Grau, 2000 Data Set 27

Reference: Grau, Anne, 2000, Material balance: Quartz cement vs. internal sources of silica, East Brae Field, offshore United Kingdom: Ph.D. Thesis, Colorado School of Mines, Golden Colorado.

Author's affiliation: Colorado School of Mines

Age: Late Jurassic

Formation: Brae Formation

Location: East Brae Field, South Viking graben, North Sea, offshore United Kingdom

Wells: Five wells: 16/3a-E5, 16/3a-E7, 16/3a-E9, 16/3a-E10, 16/3b-5 (all Marathon wells)

Depth range: 13250-13785 ft below sea level

Depositional Setting: "With subsequent developmental drilling in the mid-1980's, the depositional setting for the Brae area was recognized as fault-controlled deposition of extensive deep marine turbidites and debris flow deposits. Channelized, massive conglomerates of the proximal Brae area fields (such as South, Central, and North Brae) grade to the basin-floor sandstones of distal fields (such as East Brae and Miller field) as much as six miles (15 km) basinward."

Lithotypes: Samples were categorized into the following lithotypes:

1Massive high-density turbidites
2Argillaceous high-density turbidites
3Pebbly high-density turbidite (lags)
4Thin-bedded low-density turbidites
5Remobilized deposits

Lithology: "East Brae sandstones may be classified broadly as quartz arenites. Although feldspar and rock fragment abundances overlap into the sublitharenite and subarkose categories, the samples are highly quartzose, and most have fewer than ten percent of either feldspar or rock fragments. There is very little variation in sandstone composition by stratigraphic zone, or by well."

Zonation: "The complete Brae sequence at East Brae, including the Upper and Lower Reservoir, has been subdivided into five zones based on palynological studies. In ascending order, these are zones F-A."

Grain size and sorting: "The size classification for Brae sandstones of this study is based on the modified Wentworth scale. Mean grain size ranges from 160.5 micrometers (lower fine) to 545.9 micrometers (coarse), with an average grain size of 229.6 micrometers (upper fine). ... Grains are subangular to subrounded, with some examples of well-rounded grains. Sands are generally moderately well sorted, with some examples of poorly sorted sandstone."

Alteration: "East Brae reservoir sandstones have been significantly overprinted by quartz cementation, dissolution of grains, calcite cementation, authigenic clay precipitation, and pyritization"

Feldspar alteration: "Total feldspar represents from 0.6 to 6.5 percent of the total rock volume, with average feldspar content of 3.2 percent. Potassium feldspar is relatively abundant, comprising from 0.6 to 6.5 percent of the rock; plagioclase feldspar is much less common, with a maximum of 1 percent of the rock volume. In general, feldspars were highly altered and partially to completely dissolved in these sandstones. Point-count values may underestimate the initial volume of feldspar."

Quartz cement: "Quartz cement is present in all samples, with cements exhibiting variable character, ranging from uniform thickness to sparse, serrate and patchy. The character varies by well, and even within a given sample. ... Quartz overgrowths make up as much as 21 percent of the whole rock, with the average sand containing approximately 11 percent quartz overgrowth cement."

Authigenic clays: "Authigenic illite, as identified by XRD, is present in all samples. Illite forms as: (1) a grain-coating clay that precipitates as small wisps on grains, (2) a pore-filling cement composed of hair-like fibers that bridge pores, and (3) a replacement product of feldspars and micas. Pore-filling authigenic clay ranges from zero to 3.9 percent, with an average of almost 1 percent of total rock volume. Pore-lining clay is more pervasive, ranging from 0 to 5.9 percent, and averaging 1.4 percent. Replacive clay ranges from 0 to 5.2 percent, with an average of 1.9 percent. Cumulatively, these three authigenic clay types make up as much as 9.6 percent of a sandstone, and average approximately 4 percent."

Calcite and pyrite cement: "Calcite cement is present in many samples in trace amounts, and in several samples as pervasive pore-filling cement. Two main types of calcite cement are observed: (1) poikilotopic sparry cement that envelops grains in sandstones that show little compaction, and (2) ferroan cement that envelops grains, authigenic clays, and quartz overgrowths in compacted sediments. Calcite cement was found to range from zero to as much as 33.7 percent of a sandstone. ... Pyrite is present as a replacement product and as a pore-filling cement. Both types are present in most samples in zero to trace amounts. Individual samples in highly cemented zones have as much as 30 percent pore-filling pyrite and 8 percent replacive pyrite cement. However, these values represent isolated features sampled for the study."

Porosity: "Primary porosity is volumetrically the most abundant pore type as determined by point count analysis, ranging from 0 percent in completely cemented sandstones to as much as 23 percent. The average sand has primary porosity of 8 percent of its rock volume. Primary pores are commonly triangular spaces between grains, typically lined or partially occluded with clay minerals or cement. In extensively calcite-cemented sandstones, primary porosity is completely occluded. Quartz cement also serves to reduce primary porosity, ranging from minimal to complete occlusion of individual pores. ... Secondary intergranular porosity ranges from zero to 8.5 percent, with an average value of 2 percent. Secondary intergranular porosity is associated with partially dissolved grains, and differs from the other secondary porosity types in that it contributes to effective porosity within the rock. The most commonly dissolved grains are feldspars. ... Secondary intragranular porosity, which is primarily a product of partially dissolved grains, ranges from zero to 4.5 percent. This type of porosity contributes an average of 1.1 percent to the total porosity. Intragranular porosity represents the porosity that is created within a grain that is not connected to the whole pore system. Secondary intragranular porosity is most commonly associated with partially dissolved feldspars, and altered micas. ... Secondary grain mold porosity is the least abundant pore type, averaging only 0.6 percent of the sandstone. This type of porosity results from grains that are completely dissolved, yet, the resultant porosity is isolated from the primary pore system. Feldspars are the most common grains to undergo complete dissolution in these sandstones."

Production: gas condensate

Core measurement conditions: not given

Data entry: From cdrom provided by the author.