DISPLAY B2

CMS III - A Carboniferous Westphalian channel sand development in the Southern North Sea

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This core display consists of samples from various parts of the Westphalian channel sand reservoirs producing as part of the CMS III (Caister-Murdoch System) development in the Southern North Sea. The project consists of production from 6 individual accumulations.

The Westphalian CD can be broadly subdivided into three chronostratigraphic units - from the base, these are the Lower Schooner, the Lower Ketch, and the Upper Ketch. The Lower Ketch 2 sub-unit contains the best developed reservoir sands of the Westphalian CD observed in the Boulton B and Hawksley fields. The sands tend to be blocky in log character, and conglomerate is common, especially in the more proximal setting around Hawksley.

The Hawksley development well was brought on stream providing a constrained initial rate of 184 MMSCF and a potentially commercial accumulation was identified in the overlying Rotliegendes North Leman Sandstone. The McAdam discovery well 44/17-1 encountered gas in the Murdoch and overlying Westphalian B sandstones. The Watt discovery well 44/22b-8 encountered a gas sand within the Westphalian B .

Murdoch K is a wedge of Westphalian C/D fluvial sandstones on the down-thrown side of a major NE-SW trending spoon-shaped Carboniferous normal fault to the SE of Murdoch, with an initial constrained rate of 204 MMSCF.

Carboniferous diagenesis is strongly influenced by multi-phase weathering processes. There are repeated episodes of dissolution, quartz cementation and replacement of feldspars by kaolinite. Early quartz cementation has inhibited compaction and preserved high primary porosity which is enhanced by the generation of secondary porosity due to dissolution. Reservoir quality within the Carboniferous sandstones is principally a result of depositional texture. The clean, coarse grained, often conglomeratic channel-fill sandstones exhibit the best permeabilities due to lower cement content and enhanced framework grain dissolution. The flood-related sandstones (crevasse and sheetflood deposits)

show poor reservoir quality due to their finer grain size and significantly enhanced ductile content, which has rendered them more susceptible to the effects of compaction.

Plate A

Well: UKCS 44/22b-8 Interval: 12703 ft – 12721 ft

This core is from the Watt Field discovery well, 44/22b-8. It is Westphalian C/D, (Lower Schooner) in age. The Lower Schooner represents the drying-up period as you go from the Westphalian B swampy, humid conditions into the more fluvial dominated Lower Ketch unit of the Westphalian C/D. It is predominantly claystone with occasional sandstones. The core shows medium to dark grey claystone, with abundant plant material, becoming coaly in places.

Plate B

Well: UKCS 44/21-4 Interval: 12596 ft – 12608 ft

This core is also from well, 44/21-4. It is Westphalian C/D (Lower Ketch 1) in age. The Lower Ketch 1 sits immediately above the Lower Schooner and represents a drier period dominated by mudstones. Sand filled channels do exist, but these are mostly localised thin channels (see Plate C). The core seen here is immediately below the Base Permian Unconformity and therefore the mudstones show a red colour due to oxidation. The core is scattered with 0.5mm or less dark red spots (iron concretions). Occasionally the mudstones grade into siltstones but no sandstones are present in this part of the core.

Plate C

Well: UKCS 44/21-4 Interval: 12629 ft – 12735 ft

This core is from the Boulton H discovery well, 44/21-4. The core shows a sand channel that lies at the base of the Lower Ketch 1 unit, immediately above the Lower Schooner unit. This sand is likely to be a localised channel, grading from medium to fine grained from the base upwards. The conglomeratic base of this fining-upwards sequence is not seen here.

Plate D

Well: UKCS 44/22-5 Interval: 11972 ft – 11990 ft

This core is from the Murdoch Field, well 44/22-5. In the Murdoch Field, the Base Permian Unconformity has eroded the Westphalian C/D and the Upper Westphalian B. The core shows grey to brown claystones of the Lower Westphalian B (above the Murdoch Sandstone).

