Newly Defined Plio-Pleistocene Plays, Northern Gulf of Mexico: Field Characteristics and Production Statistics

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The offshore northern Gulf of Mexico (GOM) has recently accounted for ~13% of the oil and ~26% of the gas produced annually in the nation (Seni et al., 1997). In 1997 and early 1998, leasing activity reached record levels in the GOM, emphasizing the increasingly important role of the region in supplying domestic energy. Of all the reservoirs in the GOM, Plio-Pleistocene reservoirs: 1) contain 55% of the total original proved reserves (sum of cumulative production and remaining proved reserves), 2) have produced 62% of the cumulative oil and condensate and 53% of the cumulative gas, and, 3) account for 67% of the remaining proved oil and condensate reserves and 45% of the remaining proved gas reserves. Of the Plio-Pleistocene strata alone, Pleistocene reservoirs contain most (66%) of the total original proved reserves.

For the first time, geologic and engineering data on all 5,622 sandstone-body reservoirs in the 567 Plio-Pleistocene fields in the northern Gulf of Mexico have been synthesized into a play framework based primarily on depositional style and geologic age (Hentz et al., 1997). Definition of 19 Plio-Pleistocene plays comprising 5 chronozones (lower and upper Pliocene; lower, middle, and upper Pleistocene) (Seni et al., 1995) and four depositional styles (aggradational, progradational, submarine fan, and caprock) (Hunt and Burgess, 1995) allows comprehensive compilation and comparison of production and reserves statistics among chronozones and depositional styles in the northern GOM. Production and reserves data are derived from annually compiled records of the Minerals Management Service (Gulf of Mexico OCS Region) and the Louisiana Office of Conservation.

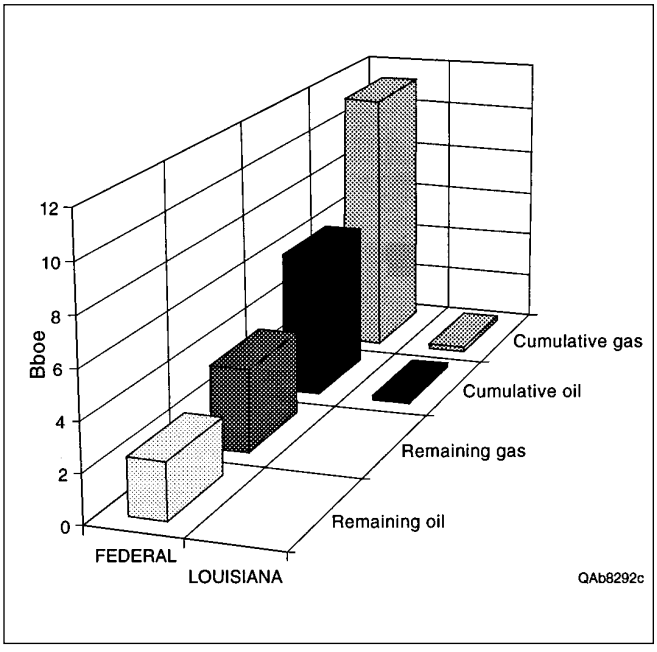

Figure 1. Histogram ranking the total of cumulative production and remaining proved reserves in billion barrels of oil equivalent (Bboe) in Plio-Pleistocene reservoirs according to jurisdiction: Federal Outer Continental Shelf (OCS) and Louisiana Offshore State waters.

Through 1994, Federal Outer Continental Shelf (OCS) Plio-Pleistocene reservoirs produced 63.439 trillion cubic feet (Tcf) of gas (98.8%) and 6.016 billion barrels (Bbbl) of oil and condensate (97.0%), as compared with 796.470 billion cubic feet (Bcf) of gas (1.2%) and 182.890 million barrels (MMbbl) of oil and condensate (3.0%) from fields in Louisiana Offshore State waters. Plio-Pleistocene reservoirs in Federal OCS fields have total remaining proved reserves of 15.412 Tcf of gas and 1.713 Bbbl of oil and condensate (Fig. 1). Remaining-proved-reserves data are unavailable on reservoirs in Louisiana Offshore State waters.

Pleistocene reservoirs account for ~72% of the total Plio-Pleistocene gas production and ~53% of the total oil and condensate production of the offshore northern GOM. Lower Pleistocene reservoirs have the most gas (35.6%) and the greatest cumulative oil and condensate (35.8%) production. Nearly 72% of remaining proved gas reserves and ~62% of remaining proved oil and condensate reserves reside in Pleistocene strata. The lower Pleistocene leads all chronozones in gas (36.0%) and oil and condensate (31.1%) remaining proved reserves, nearly equaling the total gas (28.3%) and liquid (38.3%) reserves of the entire Pliocene succession (Fig. 2).

