

Buchan Field

1 Reservoir revisited



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Jersey Oil and Gas plc is undertaking the redevelopment of the Buchan oil field in the UKCS Central North Sea, which produced 148 MMbbls of oil until its cessation in 2017 due to facility certification issues. The reservoir is Devonian in age, comprising well consolidated sandstones with fractures helping the overall fluid dynamics within the reservoir.

Recently, we had the privilege to visit the BGS core store in Edinburgh to view the core from 21/01-6 (B1). This well lies in the core of the field and was responsible for producing in excess of 44 MMbbl (30% of all production). The well was extensively cored through most of the 575m of the hydrocarbon column. The cores indicate deposition in a fluvial (braided) system with dominantly channel-fill and bar-form sands (Figure 1.). Where bar tops have been preserved, point bars are topped by channel abandonment and floodplain mudstones with occasional ephemeral lake deposits containing pedogenic carbonates.

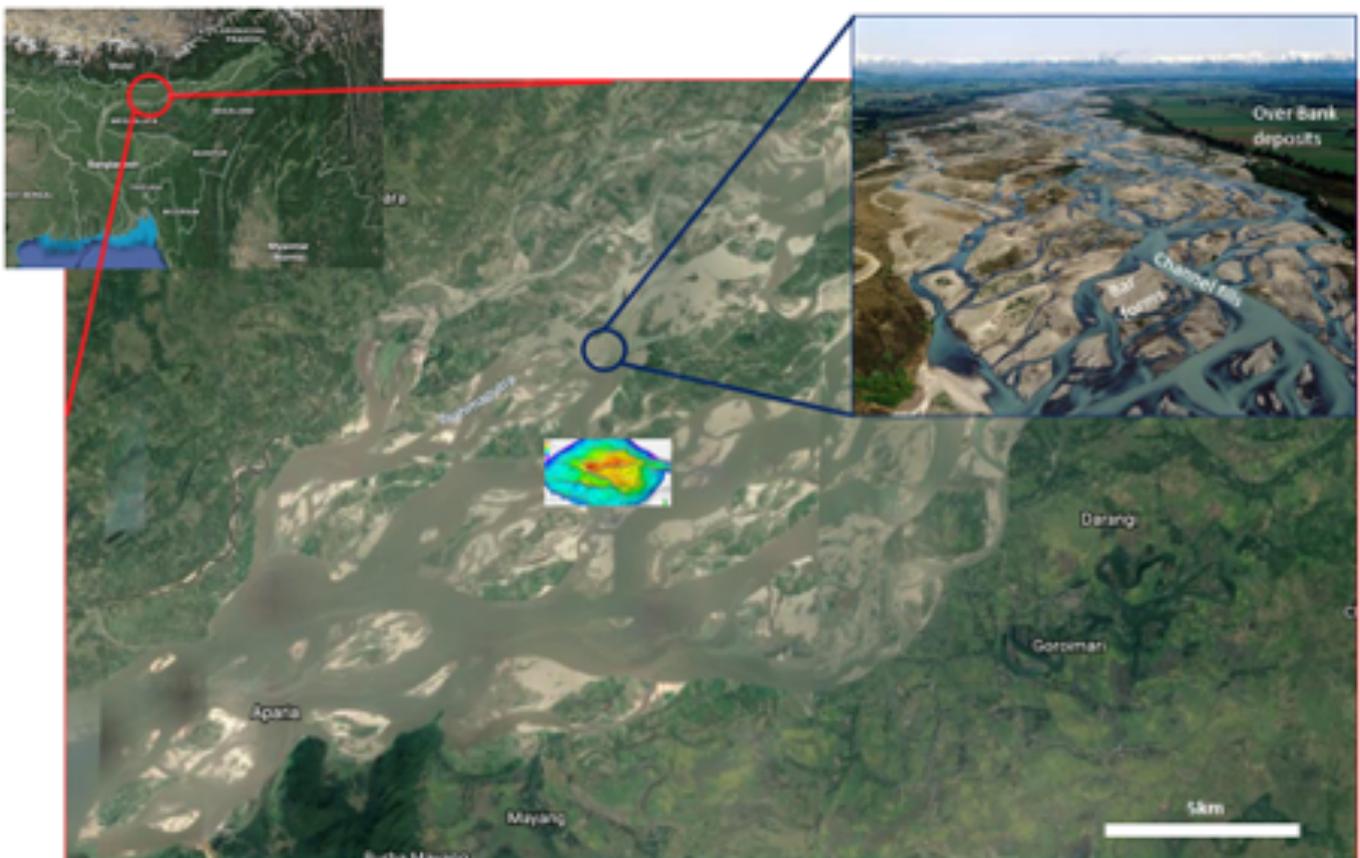


Figure 1 Modern day analogue of the Buchan reservoir depositional environment. Upper reaches of Brahmaputra river has a wide flood plan where braided channels are widely present. Channel systems are cross cutting each other, with preserved inter-channel bar forms. Inset in the centre is Buchan field to scale, to demonstrate that the entire field lies in one of the channel systems, resulting in fairly homogenous depositional facies.

