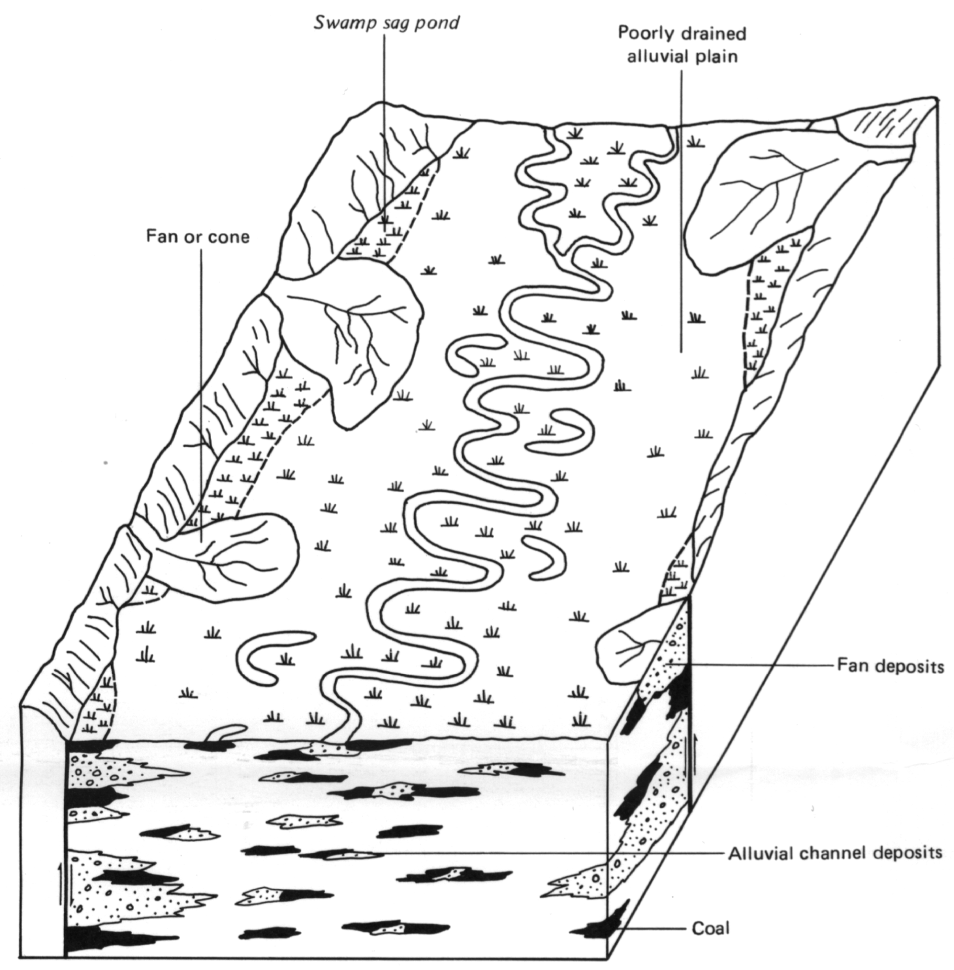
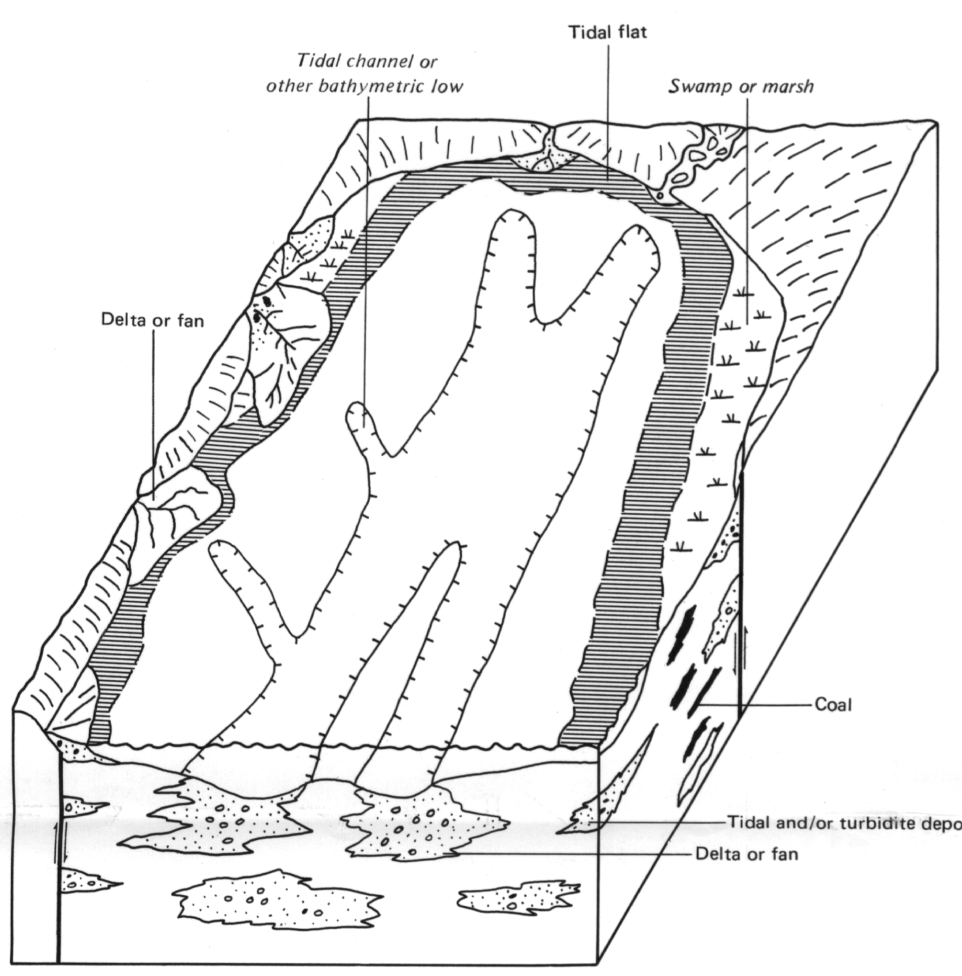
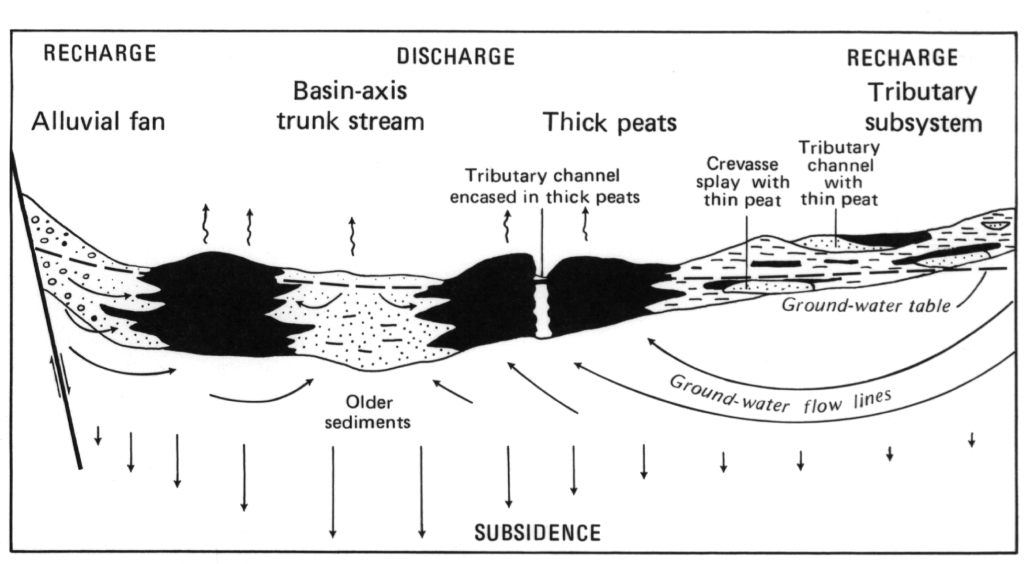


