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# Seismic texture and amplitude analysis of large scale fluid escape pipes using time lapses seismic surveys: examples from the Loyal Field (Scotland, UK)

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Fluid escape pipes are key features of primary interest for the analysis of vertical fluid flow and secondary hydrocarbon migration in sedimentary basin. Identified worldwide (Løset et al., 2009), they acquired more and more importance as they represent critical pathways for supply of methane and potential structure for leakage into the storage reservoir (Cartwright & Santamarina, 2015). Therefore, understanding their genesis, internal characteristics and seismic expression, is of great significance for the exploration industry. Here we propose a detailed characterization of the internal seismic texture of some seal bypass system (e.g fluid escape pipes) from a 4D seismic survey (released by the BP) recently acquired in the Loyal Field. The seal by pass structure are characterized by big-scale fluid escape pipes affecting the Upper Paleogene/Neogene stratigraphic succession in the Loyal Field, Scotland (UK). The Loyal field, is located on the edge of the Faroe-Shetland Channel slope, about 130 km west of Shetland (Quadrants 204/205 of the UKCS) and has been recently re-appraised and re developed by a consortium led by BP. The 3D detailed mapping analysis of the full and partial stack survey (processed using amplitude preservation workflows) shows a complex system of fluid pipe structure rooted in the pre Lista formation and developed across the paleogene and Neogene Units. Geometrical analysis show that pipes got diameter varying between 100-300 m and a length of 500 m to 2 km. Most pipes seem to terminate abruptly at discrete subsurface horizons or in diffuse termination suggesting multiple overpressured events and lateral fluid migration (through Darcy flows) across the overburden units. The internal texture analysis of the large pipes, (across both the root and main conduit zones), using near, medium and far offset stack dataset (processed through an amplitude preserved PSTM workflow) shows a tendency of up-bending of reflection (rather than pulls up artefacts) affected by large scale fracture (semblance image) and seem consistent with a suspended mud/sand mixture non-fluidized fluid flow. Near-Middle-Far offsets amplitude analysis confirms that most of the amplitude anomalies within the pipes conduit and terminus are only partly related to gas. An interpretation of the possible texture observed is proposed with a discussion of the noise and artefact induced by resolution and migration problems. Possible hypothetical formation mechanisms for those Pipes are discussed.