Plate E

Well: UKCS 44/22b-8 Interval: 12648 ft – 12666 ft

This core is from well 44/17-2, just to the NW of the McAdam Field, shows the Murdoch Sandstone. This is interpreted as a Lower Westphalian B incised valley fill sandstone, deposited by a high-energy NE-SW flowing braided river system, in which channels stacked and amalgamated to form the Murdoch Sandstone package. The core shows, a brown to grey sandstone that varies in grain size, from fine to very coarse with a conglomeratic base to the channel.

Plate F

Well: UKCS 44/17a-4 Interval: 12055.3 ft – 12073 ft

This core is from the Hawksley Field, well 44/17a-4. This part of the Southern North Sea (Quad 44) was dominated by river systems flowing from the north at this time and therefore the Hawksley Field is the most proximal, being the most northerly of the CMS III developments.

The core shown here is Westphalian C/D (Lower Ketch 2) in age. The Lower Ketch 2 shows an increase in sand content compared to the rest of the Westphalian C/D and therefore is the best potential reservoir unit. This increase in sand corresponds to significantly drier conditions than seen in the underlying formations. The Lower Ketch 2 sands are thought to represent large, stacked, low sinuosity channels.

Plate G

Well: UKCS 44/21-9 Interval: 12643 ft – 12652 ft

This core is from the Boulton Field, well 44/21a-9. This core is from the unit that directly overlies the Base Permian Unconformity. The first part of the core shows the first of the Permian, Silverpit Formation halites. This shows that the system has gone from the drier, fluvial dominated system of the Westphalian C/D, through the Base Permian Unconformity, (where anything from 500 – 2000ft+ of section has been eroded), into a more basinal setting (Quad 44 lies on the NE flanks of the Silverpit Basin). Beneath the halite lies a sandstone unit of debatable depositional history. This unit is sometimes described as the Lower Leman Sandstone, although true deposition from this fluvial/sabkha system from the north, probably stops to the north of the CMS III fields. An alternative interpretation would be that this sandstone is of erosive origin, being a product of the Base Permian Unconformity. The red colour is due to oxidation, which makes a specific age interpretation through chemo-or-biostratigraphy difficult.