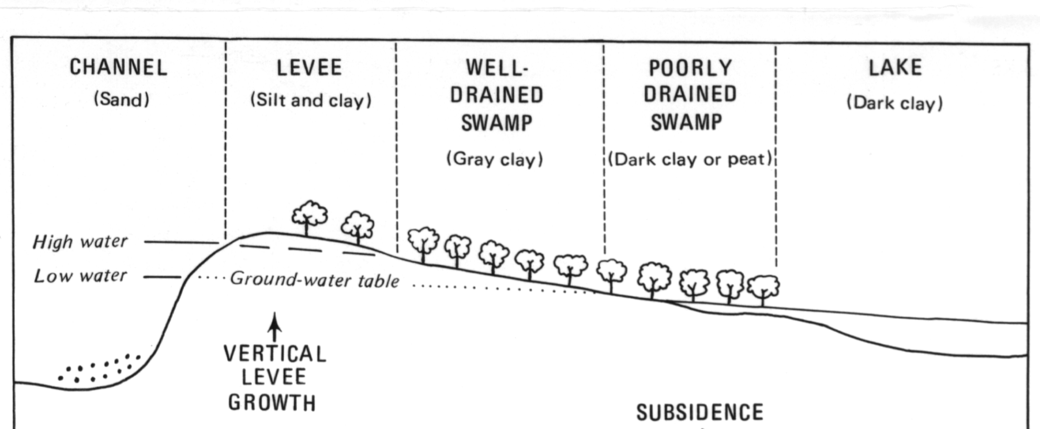
Idealized depositional model for the Tyonek Formation, Kenai Group, Cook Inlet, Alaska (after Hite, 1976).



