EART120 FIELD TRIP #2 – April 24, 2016

PEBBLE BEACH AND PIGEON POINT

INTRODUCTION

The Upper Cretaceous Pigeon Point Formation (PPF) consists of more than 2.6 km of interbedded marine mudstone, arkosic sandstone, pebble and cobble conglomerate, and pebbly mudstone (Clark & Brabb, 1978). This formation is well exposed along a 16 km section of the central California coast in San Mateo County.

The outcrops that we will focus on today are part of an Upper Cretaceous succession on the Pigeon Point block located to the west of the San Gregorio fault (Fig. 1). Sediment-gravity flows, soft-sediment deformation, and other continental slope depositional processes were dominant in these environments. The locality lies along the Salinian block, a large tectonic sliver underlain by granitic rocks that is bounded by the San Andreas fault to the east (Fig. 1). The basal contact of the PPF is not exposed, but the basal contact for (presumed) coeval units at Point San Pedro to the north and Point Lobos to the south lies directly on the Salinian granitic basement. At no locality is the base or the top of the PPF exposed; in a few locations >50 m of unbroken section of this formation can be found. Fossils are rare in the PPF but ammonites of Campanian age (84-72 Ma) have been found.

In this field exercise you will measure two sections of the PPF where it outcrops at Pebble Beach State Beach (Fig. 2). You will also make observations at one locality at Pigeon Point (Fig. 3).

The goals of this exercise are to:

(1) **Measure two stratigraphic columns, one of great thickness and limited detail, and a second stratigraphic column that is only ~2 m thick but with a greater level of detail.** In making observations for this second outcrop you will examine in greater detail the structures that are contained within these deposits. All outcrop segments will be designated once we reach the outcrops. Like previous trips, you will work with a partner for the day.

(2) Interpret the sedimentary processes active during deposition of the beds. The succession is largely composed of various types of sediment-gravity flows; try to determine the rheology and sediment support mechanisms of the beds, based on sedimentary structures and textures, and determine the dominant type of deposit (Fig. 4).

(3) Subdivide the outcrop into more specific depositional environments. For the overall depositional environment you will need to explain the linkages between the deposits observed at Pebble Beach State Beach and at Pigeon Point. You should interpret the submarine fan environments (Fig. 5) as specifically as possible, and you should discuss possible reasons for facies shifts or cyclicity at the section.

ASSIGNMENT

1. PEBBLE BEACH: MEASURE BED THICKNESSES AND DESCRIBE LITHOLOGIC UNITS FOR TWO OUTCROPS (OUTCROPS TO BE IDENTIFIED BY INSTRUCTOR ONCE WE REACH THE SITE).

Again, you will use a Jacob's staff to measure the thickness of the beds at the outrop. Since the beds at Pebble Beach are tilted, you need to use the staff to correct for tilt while in the field (the process is the same as field trip 1, but if you would like a refresher on how to do this ask your TA). Before you start measuring, you should look for stratigraphic "up" indicators, such as ripples, graded bedding, or sole markings, to determine whether the section is upright or overturned.

As in previous field exercises, the features you should look for and take note of include:

- full lithology description
- bed thickess and lateral continuity
- grain size variations
- nature of bed contacts
- bed top and bottom structures (ripple marks, sole markings, etc.)
- internal sedimentary structures and textures
- vertical patterns/trends/cycles (in bed thickness, grain size, etc.)

These and other data should be systematically recorded in your field notes as you make detailed observations and measure the sections.

You will produce two stratigraphic columns from today's exercise. The larger column (Title = "Pebble Beach, Full Outcrop") should be drafted at a vertical scale of **1 inch = 3 m**. The smaller and more detailed column (Title = "Pebble Beach, Detailed Section") should show all of the small-scale features that are visible in that designated outcrop. This detailed column should have a vertical scale of **1 inch = 25 cm**. As with all of your columns, they should be constructed with the horizontal axis indicating the grain size profile (see template at eCommons). Note that the vastly different vertical scales require you to adjust your perspectives in observation and interpretation between each column.

2. PIGEON POINT: DESCRIBE ONE OUTCROP (TO BE IDENTIFIED ONCE WE REACH THE LOCATION). COMPARE AND CONTRAST THE DEPOSITIONAL ENVIRONMENTS AND FACIES HERE TO THE PEBBLE BEACH OUTCROP.

