Spatial and Temporal Variations of Sand Quality and Constituents in the Deepwater Gulf of Mexico

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Drainage patterns feeding sediment into the Gulf of Mexico have evolved over time, changing from a pattern of multiple moderate size inputs (Rio Grande, Sabine/Red, Mississippi, southern Appalachian) to a system dominated by the modern Mississippi (Figure 1). As the Mississippi progressively captured more of the continental drainage pattern, source provenances, discharge volumes, and possibly flow processes into the slope and abyssal plain could have been affected.

These factors could end up reflected in the rock quality of the reservoir. Questions affecting risk frequently asked during the evaluation of ever more distal deepwater prospects include queries such as whether the reservoir will become cleaner or finer as we move downdip, or if it will change compositionally. Also of concern and interest is whether there are any dramatic changes in composition either spatially or areally which would affect rock petrophysics as related to either amplitude response or reservoir quality.

Earlier work in the Green Canyon area has indicated that the composition of Pleistocene reservoirs pretty much reflects that of the sediments being transported by the Mississippi, with the implication the sediments move directly from a shelf edge delta position and are transported downdip as turbidite flows with little or no change in overall sand size or sand composition. A pilot study was undertaken looking at 1600 samples from 35 wells to look at the issues of reservoir quality over a wider distribution of age and geographic location. Due to limits of available data the deepwater area of the Rio Grande is not represented, with all the well control being from the middle of East Breaks eastward to Viosca Knoll. A variety of data were available, including whole core, side wall cores, various grainsize data using different methodologies, XRD compositional data, and limited petrographic data. Most of the samples are mid Miocene and younger.

Observations from the overall data:

1. Some coarser and older samples in east. Possible Appalachian source?

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2. Mean grainsize as a function of age shows more coarse fraction younger. Is the young Mississippi more capable of transporting large grains (bigger river) or has access to bigger grains?

3. Kaolinite is more abundant in the older rocks in the east (Figure 2-3). Is this due to source or diagenesis?

4. Plagioclase is more abundant in the younger rocks in the central area (Green Canyon) (Figures 4-5).

5. Bar graphs of grainsize parameters versus different age brackets shows relative uniformity with time (Figure 6).

6. Bar graphs of constituents versus various age brackets shows slight trends (Figure 7).

Since the bulk of the data was focused in the Green Canyon corridor this data was looked at as a separate population. Changes in the rocks in this area should mostly reflect changes in the Mississippi, with some influences from the Sabine/Red. Observations from this area include:

1. Slight decreases in plagioclase, kaolinite, and chlorite with increasing age.

2. Mean grainsize increases in younger rocks.

3. In the dip direction both mean grainsize and sand percent tended to increase in the dip direction, then decrease in the most distal samples.