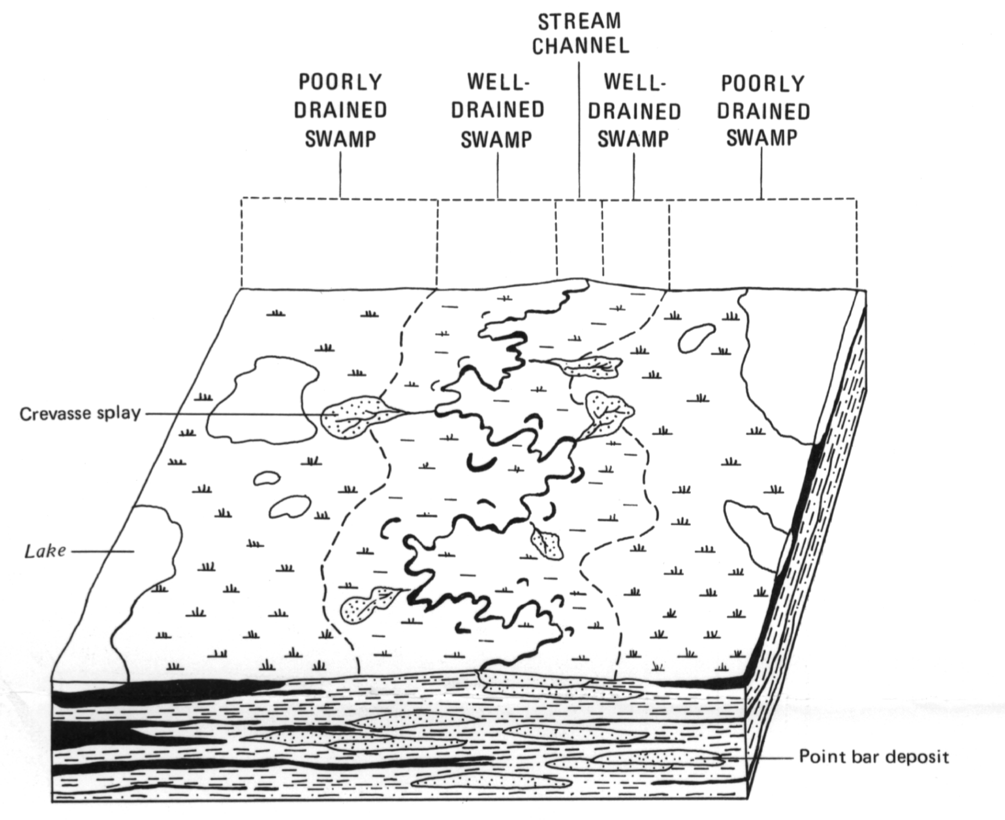
Idealized depositional model for the Hemlock Formation, Kenai Group, Cook Inlet, Alaska (after Hite, 1976).



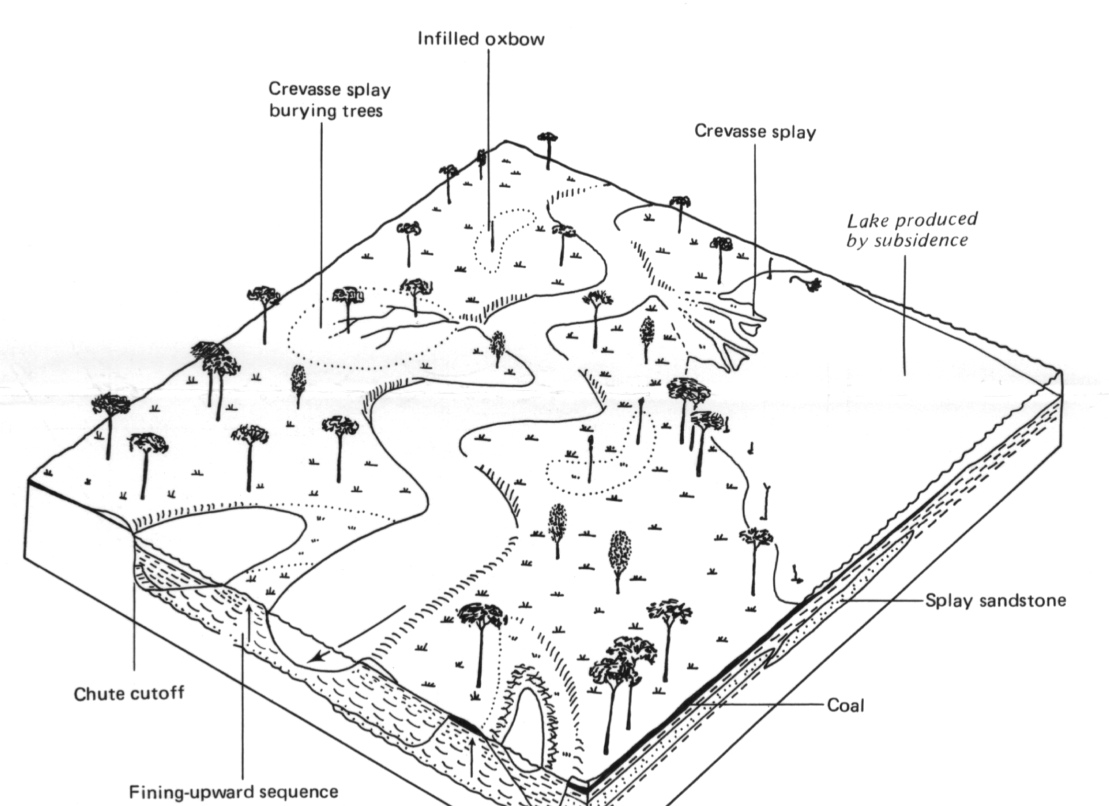
Generalized model (after Ethridge and others, 1981) illustrates both a mechanism for the development of thick peats adjacent to major stream channel systems and its relation to regional uplift, subsidence, and ground-water hydrology. Model developed for coal-bearing lower Wasatch and upper Fort Union Formations, southern Powder River Basin, Wyoming, but equally applicable to coal depositional areas of the Kenai Group strata of the Susitna Lowland.