Several sites will be designated for observation at this field stop. You will sketch one outcrop and describe the details you observe. In your lithologic descriptions at this site pay careful attention to clast lithologies. These data may help to indicate the source of the exposed units. In addition, at the designated sites pay careful attention to bed geometries, lateral continuity, and stratigraphic orientation of the beds. You will not have to turn in any column or figure from this site but your observations may help to you synthesize the data between the two field sites and gain an overall grasp of the depositional systems that produced these deposits.

3. WRITE A REPORT AND DRAFT TWO STRATIGRAPHIC COLUMNS.

Using the format provided in previous handouts, document your results and interpretations in the form of a written report (maximum length 1000 words). The report should be double-spaced and include all of the relevant information, such as:

- Your succinct description and interpretation of the Pebble Beach outcrop section
- Your succinct description and interpretation of the Pigeon Point locality
- Causes of any depositional cyclicity or trends at Pebble Beach
- The relations between the depositional environments represented by the two outcrops

As always, each student should write his/her own report and construct his/her own columns, and all interpretations *must* be supported by your own observations. Make sure to follow the instructions and tips for writing – in particular, include specific details and be organized and logical! You should give your report a descriptive title (not included in the word limit). You can use subheadings if you wish (they also will not be counted in the word limit).

Your report draft is due by noon on May 9th. Submit it electronically to your eCommons drop box.
The final report and two stratigraphic columns are due by class on May 13th. Submit the report electronically to eCommons and the columns as hard copies in class or my box.

References Cited:

Clark, J. C. And Brabb, E. E., 1978, Stratigraphic contrasts across the San Gregorio fault, Santa Cruz Mountains, west central California, In: San Gregorio-Hosgri fault zone, California (Silver, E. A. and Normark, W. R., eds.), California Division of Mines and Geology, Special Report 137, p. 3-12.

Walker, R. G., 1984, Turbidites and associated coarse clastic deposits, in: Facies Models, 2nd Ed. (R. G. Walker, ed.), Geoscience Canada Reprint Series 1, p. 171-188.

