b21 Periglacial loess and dunes < *peri* means "*just beyond the margin of* ">

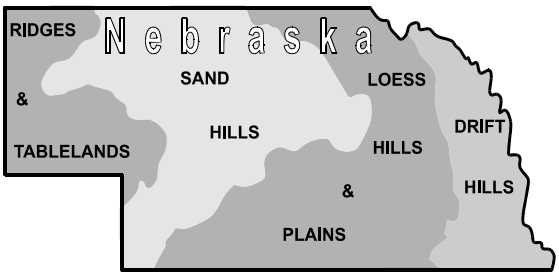
> ... mounds and winding ridges, ... give a hummocky and rapidly undulating outline to the ground. ... Seen from some dominant point, such an assemblage ... looks like a tumbled sea ... carpeted with fresh green turf ... Almost all the isolated solitary mounds ... are made up of fine sand ... A small one, quite close to Dunfermline, is locally famous under the name of Mont Dieu. According to old story this drift mound owes its origin to some unfortunate monks who, by way of penance, carried the sand in baskets from the sea-shore at Inverkeithing. A similar tradition accounts for a conical hill of fine sand at Linton, in the valley of the Kale Water, Roxburghshire; of this hill it is said that 'two sister nuns were compelled to pass the whole sand through a riddle or sieve as a penance for their transgressions, or to obtain pardon for a crime of a brother.' —James Geikie, *The Great Ice Age*, 1875.[1]

In the northern Great Plains, periglacial depositional features are extensive areas of loess and dune sand deflated from glacial meltwater river floodplain deposits that were evidently unprotected by vegetation cover when frigid katabatic easterlies drained off of the Laurentide ice sheet.

Loess Since the ice age, the loess has weathered into rich agricultural soils that support an abundant growth of grasses (wheat, sorghum, corn, oats, barley, and alfalfa hay), soybeans, and beets.[2]

Dunes Ice-age related relict dune sands are now mostly stabilized (fixed) by vegetation. But everywhere these are in a precarious state as soils on them are neither thick nor well developed and are poor in the organic matter that promotes the growth of vegetation (the same holds for buried relict soils in the dunes). Although grass-fixed dunes can support limited grazing by cattle, overgrazing or drought can remobilize the sand turning the whole back into a wind-shifting erg (sand sea). The largest area of fixed dunes in North America are the Sand Hills in Nebraska (***Figure b21.1***) that cover a full one-quarter of the state.[3] Westbound pioneers were frustrate on the Great Plains by active dunes that had been that revived 50 years earlier by a lengthy dry spell in the 1790s. The same drought had remobilized dune fields in the Great Sand Hills region between Medicine Hat, Alberta, and Swift Current, Saskatchewan.[4] In Nebraska, NW-SE longitudinal dunes with crossbedding dips in two directions record seasonal northerlies and southwesterlies late (800-1000 years ago) in the Medieval Warm Period.[5] Sediment cores reveal that for 2,000 years before, the dune fields at several times were active over wide areas. This is contrary to a long held belief, informs Daniel R. Muhs, that the dunes have been "frozen [fixed]" in place since the last ice age.[6]

Figure b21.1 Surficial deposits in Nebraska



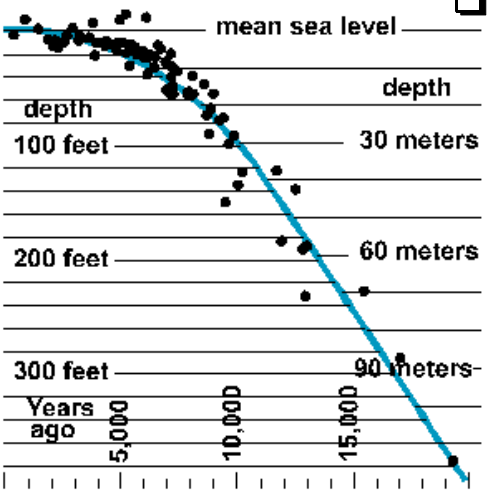


Figure b22.1 [1] Sealevel rise shown is due to water returned to the sea as continental glaciers melted at the end of the Ice Age. The data are carbon-14 ages and (negative) elevations of littoral shells and estuarine peat of drowned stable continental margins. Evidently, areas (volumes) of glacial ice have remained about the same size in the last 6000 years. The melting to this remnant of Ice Age glaciers (evidently well underway by the beginning of the Holocene 11,800 years ago) caused sealevels to rise rapidly (at the rate of about a meter a century).[2] Before post-glacial uplift eliminated them, the rising sea, which prehistorically flooded the Gulf of St. Lawrence, poured into deep channels in the shelf and to the east and west of the now Québec city formed semi-enclosed seas called the *Goldthwait* and *Champlain* seas respectively .[3]