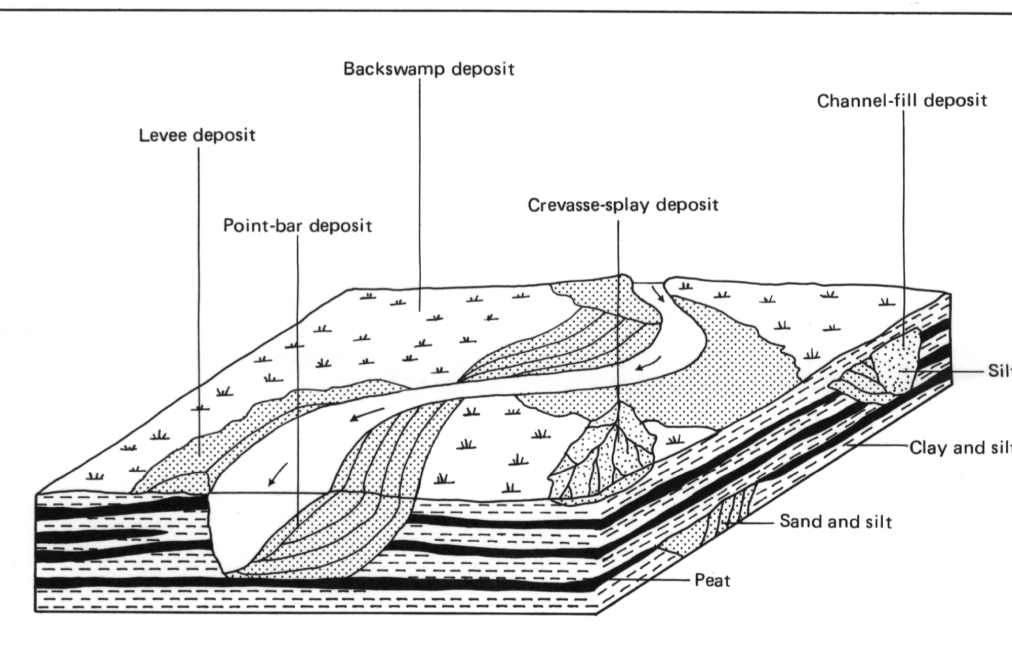
Relation of high- and low-water levels of the ground-water table to channel and channel-margin environments (after Beaumont, 1979). Petrology indicates that most Susitna Lowland coals probably formed in the telmatic zone—between high- and low-water marks. The typical forest-moor facies forms in this zone. A drier paleoenvironment, perhaps in the terrestrial zone, and an origin from tree-vegetation peats are envisioned for some of the relatively thin and high-ash coals of the upper Tyonek and Sterling Formations of the northern Yentna basin; these coals contain relatively high fusinite contents.



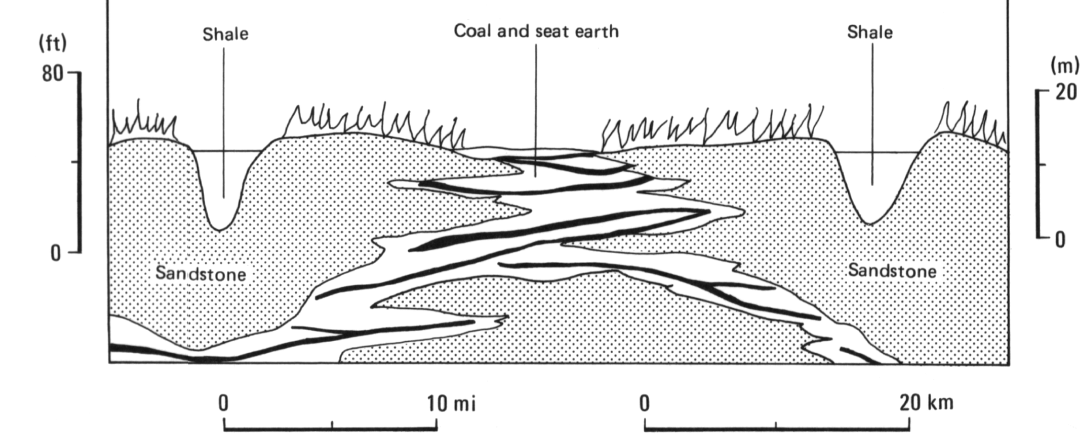
Depositional environments of the Fort Union Formation (Tertiary), northwestern Colorado (after Beaumont, 1979). Similar depositional areas were prevalent in south-central Alaska during Tertiary time. Source areas adjacent to the basin of this region were rejuvenated during the Late Cretaceous and early Tertiary. Periodic and gradual tectonism (uplift) converted areas of the developed alluvial flood plain into coal-forming environments. Occasional stagnation of depositional areas allowed the accumulation of vegetal material and peat formation. For the thicker and more continuous seams such as those of the Tyonek Formation, a restricted sediment supply that would not interrupt formation of a thick peat deposit is postulated. A gradual rise of the ground-water table is also envisaged; it would preclude 'drowning' of this developing peat swamp. Rapid subsidence would have initiated the accumulation of clastics. However, gradual subsidence with periodic standstills formed coal swamps in paleolows between flood events. Thicker coals within the fluvial system generally parallel the depositional dip. The thickest seams in a particular depositional basin are found adjacent to depocenters; coal beds typically thin and pinch out toward the periphery of basins.