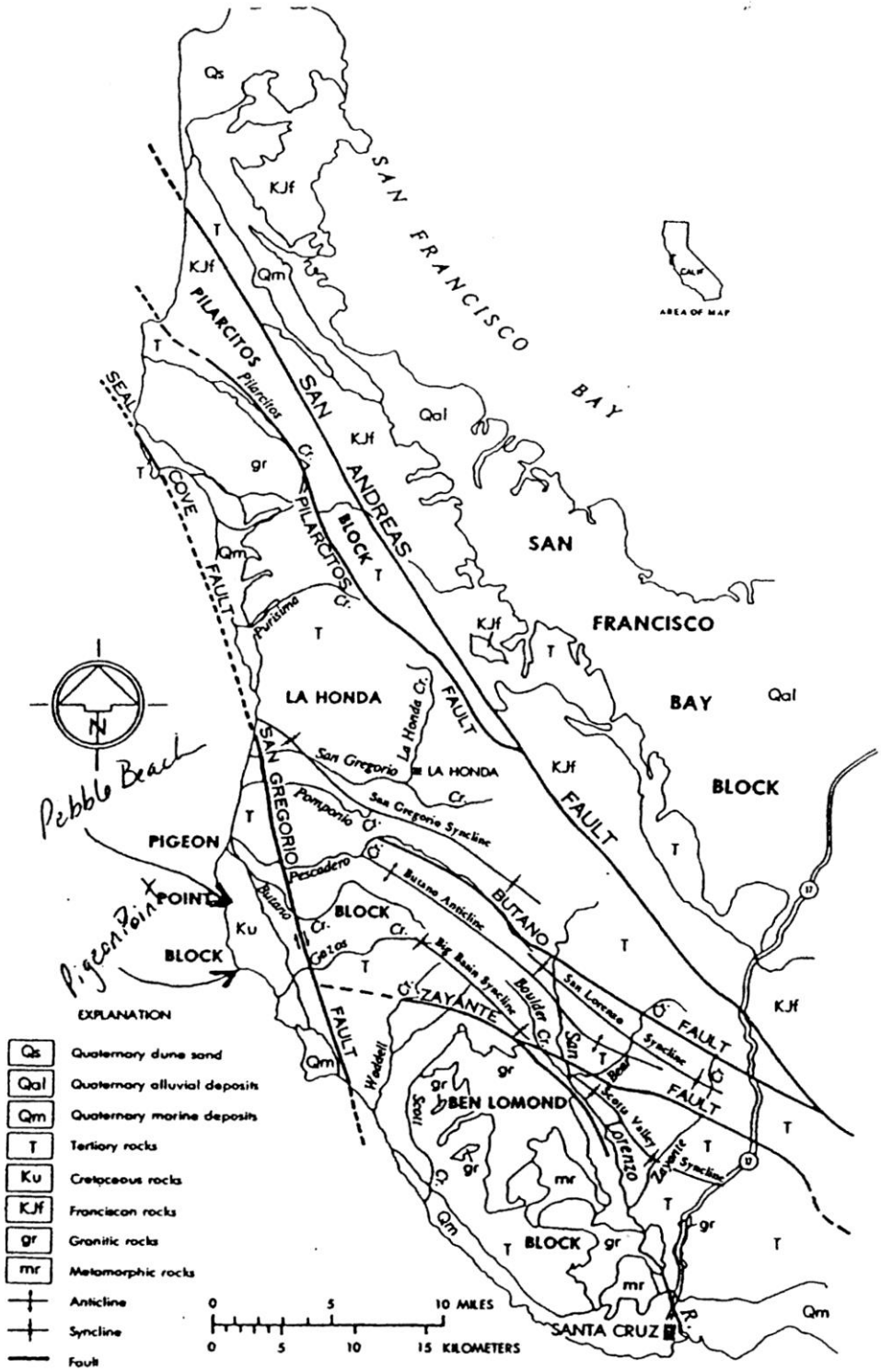

Figure 1. Simplified geologic map of the Santa Cruz Mountains area showing major tectonic blocks, faults and folds (after Clark and Brabb, 1978, and others)