Display B2 Plate A

Well UKCS 44/22b-8

Core photography and digital processing by
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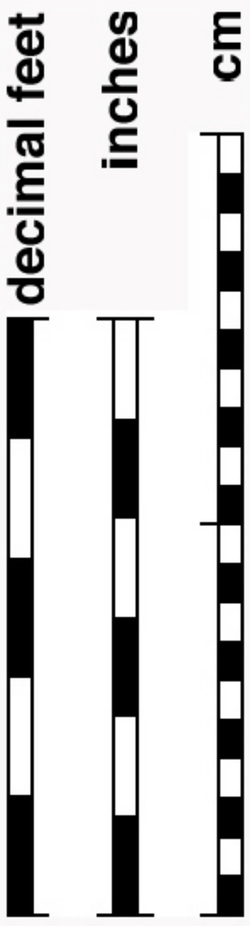
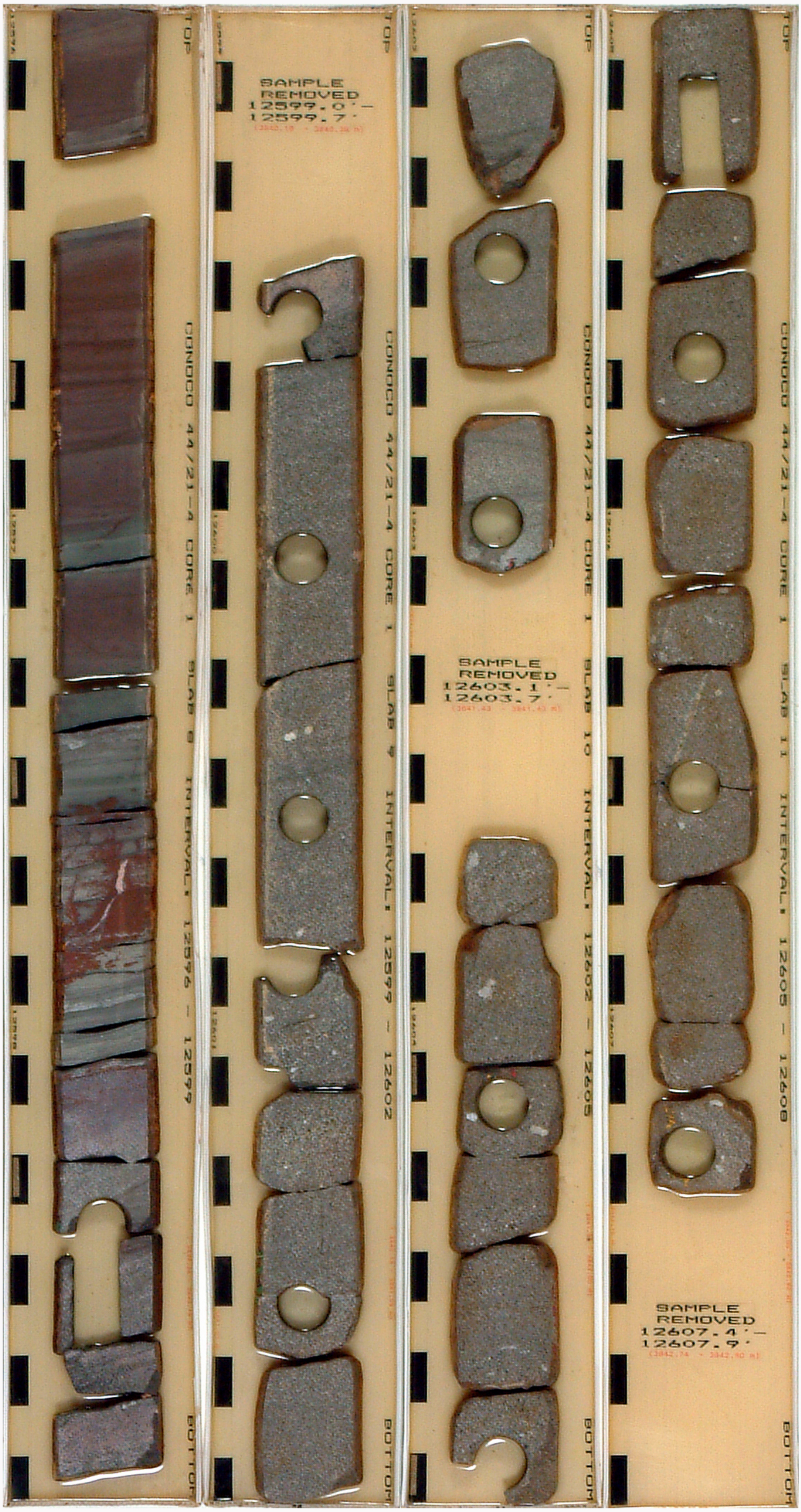
and
Colin Oakman (Colin Oakman Associates)

Core Display B2 Plate B

Well UKCS 44/21-4





Core photography and digital processing by
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and
Colin Oakman (Colin Oakman Associates)

Display B2 Plate C

Well UK 44/21-4

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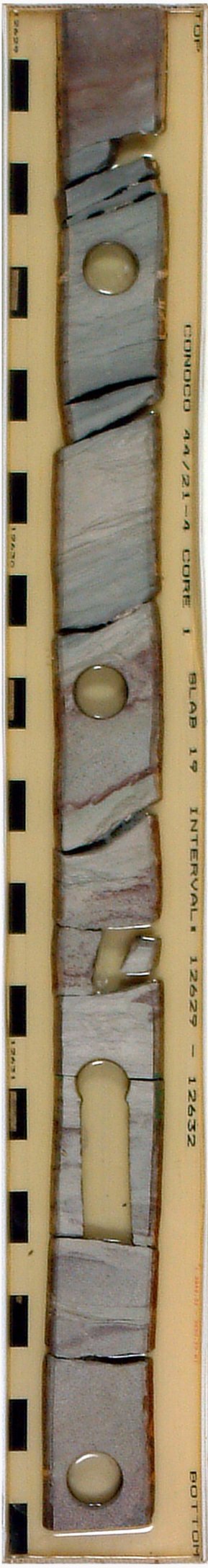
and
Colin Oakman (Colin Oakman Associates)