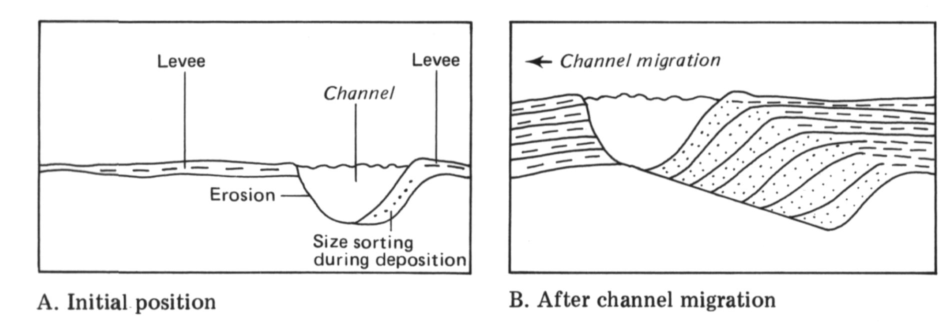
Model for deposition of Port Hood Formation (Carboniferous), Cape Linzee, Nova Scotia, Canada (after Gersib and McCabe, 1981). Fluvial depositional environments such as those indicated in this model characterize the deposition of certain sedimentary sequences of the Kenai Group (especially Tyonek Formation strata). The chief subenvironments are point bars, natural levees, lakes, lacustrine deltas, abandoned channel fills, crevasse splays, and backswamps. Abundant plant growth characterized these broad flood-plain platforms. Rapid sedimentation during flooding buried these plant materials. Upright stumps or kettles are common in continental fluvial paleoenvironments (Horne and others, 1978).



Generalized depositional model for Bullion Creek and Sentinel Butte Formations (Tertiary), western North Dakota (after Groenewold and others, 1981). The same subenvironments depicted in this model also characterize Tyonek Formation deposition. The backswamp deposits ideally consist of the basal seatrock (often underclay), coal, and overlying carbonaceous shale. Discontinuities or splits in coal seams often represent ancient levee deposits of active channels and crevasse splays. Localized pod-shaped coal bodies may represent accumulations of organic materials adjacent to meander channels of ancient flood plains. Channels can be either contemporaneous with or postdate peat accumulation. These channels (channel fill) directly affect the minability of a particular seam. When a channel completely removes a coal seam it results in what is termed a 'washout' (Horne and others, 1978).



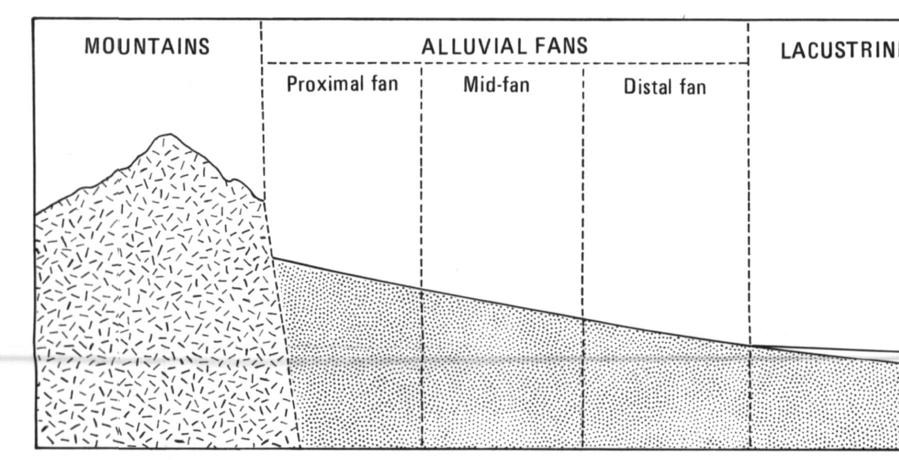
Generalized cross section of alluvial plain depositional environments (after Ferm, 1974). Model developed from Allegheny of West Virginia. However, the model is equally as applicable to Tyonek Formation deposition. In this system, subsidence rates vary from area to area during deposition and often is controlled by regional faulting, which definitely played a role in the Susitna Lowland. At any one time, coal or peat was probably forming in numerous but relatively contained areas of the plain, as illustrated by the lack of extensive lateral continuity of the seams. The rapid lateral and vertical changes in lithology result in a general inability to correlate the coal beds.



