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Improved Assessment of Chemosynthetic Community Presence in Areas of Potential Deepwater Oil and Gas Development by Modification of Routine Sampling Methods

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Abstract

Techniques for identifying deepwater chemosynthetic communities can be classified as indirect (inference from geophysical data), direct (bottom samples), and visual (ROV/submersible). Exhaustive visual inspection is the best, but most expensive, means of detecting chemosynthetic communities. Some less-common techniques employ both indirect (multibeam echosounder) and direct (cores) methods. These surveys have the specific purpose of locating sediments near potential seeps to assess reservoir potential in frontier basins and predict chemosynthetic distribution in deep basins. Other methods are routine, such as environmental baseline studies that establish a “snapshot” of seabed conditions and geotechnical cores for mooring and pre-development site investigations. These are direct methods that are routinely collected for specific purposes, but not for the assessment of potential chemosynthetics. Direct sediment sampling is underutilized for assessing chemosynthetic potential. Sulfides and methane in sediments are nutrients for microfauna which then feed macrofauna, forming the chemosynthetic community. Deepwater operators desiring to minimize exploration/production impacts on the environment can analyze sediment during routine sampling programs, thereby assessing local chemosynthetic community potential by geochemical and biochemical analyses. Use of these analyses can target and minimize costly ROV usage. Because geochemical analyses quantify sulfide and methane fluxes, they can quantitatively assess the potential for chemosynthetic development. Biochemical analyses of stable biomarkers can assess whether chemosynthetic communities have been present over certain timescales. The presence of sulfides and methane flux is required to have a chemosynthetic community. The best method to identify chemosynthetics, ROV/submersible observation, is expensive. Improved utilization of chemical analyses of routine cores taken by industry can provide for robust assessments of chemosynthetic communities in deepwater development sites.

Introduction

The rapid expansion of exploration activities in deepwater worldwide, begun in the 1990s, has now led to the field development stage of the discovered hydrocarbon resources. The cumulative footprint of development on the deep seabed will continue to increase as will the requirement for far more detailed knowledge of the foundation zone conditions. In concert with expansion of designed facilities is a progression of survey efforts to characterize foundation zone conditions.

For example, for the exploration well, top hole and foundation zone hazards will often be assessed with conventional exploration 3-D seismic data, or less often with traditional surface towed subbottom profiler and high resolution 2-D seismic (HR 2-D) lines. Development drilling will often continue with the foundation zone information inferred from the same data sets. However, the planning and design of subsurface facilities and production structures require far more foundation zone information than is typically assessed for development drilling. Foundation zone survey requirements for subsurface facilities and production structures typically involve deep-towed subbottom profiler data and geotechnical borings, at a minimum. Now more commonly, multibeam, sidescan sonar, and subbottom profiler data from an Autonomous Underwater Vehicle (AUV), an untethered high-resolution seafloor and foundation zone survey platform, are used.

These surveys are performed irrespective of whether there is potential or concern for deepwater chemosynthetic community detection. Furthermore, where there is concern or requirement for detecting chemosynthetic communities, each of the above seafloor and foundations zone survey data are used, to varying degrees of success, to make determinations for the presence of, or potential for, high-density chemosynthetic communities. This paper examines the use of geochemistry