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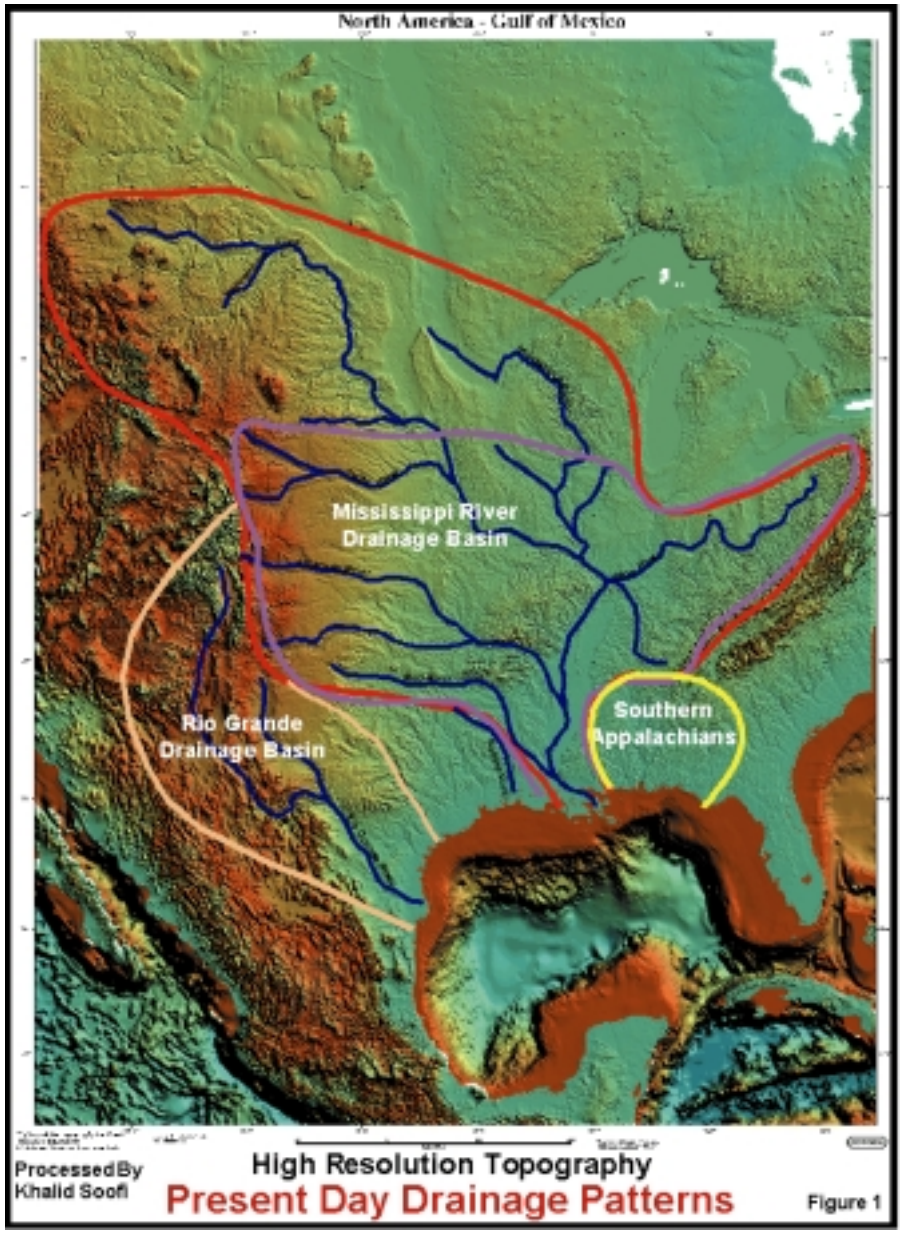


