

## World-Wide Deepwater Exploration and Production: Past, Present and Future

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### Abstract

Exploration and production in deepwater (>500m) has expanded greatly during the past decade, with approximately 57 BBOE discovered, more than half since 1995. Despite this rapid emergence, deepwater remains an immature frontier, accounting for less than 5% of the current world-wide total oil-equivalent resources. Only about 20% of the discovered deepwater resources are developed and less than 5% have been produced. The global deep water exploration success rate was about 10% until 1985, but has since averaged approximately 30%, driven by remarkable success in the Gulf of Mexico and West Africa. Whereas the world-wide discovery of giants has fallen off in recent decades, the discovery rate of deep water giants is rapidly increasing.

Most exploration activity has been concentrated within only three areas of the globe, with a majority of the discovered resources in the Gulf of Mexico, Brazil, and West Africa. Consequently, large portions of the world's deepwater margins remain lightly explored. Deepwater gas exploration is extremely immature, reflecting current infrastructure and economic limitations, but destined to become a major future focus. Most of the currently most active deepwater exploration frontiers and associated resources are located along passive margins, downdip from productive Tertiary delta systems, in depocenters confined by mobile substrate. In simplest terms, petroleum systems responsible for the majority of the discovered resources can be classified as either early rift (lacustrine) or later passive margin (marine). Ninety percent of the resources are reservoired in turbidites, primarily of Cenozoic age. A key success factor is targeting "high kH" reservoirs, which have high flow rates and high per-well ultimate recoveries. These commonly occur within ponded minibasins associated with mobile substrate, where stacked turbidites result in high net pay per area values. Other key exploration success factors have been seismic DHI's, identification of stratigraphic traps, and improved reservoir architecture prediction. Leading companies are moving into non-DHI plays and other geologic settings, including pre-Tertiary objectives and areas lacking major updip reserves. Recent trends suggest several themes for future deep water exploration: 1) a continuation of established plays, which are still at an immature stage of drilling, 2) going beyond the established formula, to basins lacking updip production, unconfined basins, compressive margins, and targeting pre-Cenozoic, non-turbidite, and non-DHI objectives, 3) increased gas exploration, as pipeline networks and liquefaction technology advance in conjunction with increased demand, 4) going deeper, both ultra-deep water and deeper drilling depth, including subsalt, sub-detachment, and sub-volcanic targets, and 5) new business opportunities which may arise in areas currently not open due to government monopolies, moratoriums, and international boundary disputes. New frontiers with these characteristics are being actively leased, but it remains to be seen whether the deepwater play will continue to add reserves at the rate of recent years.