian Condroz Group to the carbonates of the Kolenkalk Group.

The top of the formation is picked at the top of a ~3m thick limestone bed, characterized on the GR-log by a drop in GR-readings. Below this limestone bed, there is 2m thick claystone bed (from 4676.5 to 4678.5m), with a remarkable high Thorium content. A 1.5m thick claystone bed with high Uranium content marks the base of the formation.

The formation comprises interbeds of CLAYSTONE: dark grey to black, moderately hard, pyritic, and LIMESTONE: off white to light grey, brittle to hard, slightly dolomitic, with locally traces of CALCITE.

From 4740m 5-10% SANDSTONE: off white to beige, fine to medium, moderately hard to hard.

5.15 Condroz Group

Mol-GT-03-S1: 4747.5m to Total Depth of 4905.0m (-4057.0 to -4210.7m/TAW)

Of the Condroz Group only the Evieux Formation was penetrated.

Evieux Formation *Late Famennian*

Mol-GT-03-S1: 4747.5 to Total Depth at 4905.0m (-4057.0 to -4210.7m/TAW)

The top of the formation was picked at the base of a high GR peak (from HNGS: mainly Uranium) marking the base of the overlying Bosscheveld Formation. Also the calcimetries reveals a drastic reduction over the top.

The formation comprises interbeds of SANDSTONE: off white to beige to light greenish grey, from 4840m also brownish red, firm to hard, fine to medium, locally pyritic, locally silty and argillaceous grading to siltstone, and CLAYSTONE: dark grey to black, moderately hard, fissile, locally pyritic.