Figure 1 Present Day Drainage Patterns

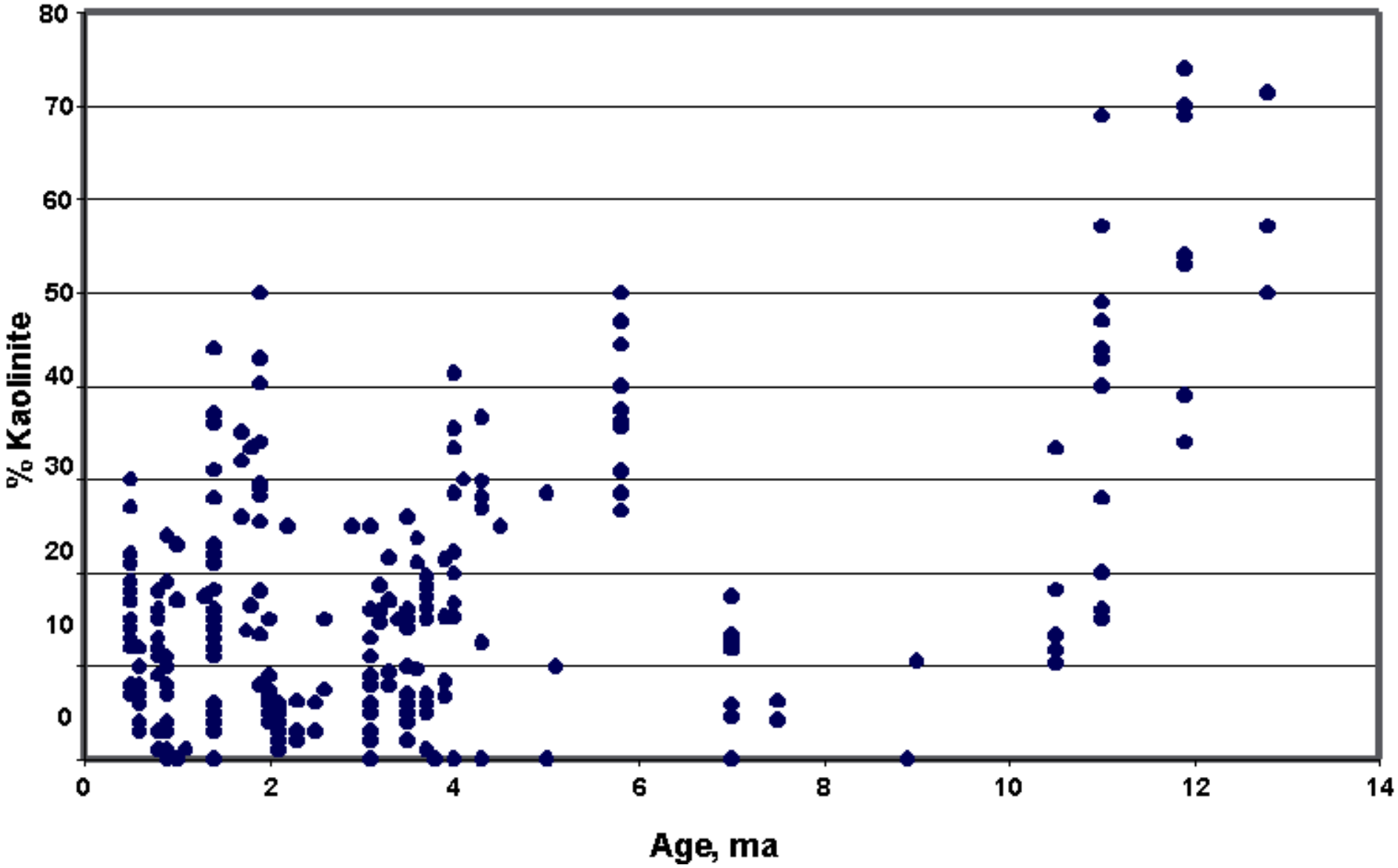


Figure 2 Percent