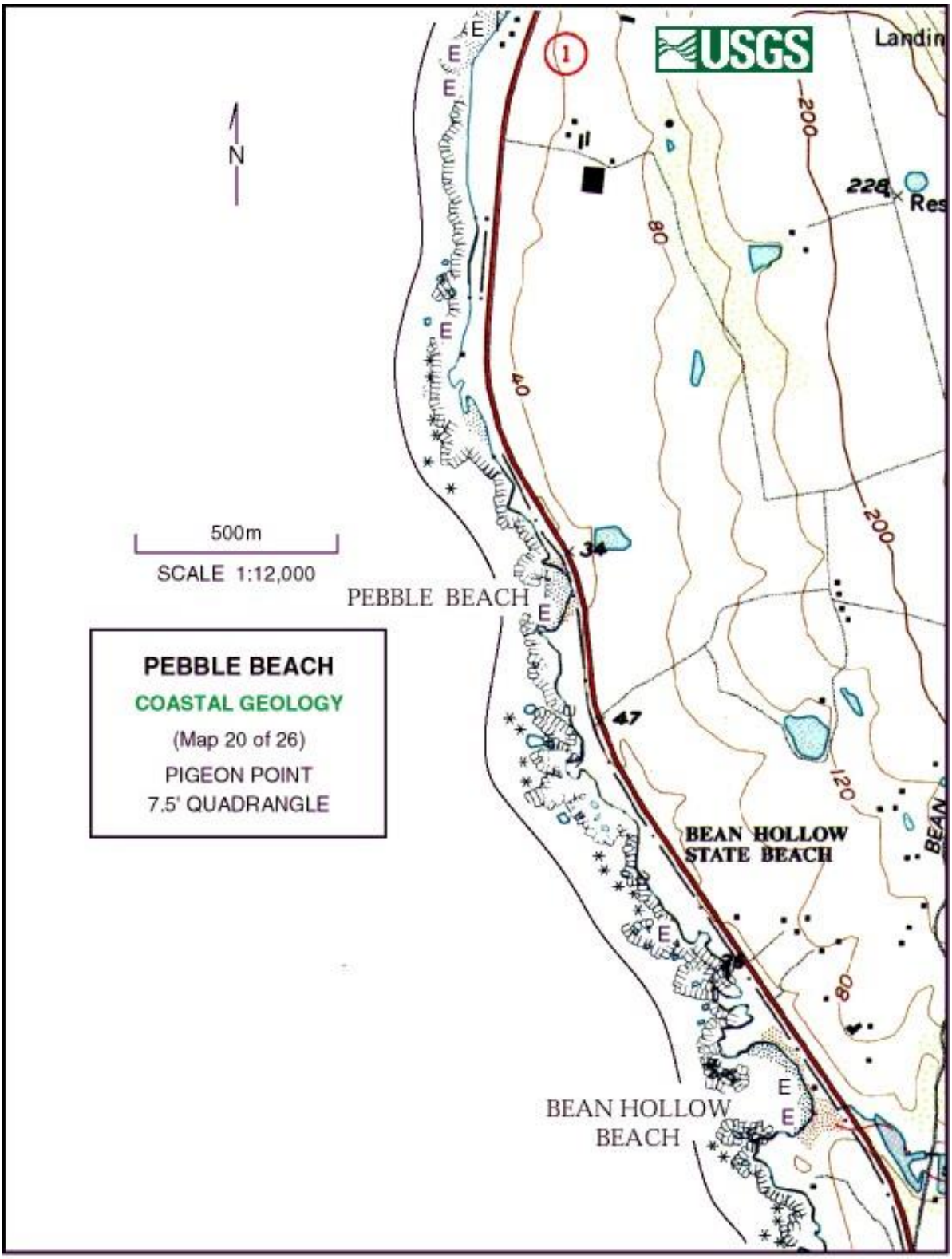

Figure 2. Pebble Beach location map, Pigeon Point quadrangle.

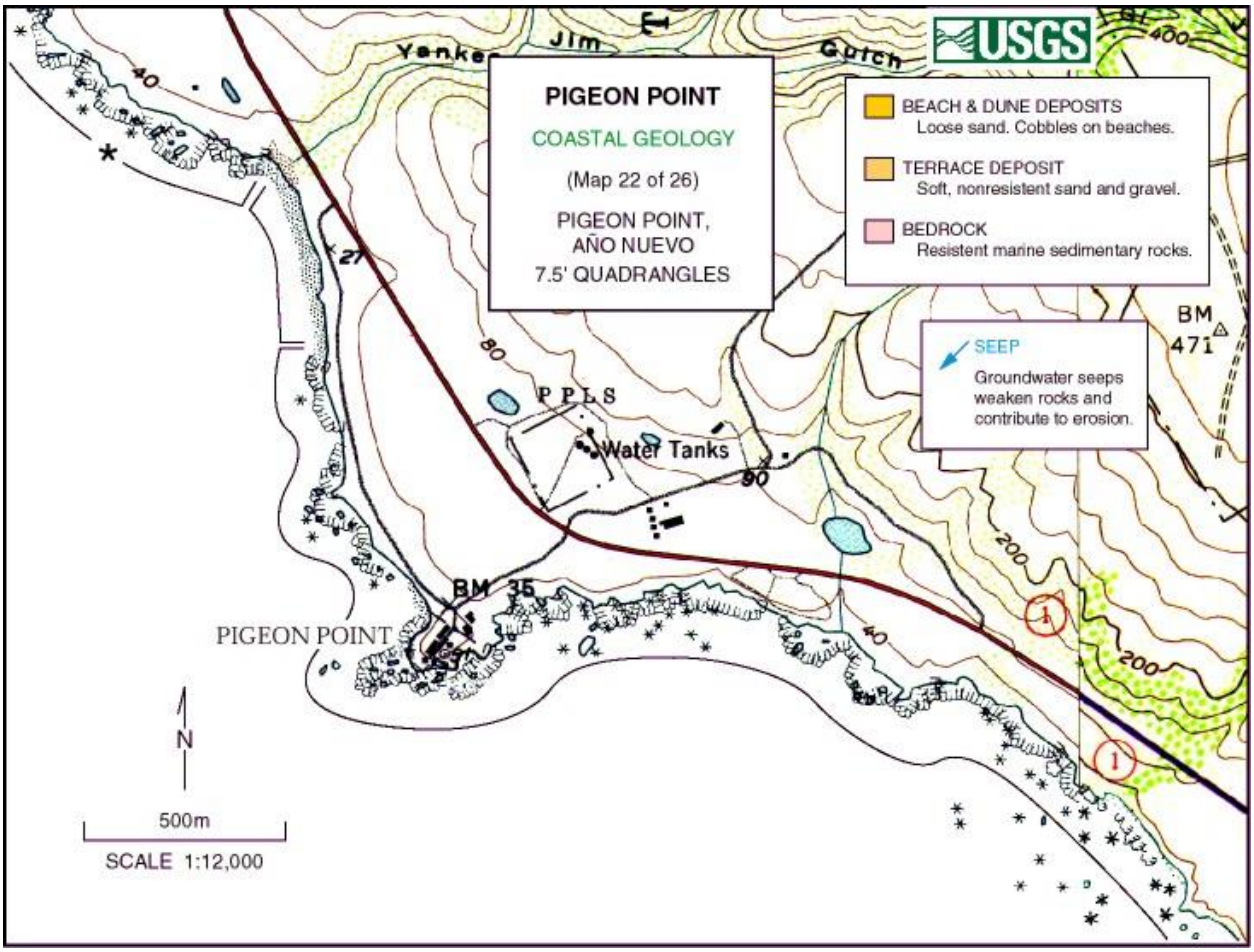

Figure 3. Pigeon Point location map, Pigeon Point quadrangle.