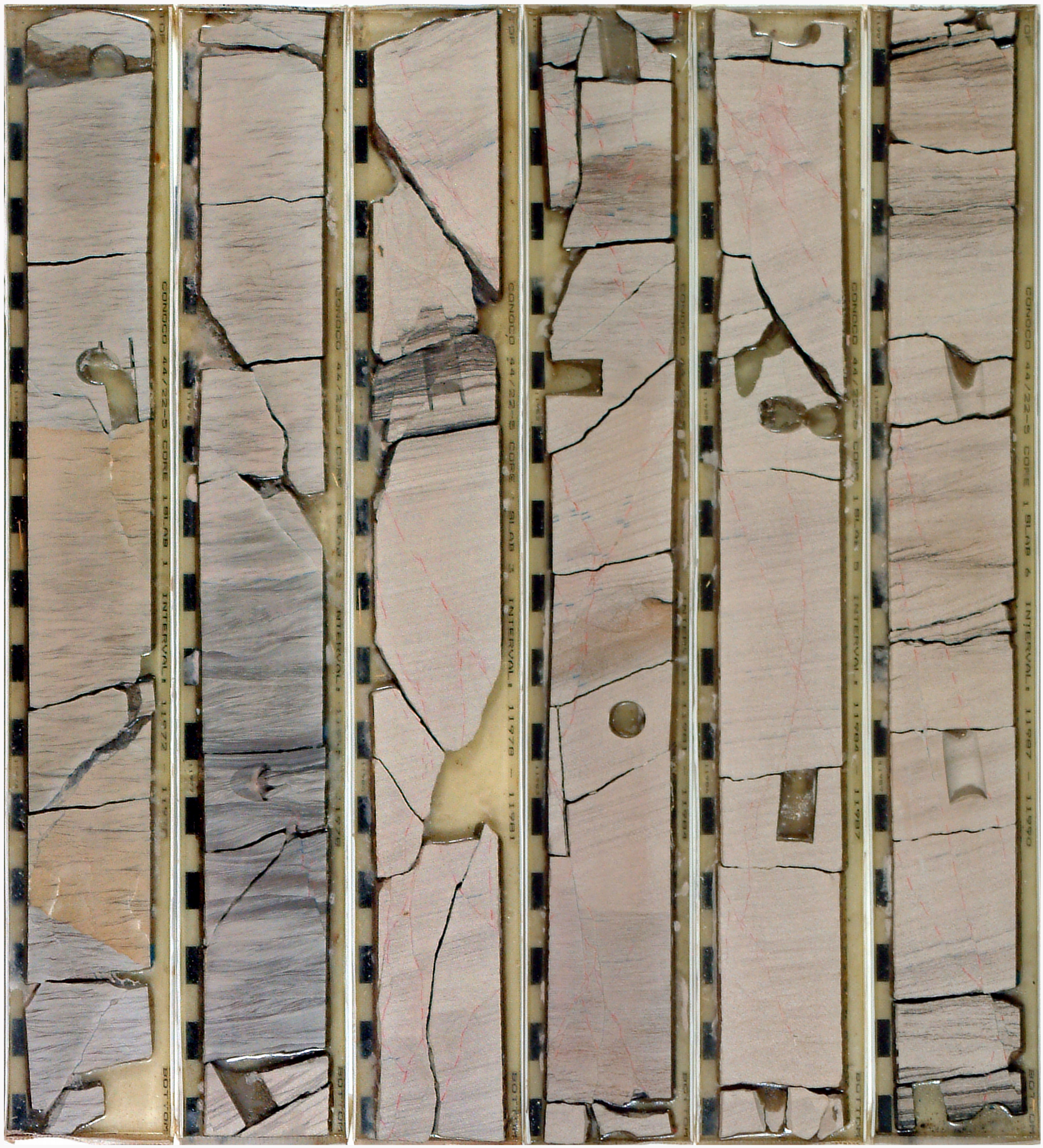
12629 ft



12632 ft

Display B2 Plate D

Well UKCS 44/22-5