Kaolinite as a function of age

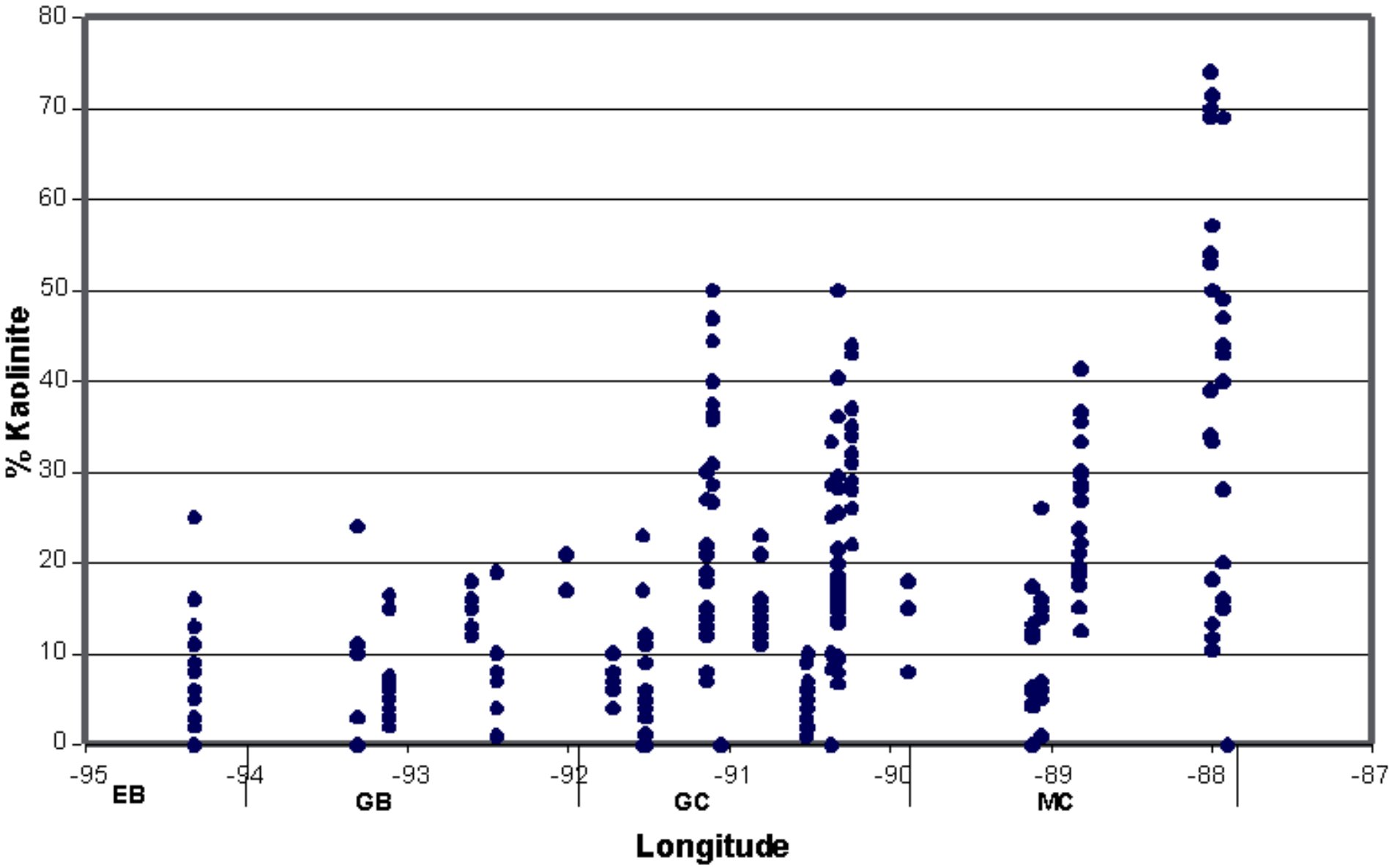


Figure 3 Percent Kaolinite