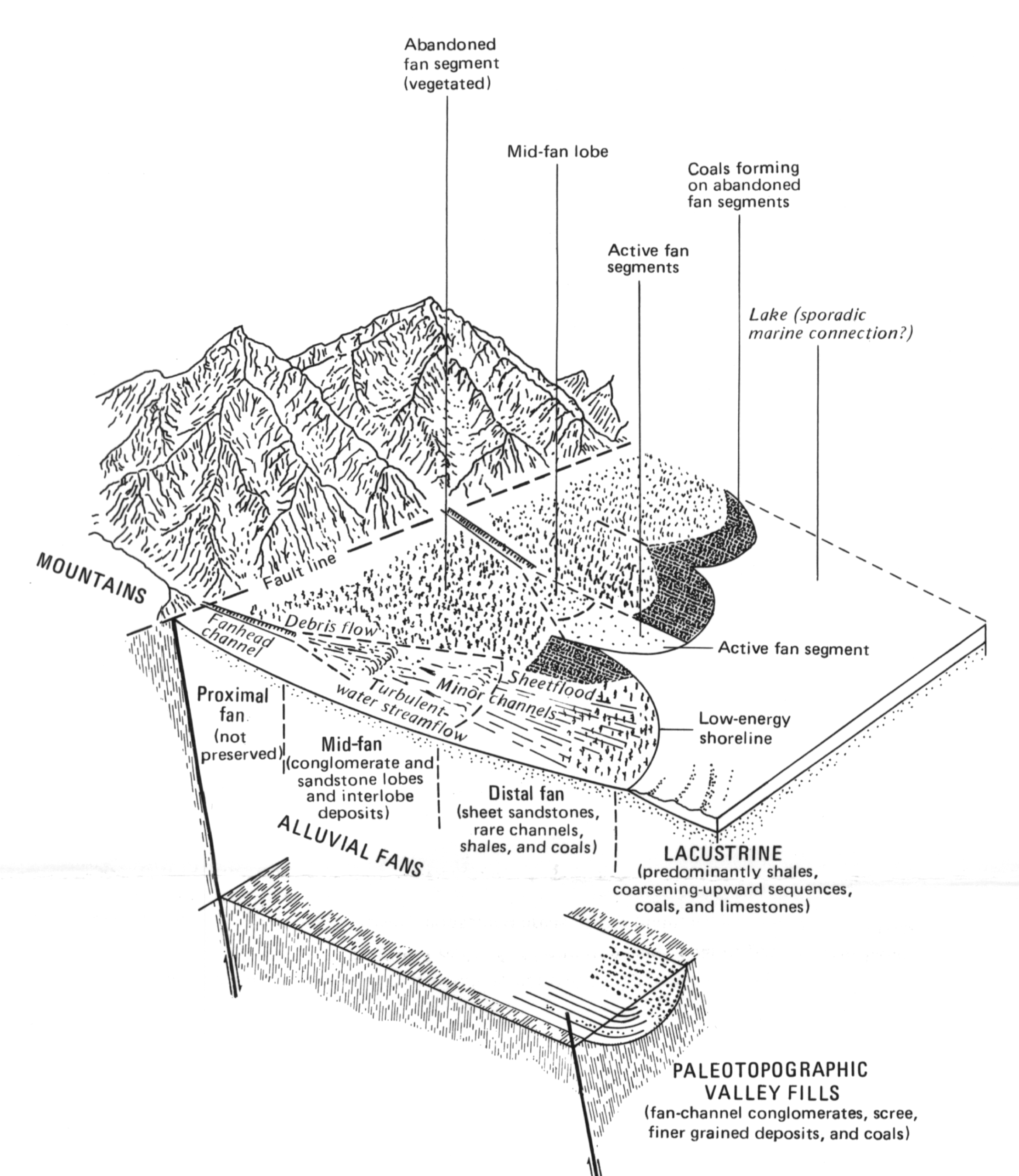
A. Initial position

B. After channel migration

General sediment distribution pattern in an alluvial channel with coarser sediment deposited in lower part of channel and finer material on the banks (after Ferm, 1974). Lateral migration yields fining upward sequences common within the Tyonek Formation of the Susitna Lowland. Locally these sequences are cyclic, as displayed at Fairview Mountain.

