Relationship of Amazon Fan growth to sea-level change

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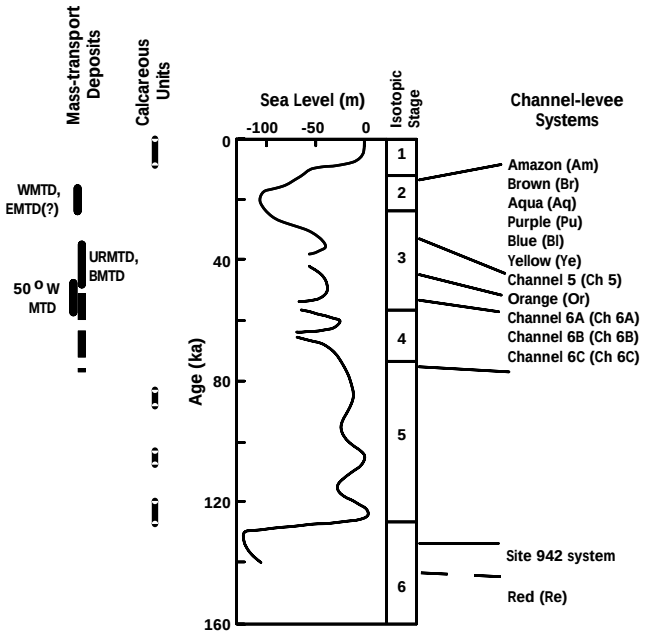
Submarine fans form the largest deep-water sediment bodies on continental margins, and their sediments provide important information about land and sea climate, sea level, and tectonic activity. Muddy fans form where sediments from large rivers deposit directly into the deep sea while sandy fans are more likely to form near smaller rivers. At the present time, sea-level is high because continental glaciers are small, and sediments from most large rivers create deltas on the continental shelf. However, during glacial periods sea level was up to 100 m lower than today because water from the ocean went into ice on land. As a result, muddy fans were active off all large rivers (for example, off the Amazon and Mississippi Rivers) during glacial periods. An understanding of fan structure and growth is important because many oil and gas deposits occur in sandy layers in older fan sediments. Some workers (e.g., Posamentier and Allen, [1993]) have suggested that sandy sediments are not common in muddy fans, or that they are present only in channels or when the fan first becomes active. However, our studies [*Flood et al.,* 1991] suggested that sandy layers are more common because they also form as channel patterns evolve. The Amazon Fan, one of the largest modern fans, is a typical muddy fan with a well-developed network of submarine channels that look (and probably act) like subaerial river systems with meanders, levees, overbank deposits, and avulsions [*Flood et al.,* 1991]. Leg 155 studied the development of the Amazon Fan during the last few late glacial-interglacial climate and sea-level cycles to characterize its growth patterns and sediment facies, and to determine the climate records contained in the sediments. Channels, levees and other facies imaged on seismic records, were sampled and dated using combined paleontology, paleomagnetics, ^{14}C, and seismic profiles, and their activity was related to sea level (figure). These results show that a sequence of channels and levees were active on the fan whenever sea level was low, and inactive when sea level was high. Sedimentation patterns related to channel evolution (especially the formation of new channels by branching off of older channels) created coarse, flat-lying sand deposits that extend into still deeper water. These sandy deposits are newly described units that may significantly change our understanding of how and when sandy sediment deposits form on continental margins.

Amazon Fan Stratigraphic Summary



Sea-level curve for the last appx. 150,000 years showing the ages of the different channel-levee systems (left, given color names), mass-transport deposits (right) and calcareous units. Channel-levee systems existed whenever sea level was lower than about 25 to 30 m below present. Calcareous units are only present when sea level is at its highest. Mass-transport deposits, which appear to have formed whenever the fan was active, occurred over short intervals within the time ranges shown. Extensive sandy layers are found when and where new channels are created.

References:

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