This appendix explains the well data available for the Kemira 1 well and the details of, or additions to the general method explained in Method.

The Kemira 1 well was drilled in 3 sections and wireline log suites run over each open hole section. Wireline services acronyms in Figure 6:

GR = natural formation gamma ray
CALI = calliper (borehole diameter)
Dens = density
Neutr = neutron

Data availability

Much less data is available for Kemira 1 than for Ince Marshes 1 (Appendix 2 - Ince Marshes 1 (SJ47NE/100)). See Table 2 for comparison.

Digital PDF scans of company field prints are available for the 3 wireline logging runs. These display the curves for most of the services run. Notable exceptions include the resistivity curves for Run 1 and the dipmeter and SP curves for Run 2. Legacy digital curves exist for most of the services in the log prints, digitised from the log scans. Notable exceptions that would have proved useful to the digital interpretation include the density correction curve (DRHO) for runs 2 & 3.

The PDF scans of the end of well report and mud (cuttings) log is also available to provide ancillary
Data loading and quality checks

The data was checked according to the summary in the section Data preparation.

Data load and quality summary notes
Sourced and spliced in missing data in vicinity of casing shoes from the previously merged data from individual run files. Fixed off-depth run 2 sonic (off depth in field print cf N-D and GR-res run 2s. Added 1.635 m) and spliced in (needed to improve Vcoal picks — so sonic and N-D curves line up). Filled remaining gaps with straight line. Low confidence in absolute NPOR values. Field print states it was recorded in sandstone units. Needed in limestone units for petrophysical interp: Used IP conversion Neutron to ‘limestone matrix’ (BPB transformation unavailable, used median of those available, i.e. the Schlumberger one). Therefore additional error on neutron absolute values, but curve shape OK. DRHO not available digitally (but shown in field prints).

Petrophysical interpretation and results

The data was interpreted according to the summary in the section Data preparation.

Vclay interpretation notes
Used GR for the interpretation. Also displayed for comparison (but did not use) Neutron-Density and Son-Den. Match OK, but not great between GR and N-D methods, but poor confidence in neutron data (resulting from sandstone-limestone matrix conversion, see load quality checks) and potentially parts of density data as there is no DRHO digitised for auto-‘bad hole’-removal of poor-quality density. CALI shows rugose hole, but calipers don’t appear to be open to their maximum extent anywhere (i.e. pad tool probably not ‘floating’ and assumed to be in contact with borehole wall). No other info available to cross check results.

PHIE interpretation notes
InterpS set — sonic porosity model, to calibrate/cross check if SPOR ok to use where HDRA suggests density quality poor. No resistivity curves used as they are only available for run 2.

Interp_noRes set — neutron-density porosity model. ‘Preferred’/best IP porosity output, plus most consistent to use between the two wells. No resistivity curves used as they are only available for run 2, and otherwise the output curves are only output over the run 2 interval (see Interp_ND set).

Interp_ND set — resistivity curves used. They are only available for run 2, so interpretation is only output over run 2 interval. Porosity used N-D method. (Output porosities comparable to those output in the Interp_noRes set). ‘Preferred’/best IP Vclay module output in this set.

Reasonable to good sonic and ND derived porosity methods match for zones 2 & 3 (collyhurst sandstone acc to CW strat), but underestimated sonic poro cf ND in zones beneath. Overestimated in zones above (i.e. zone 1), with some v high porosities output, probably resulting from the larger hole (and washouts up to 20” — the tool set up and sizes of centralisers is unknown) — which would make the amplitude of the returning signal weak and increase the likely hood of cycle skipping, which could look like higher porosity spikes. Some spikes in the porosity output can be seen as a result of proximity to coals (in the lower section) and hole washouts (see CALI curve).

VCoal parameters were selected based on log responses in coal and compared to the list of coal seams in the end of well report. (Note that sonic parameter selection was much easier once the curve had been put ‘on depth’, see data load/fixing section). Doesn’t detect 4 of the 15 coals because log response does not reach the cut off criteria. If cut off criteria is decreased, then coals appear
where they are probably not (according to the comp log scan).

Figure 7  Plot to show VCOAL cut off parameters and results. Coal bed labels in Table 10.

Interpreted coal intervals on RHS in black, cut off used shown on LHS: turquoise = DTP cut off, pink = RHOB cut off, yellow = NPOR cut off. Actual cut off parameters listed in Table 9.

Table 10  Depths of coal intervals in Kemira 1 well, from the end of well report. Plot numbers refer to Figure 7

<table>
<thead>
<tr>
<th>Label on plot</th>
<th>Name</th>
<th>Top</th>
<th>Base</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>INCE</td>
<td>1222.2</td>
<td>1222.9</td>
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<tr>
<td>2</td>
<td>CRANK</td>
<td>1235.2</td>
<td>1237.2</td>
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<tr>
<td>3</td>
<td>QUAKER</td>
<td>1239.9</td>
<td>1240.7</td>
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<tr>
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<td>BLACKBED</td>
<td>1243.0</td>
<td>1243.0</td>
</tr>
<tr>
<td>5</td>
<td>MAIN</td>
<td>1284.9</td>
<td>1287.2</td>
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<tr>
<td>6</td>
<td>KEMIRA</td>
<td>1325.6</td>
<td>1327.7</td>
</tr>
<tr>
<td>7</td>
<td>CARB1</td>
<td>1329.1</td>
<td>1330.5</td>
</tr>
<tr>
<td>8</td>
<td>CARB2</td>
<td>1332.9</td>
<td>1333.5</td>
</tr>
<tr>
<td>9</td>
<td>WIGAN</td>
<td>1334.7</td>
<td>1335.8</td>
</tr>
<tr>
<td>10</td>
<td>UNAMED</td>
<td>1336.5</td>
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<tr>
<td>11</td>
<td>FIRECLAY</td>
<td>1340.2</td>
<td>1341.1</td>
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