as a function of Longitude

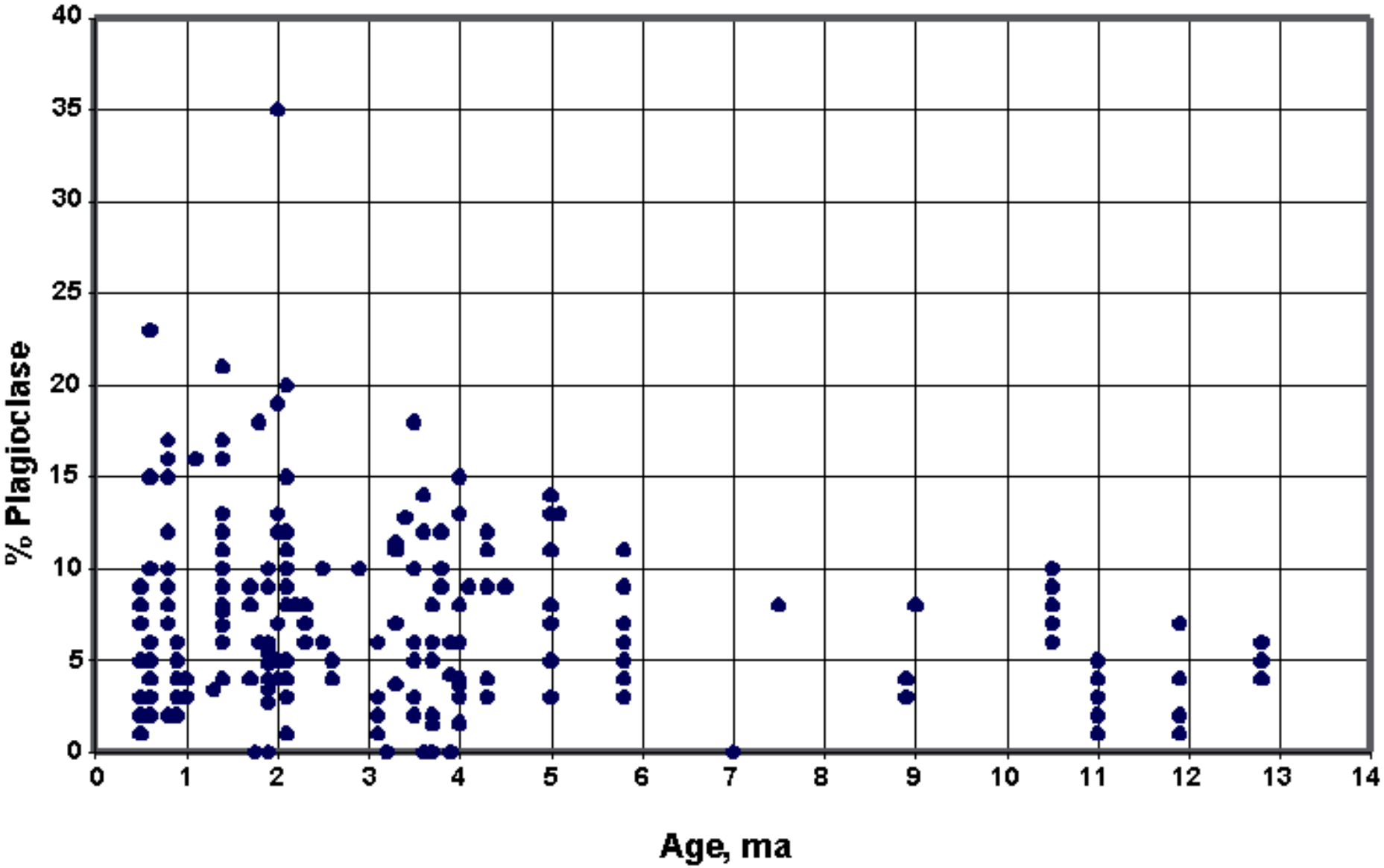


Figure 4 Percent Plagiclase as a