Plio-Pleistocene gas reservoirs produce predominantly from progradational facies (72.0%), followed distantly by submarine-fan (18.2%), aggradational (9.8%), and caprock (negligible) reservoirs (Fig. 3). Remaining proved gas reserves are also highest in progradational reservoirs (54.7%), however, submarine-fan plays also have abundant gas reserves (36.8%). The apportionment of oil and condensate production by depositional style mirrors that of gas production. Progradational reservoirs have the highest cumulative liquid production (62.8%). The next-highest liquid-producing depositional style is submarine fan (19.7%). Remaining proved oil and condensate reserves are nearly equally divided between progradational (47.3%) and submarine-fan (46.1%) sandstone facies. Among the top five Plio-Pleistocene plays in terms of total original proved reserves, four are progradational and one (ranked second) is submarine fan.

Discovery potential is highest in Plio-Pleistocene submarine-fan facies downdip of proved fields in the mostly unexplored deep-water (>1,000 ft) areas and at drillable depths in and between proved fields where drilling has not penetrated deeply enough to reach correlative facies. Progradational play areas are generally well explored, characterized by declining trends in yearly reservoir discoveries. Discovery potential in sandstone-dominated aggradational facies is limited primarily by the general scarcity of sealing shales. The abundance of aggradational sandstones having thin

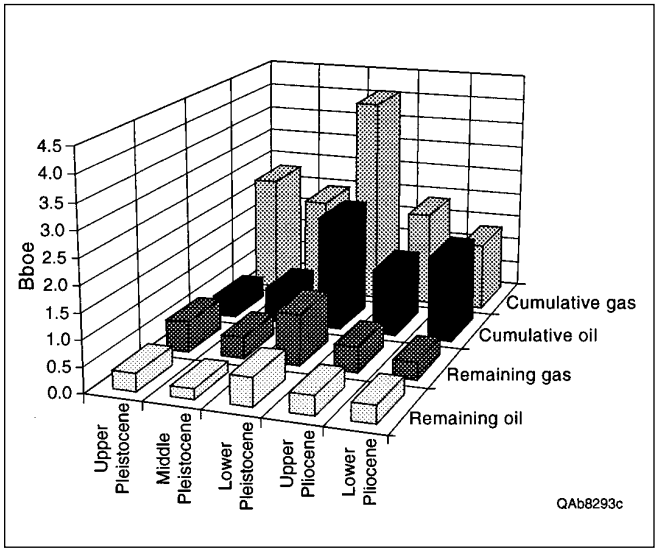

Figure 2. Histogram ranking cumulative production and remaining proved reserves in billion barrels of oil equivalent (Bboe) according to chronozone in the Plio-Pleistocene succession.

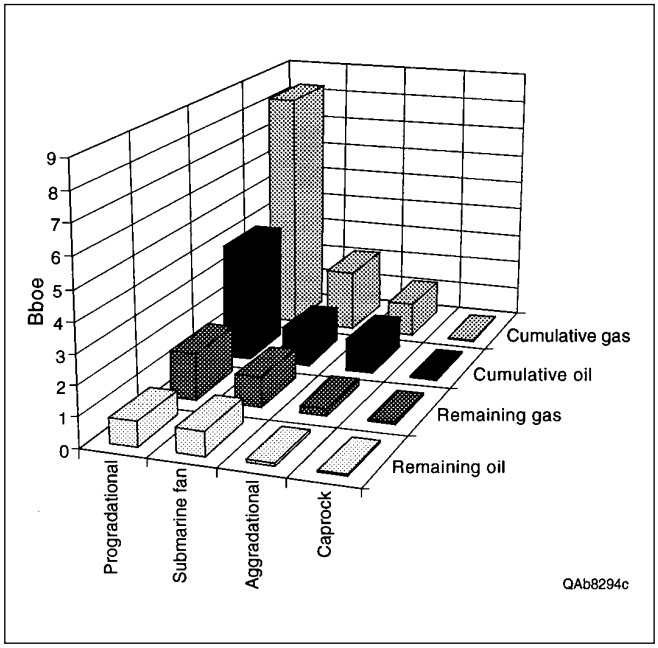

Figure 3. Histogram ranking cumulative production and remaining proved reserves in billion barrels of oil equivalent (Bboe) in Plio-Pleistocene reservoirs according to depositional style (progradational, aggradational, and submarine fan) and diagenetic style (caprock).

shale intervals increases the likelihood of sandstone-against-sandstone communication across faults, thus greatly diminishing the effectiveness of faults as trapping mechanisms.

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