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Gas Chimney Processing as a New Exploration Tool: A West Africa Example

Gas Chimneys have been observed in many parts of the world. On the seismic sections chimneys are usually manifested by washed out and chaotic seismic events. As a result presence of gas clouds often times block seismic reflections and make mapping and interpretation more difficult. Recently, a new methodology called chimney processing has emerged rendering chimneys an exploration tool. Among applications of chimney cubes are: Unraveling the hydrocarbon history model and the migration path, ranking prospects, detecting reservoir leakage and corresponding spill points, and distinguishing between sealing versus non-sealing faults.

Chimney processing technique is based on a pattern recognition technique using the principle of directional attributes, dip-steering and contrast enhancement. These patterns are used to detect not only chimneys, but also other objects and interfaces such as faults, stratigraphic bodies, and fractures. Chimney cubes are produced though running a selected and appropriately weighted set of attributes through a supervised neural network. The weights are determined by training the network from multitude of available information and geologic interpretation.

This paper describes application of chimney processing to several structures in offshore West Africa. Evidence of hydrocarbons seep through the subsurface was established from traces of high gas saturation trail, showing up on seismic data as vertical disturbance. The shape of chimneys varied considerably. Some are cylindrical (above a mound). Others are elongated or curved (along fractures, faults and paleo-channels). Integration of chimney cube with 3D structural interpretation provided additional constraints to migration path and hydrocarbon accumulation processes. This facilitated prospect ranking and suggested new play types for further consideration.