function of age

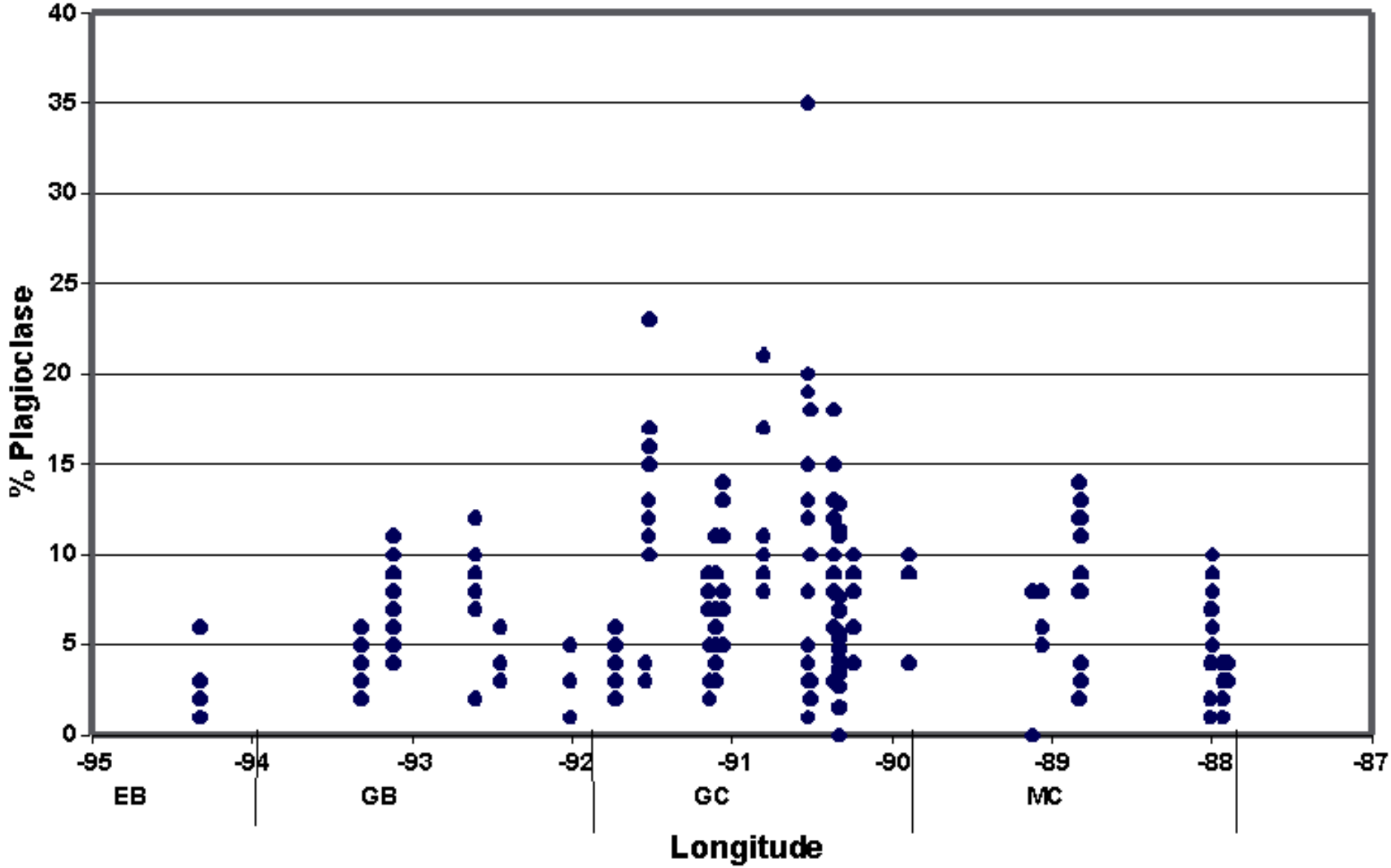
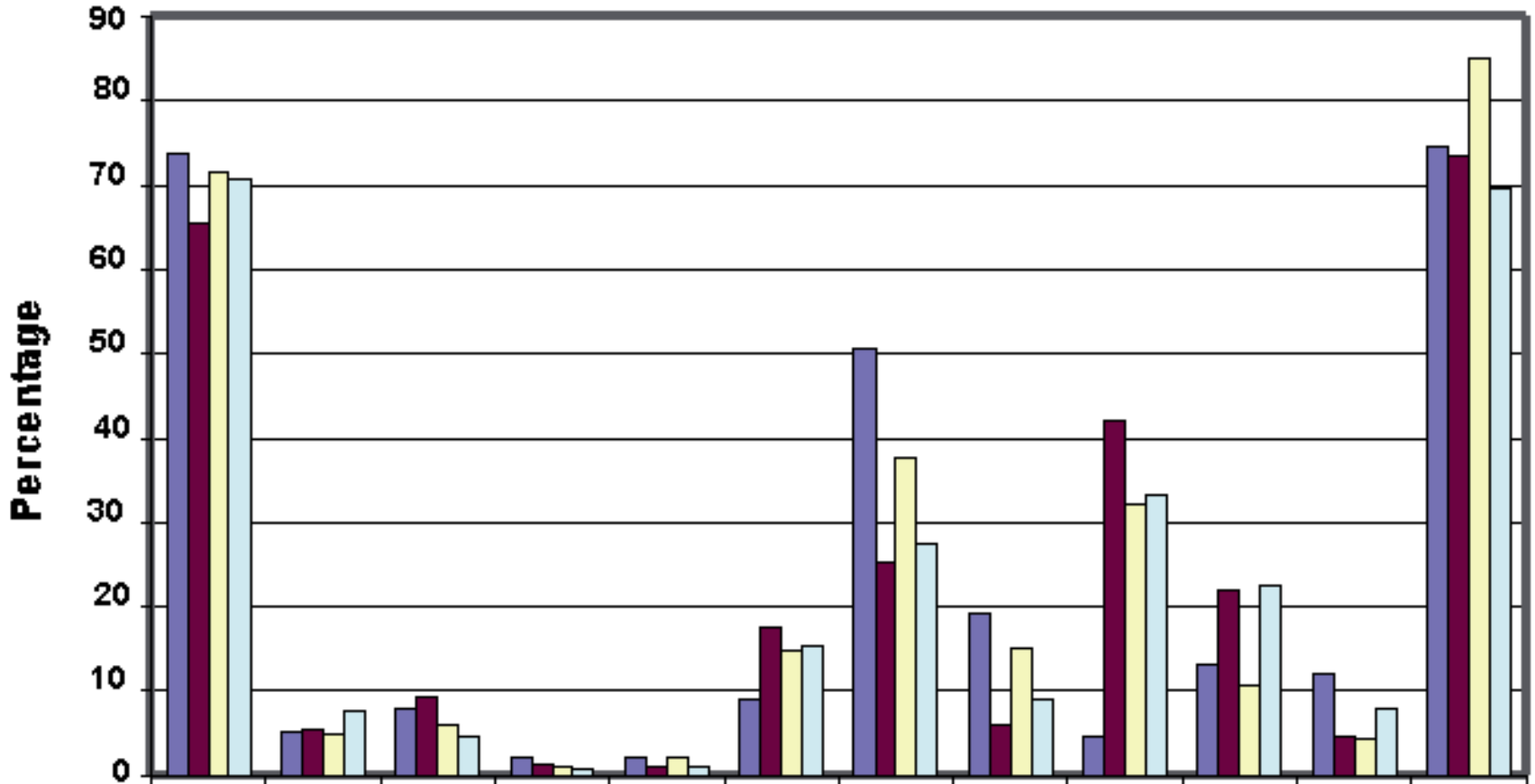