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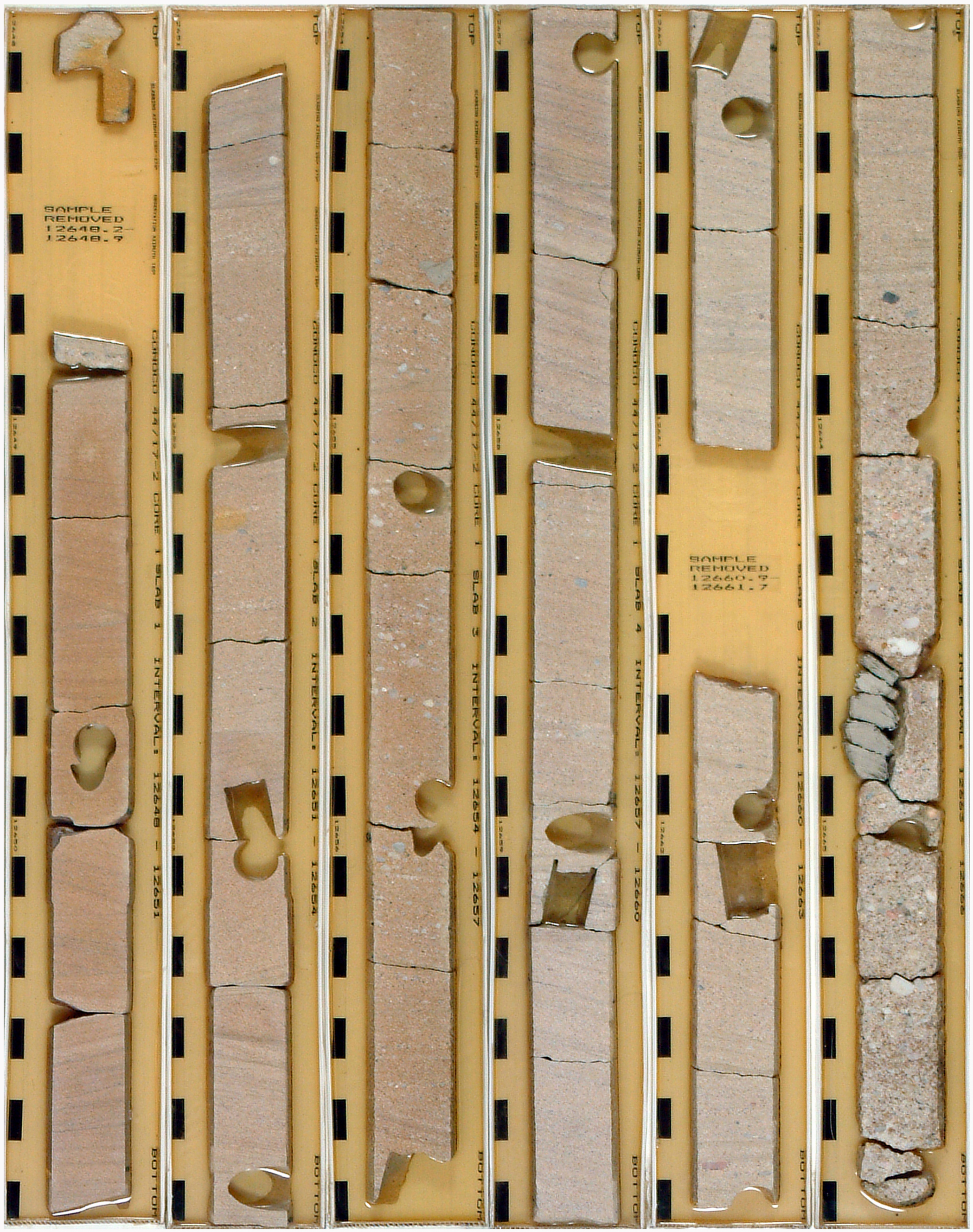
Display B2 Plate E

