

The role of the Base Cretaceous Unconformity in the distribution of porosity and kaolinite in Brent Group sandstones of the Tampen Spur area, Northern North Sea

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The effect of an unconformity on the underlying reservoir quality has long been a matter of controversy. Several studies have been presented supporting a profound relationship between the presence of unconformity surfaces and enhanced reservoir quality below. By contrast, evidence against the existence of such a relationship has also been proposed. In this study both hypotheses were examined by evaluating the role of the Base Cretaceous unconformity in the distribution of porosity and kaolinite in Middle Jurassic Brent Group sandstones of the Tampen Spur area, Northern North Sea.

Detailed petrographic analysis, using both optical microscopy and Scanning Electron Microscopy (SEM), was undertaken on 43 core samples from selected wells in the Tampen Spur region. This work documented lithology, texture, mineralogy and diagenetic characteristics in order to understand the origin and timing of dissolution and the formation of kaolinite, and their effect on the reservoir properties. Both of these diagenetic processes have had a significant effect on the reservoir properties.

The petrographic analysis results indicate that the dissolution of framework grains and carbonate cement are the main source of the generated secondary porosity and authigenic kaolinite within Brent Group sandstones. It is clear from the preservation of delicate euhedral booklets of authigenic kaolinite, and from the delicate crystal remnants lining the secondary pores from dissolved feldspar grains, that both the dissolution and kaolinite precipitation postdates the majority of mechanical compaction. The burial depth is now in excess of 2000 m. This, along with several lines of evidence, supports the hypothesis that the Base Cretaceous Unconformity has had no marked effect on reservoir properties of the underlying Brent Group Formations. This evidence includes:

- 1- The absence of obvious systematic distribution of dissolved framework grains and/or carbonate cements relative to the Base Cretaceous Unconformity.
- 2- The absence of systematic vertical variation in the volume and distribution of secondary porosity upwards through the reservoir toward the Base Cretaceous Unconformity.
- 3- The absence of any systematic increase in the content of kaolinite toward the Base Cretaceous Unconformity, in any of the studied Brent Group formations regardless of how close these formations occur relative to the unconformity surface.

In summary, this study demonstrates no marked effect of the unconformity surface on the underlying reservoir rock in this region of the North Sea. It is suggested that any such effects that may be noted elsewhere are most likely to be a localised phenomenon.