Figure 5 Percent plagioclase as a function of location



	Quartz	K-feldspar	Plagioclase	Dolomite	Calcite	Clay	Illite	Smectite	Mixed Layer (Ill-Sme)	Kaolinite	Chlorite	Ill+Smec+Mix
Above H. balthica, all	74	5	8	2	2	9	51	19	5	13	12	75
Above G. miocenica, all	65	5	9	1	1	17	25	6	42	22	5	73
Above G. nepenthes, all	72	5	8	1	2	15	38	15	32	11	4	85
Below G. nepenthes	71	8	5	1	1	15	28	9	33	22	8	70

Figure 6 Constituents bracketed by age

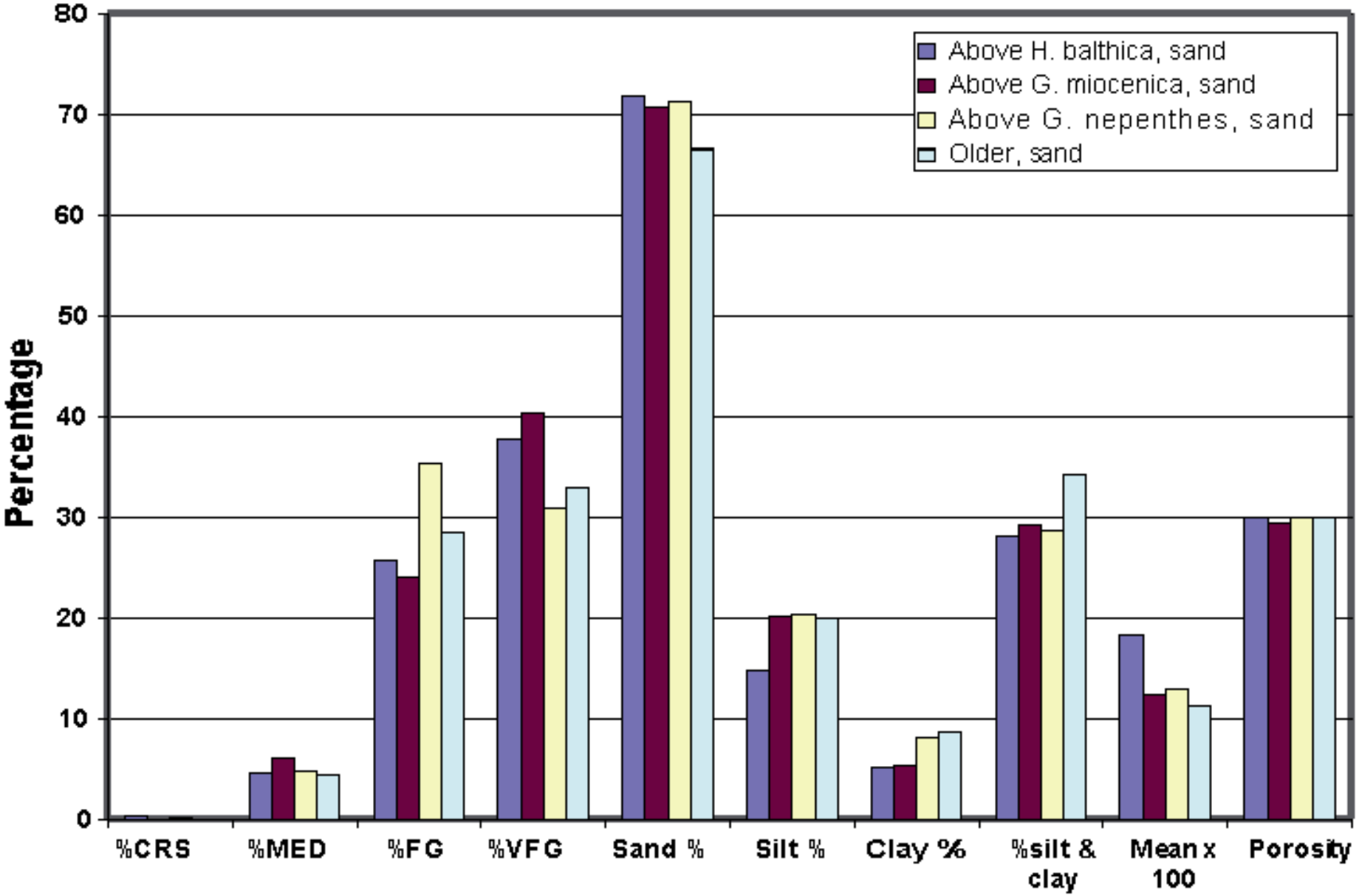


Figure 7 Grainsize analyses of samples with greater than 50% sand