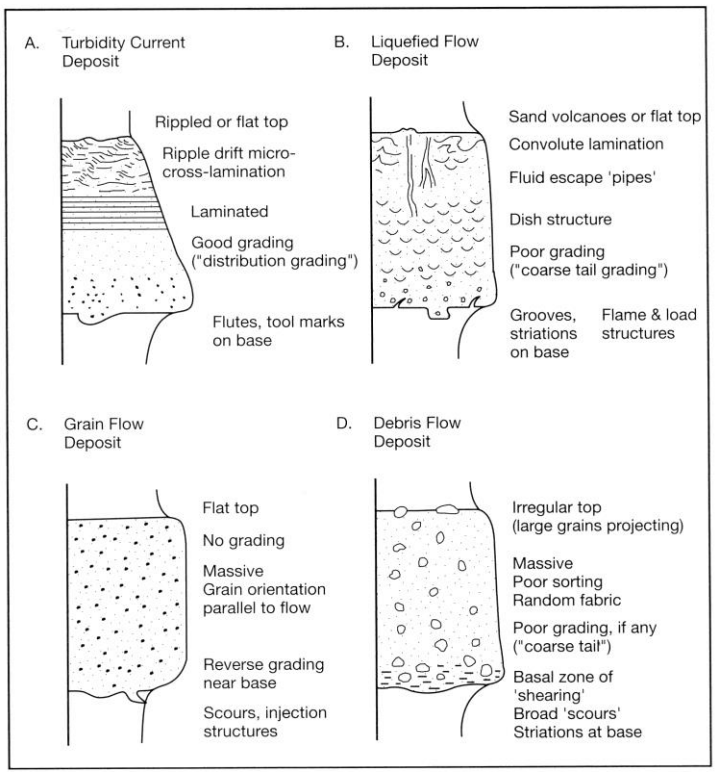

Figure 4. Sedimentary structures of the four major types of sediment-gravity flow deposits.

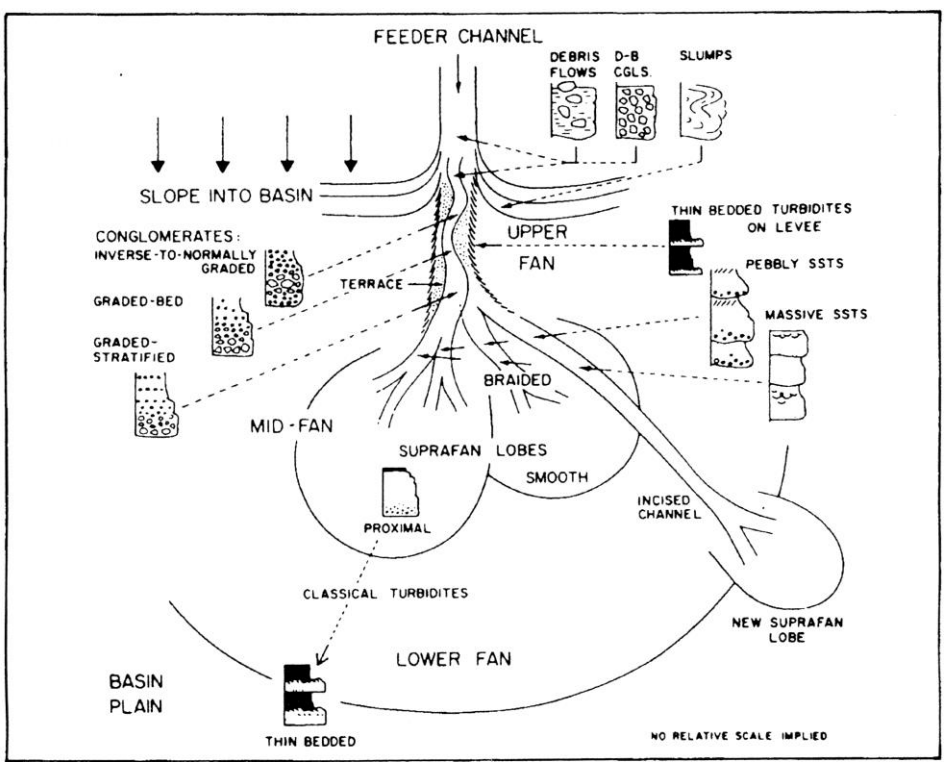

Figure 5. Classic simplified submarine fan model of Walker (1984).