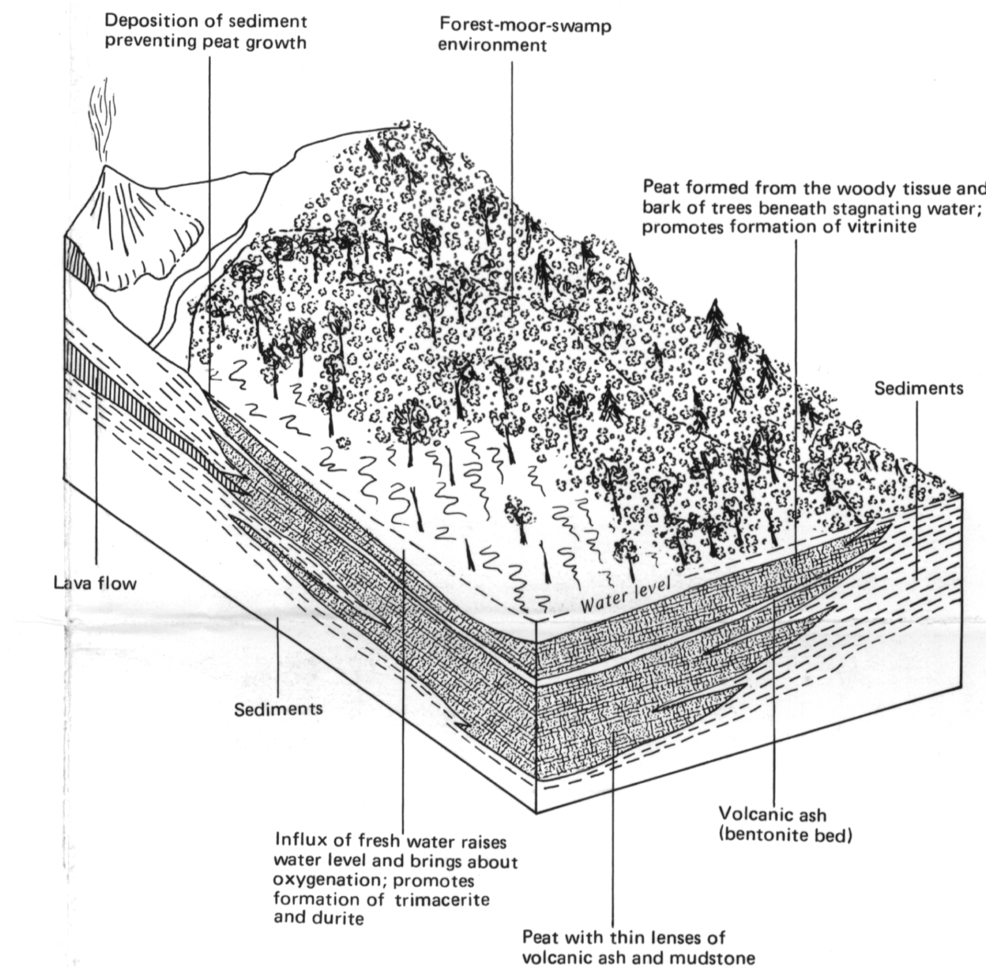


A. Generalized cross section

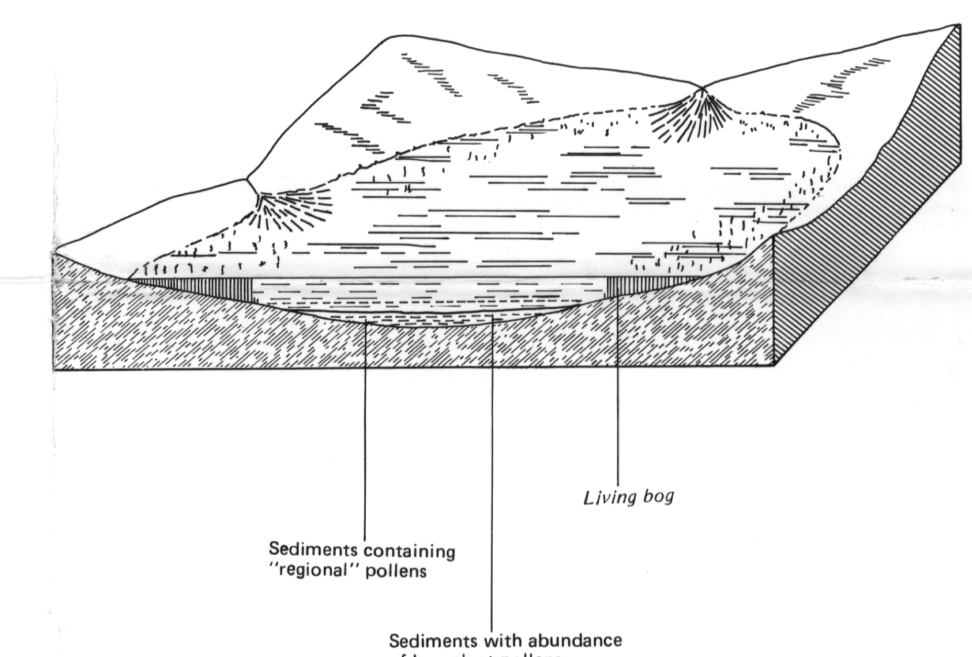


B. Block diagram

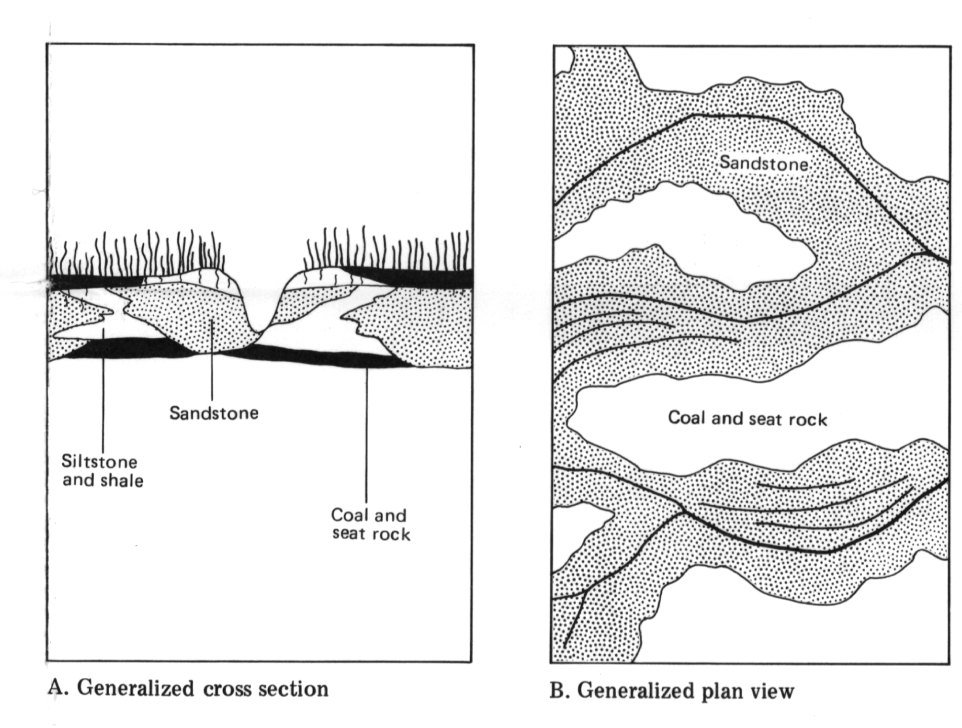
Depositional model for alluvial-fan and associated paleoenvironments of coal-bearing sediments (Upper Pennsylvanian), northern Spain (after Heward, 1978). Some coals of the Susitna Lowland, particularly those rimming the basin in or near the southern foothills of the Alaska Range (Tyonek and Sterling Formations), are probably associated with similar distal-fan and lacustrine depositional environments. Clardy (1978) points to a braided-stream system draining a tectonically active area for the deposition of the Sterling Formation, which is conglomeratic near basin margins and represents a high-energy, near-source environment; he feels that the Beluga Formation may have been deposited in an area of coalescing alluvial fans and plains from source areas of moderate to low relief.



Generalized model for the depositional setting of the upper coal seam of Tulameen coal field (Eocene), south-central British Columbia, in a forest-moor-swamp environment (after Williams and Ross, 1979). The overall petrology of Susitna Lowland coals is very similar in maceral-group proportions to this coal. Hence, most Susitna Lowland coals (particularly those of the Tyonek Formation) may have also formed in a forest-moor-swamp environment within a poorly drained low-lying basin adjacent to an eroding upland during a warm and moist climatic period. Volcanic ash partings (from volcano, upper left) show the contemporaneity of volcanic activity with coal and sediment deposition. The partings (some are tonsteins) occur in certain Susitna Lowland coals and are important for dating and correlation.



Thick coals are common in lacustrine settings (after Falini, 1965). Certain coals of the Susitna Lowland are probably related to lake deposition and lacustrine deltas. A thick coal seam in a small synclinal basin east of Beluga Lake may represent a lacustrine coal. This model would be similar to the basin-center coal and fringing marginal-shale facies model proposed by Hacquebard and Donaldson (1969) for basins in Nova Scotia. In contrast to this model is a basin-center shale lacustrine model. The relation of pollen types, abundances, and ages to bog deposition is indicated. The oldest peats and other organic matter are often found in the deepest part of the bog. Pollens are used for dating and correlation.



A. Generalized cross section

B. Generalized plan view

Alluvial plain deposition (after Ferm, 1974). The Tyonek Formation appears predominantly to be a product of a wandering, sinuous fluvial system over an alluvial plain. This lateral migration is indicated by the lithologic relations and fossil-plant associations. Rapid lateral and vertical changes in lithology are common. Channel deposits are characterized by coarser grained clastics, whereas finer grained rooted siltstone beds, shales, and thin coals compose interfluve sediments. Levees flanking channels are typically composed of finer grained sandstone and siltstone.

CONTINENTAL FLUVIAL MODELS AND PALEOENVIRONMENTS OF COAL DEPOSITION