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Tight chalk: Characterization of the 3D pore network by FIB-SEM, towards the understanding of fluid transport

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ACCEPTED MANUSCRIPT

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2 SEM, towards the understanding of fluid transport

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15 Abstract

- 16 Tight chalk intervals play a major role in North-Sea hydrocarbon fields, by controlling fluid flow
- pathways of hydrocarbon and water. Recent studies reveal that low-permeability chalk properties are
- dependent on clay content and cementation. Therefore, in this research, three characteristic samples
- were selected: (A) a porous micritic chalk, (B) a cemented chalk and (C) an argillaceous chalk.
- 20 Focused Ion Beam-Scanning Electron Microscopy (FIB-SEM) analyses were performed and 3D pore
- 21 networks were reconstructed for each sample. By using MATLAB® and Avizo® softwares, relevant
- 22 pore data were extracted, including pore volumes, lengths and network tortuosity. Results show that
- the pore length is reduced in tight chalks, with 140 nm on average in argillaceous chalk and 533 nm in
- cemented chalk, compared to 1091 nm in micritic reservoir chalk. Pore shape analysis demonstrates
- 25 that, when present, clay flakes are predominant. Argillaceous chalk displays 35% of flattened pores,
- 26 while these represent only 15 and 18% of pores in micritic and cemented chalk respectively. Virtual
- 27 rock porosity calculated from FIB-SEM is consistent with helium porosity lab-measurements. MICP
- pore-throat diameters also match calculated pore widths. These preliminary findings confirm the
- 29 potential of FIB-SEM analyses in characterizing chalks porous media. In order to understand fluid

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