Well UKCS 44/17-2



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Display B2 Plate F

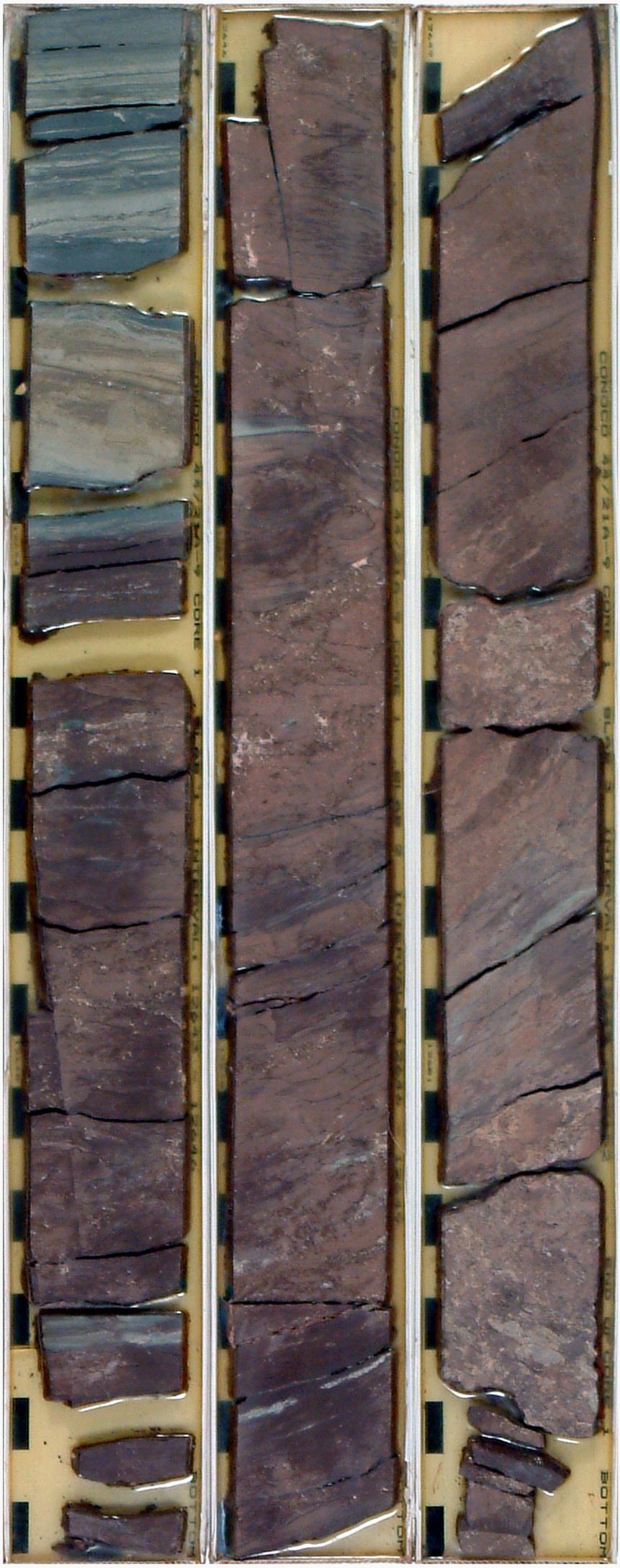
Well UKCS 44/17a-4

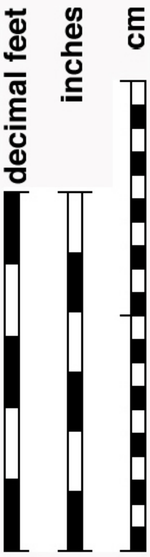
Core photography and digital processing by
Robert Leppard (Leppard Sedimentology Ltd)
and
Colin Oakman (Colin Oakman Associates)

Display B2 Plate G

Well UKCS 44/21-9

12643 ft 12646 ft 12649 ft





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