The channel fill facies broadly comprised an erosion surface overlain by an intra-clast channel lag deposits / intraformational conglomerates, passing upwards into massive sandstones and ultimately trough cross-stratified sandstones (Figure 2). The repeated upwardly fining packages can be down to a scale of less than 10m vertically.

The bar form facies comprise low angle plane bed stratified and planar tabular cross-bedded sandstones, passing upwards into the bar-top facies (Figure 3).



Figure -2: Channel facies examples well 21/01-6 (B01).

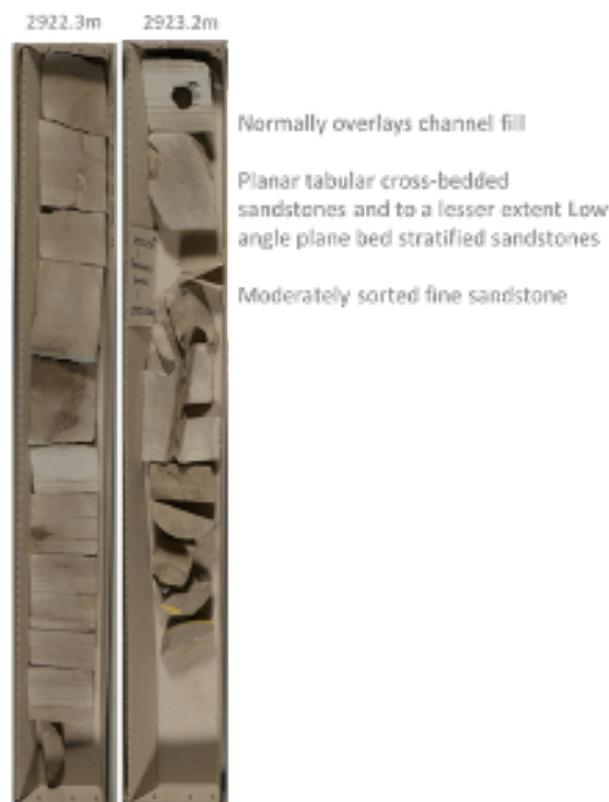


Figure -3: Bar top facies examples well 21/01-6 (B01)

The bar top facies are very fine to fine grained sandstones, parallel laminated and wavy bedded; current rippled and parallel laminated sandstones (Figure 4).

The floodplain facies contain mudstones and finely laminated and wave rippled sandstones (Figure 5).

The target reservoir zones indicate a braided system with multiple stacked channels resulting in extensive bar form facies, transitioning into a higher sinuosity fluvial environment with floodplains and caliches, passing upwards into mature fluvial facies interspersed with increasing lacustrine facies. Given the extensive fault offsets of the reservoir, significantly greater than 10m and historical production data, the potential vertical baffling impact of the shaly layers is minimal.

After careful examination of these cores, it can be concluded that this well was not drilled in a fracture dominated part of the field and most of the production (as evidenced by production logging tool data) came from the channel form facies.

A high-resolution static model incorporating all the subsurface data, including the latest high resolution 2018 broad band 3D seismic, has provided the basis for a simulation model, which is currently being history matched for the 36 years of production. This will form the basis of a development plan to drill production and water injection wells; as water injection is considered to be the main drive mechanism aided by an active aquifer.

2915.3 m



Overlay the barform facies and maybe
overlain by the floodplain facies

Very fine to fine sandstones

Parallel laminated/wavy bedded very fine sst

Current rippled sandstones fine sandstone

Finely laminated siltstones and mudstones

Modification of exposed bartops during the
low stage of the fluvial system , calcretes and
occasional bioturbation

- Mudstones
- Finely laminated/ wave rippled siltstones
- Suspension of deposition on floodplain
- Periodic overbank flood events > sandstone intervals
- Thicker sandstones and intercalations of cross laminae more proximal main channel
- Often grade upwards from bar-top deposits
- Often extensive calcrete development

2794m



Figure -4: Bar form facies examples well 21/01-6 (B01).

Figure -5: Floodplain facies examples well 21/01-6 (B01).