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Collecting in Nebraska's Glacial Deposit

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Lake Superior agates are the most sought lapidary material found in glacially derived rocks in Nebraska. Specimen from near Palymra, Nebraska.

The Quaternary deposits of North America have had a long and colorful history. In Nebraska they are of great importance because much of the economy is based on the rich soils developed from these deposits, on water drawn from them, and on construction materials derived from them. In a sense, nearly all who work the land are students of the Quaternary. Farmers note differences in soils and the odd "foreign" stones scattered about the landscape in glaciated eastern Nebraska. Well drillers recognize the stratification of these deposits and the presence of "veins" of water known to be ancient, buried stream channels often filled with water yielding gravels. In addition, studies of Quaternary deposits are important to engineers building dams, highways, and other structures. Much of our culture is based on the Quaternary—we are living in the Quaternary!

Quaternary Defined

The Quaternary is a division of geologic time believed to encompass about the last 2.8 million years. It is divided into two major subdivisions—the Pleistocene, which constitutes the bulk of Quaternary time including all of the Ice Ages, and the post glacial Quaternary which is termed Recent or Holocene and encompasses about the last 10,000 years. Although most geologic time lines are arbitrary and do not relate to global events, it now appears the beginning of the Quaternary is coincident with a global cooling that led to the onset of continental glaciation.

Dating Deposits

Deposits from continental glaciation occur in eastern Nebraska and adjoining areas. Our understanding of these deposits has been greatly facilitated by the dating of lens-shaped deposits of volcanic ash interlayered between glacial deposits at several localities. The volcanic ash consists of fine sand-to-clay-sized particles of obsidian produced during the highly explosive phase of rhyolitic volcanoes located in the Yellowstone National Park area and from those in the Bishop area of Northern California. The ash was probably carried into Nebraska by jet stream winds and may have served as nuclei for rain drops. Although the ash may have once covered large areas, it was preserved as lentils in pond and lake environments where it was rapidly buried and protected from reworking. These lens-shaped deposits can be dated by means of the fission-track technique which is based on the slow but steady rate of natural fission or splitting of the uranium-238 nucleus. The fission fragments produce submicroscopic tubules in the glass shards, much like a bullet-hole in wood. These damaged zones can be enlarged and made visible by etching the shards in hydrofluoric acid and examining them with an optical microscope at 500 magnifications. Dating of ash deposits in Nebraska has shown that many ages of ashes occur rather than just one as previously thought.

Glacial Till

A detailed study of the minerals and pebbles comprising

the glacial tills of eastern Nebraska and adjoining areas has revealed the presence of three compositionally distinct types of till—here labelled “A”, “B”, and “C”. Fission-track dates on volcanic ashes associated with these tills has permitted placing them in a chronologic framework; the older being the “C” tills and the youngest the “A” tills.

The First Ice Age

The paleotemperature record of the Gulf of Mexico suggests the first late Cenozoic Ice Age in North America commenced about 2.8 million years ago, reached a maximum around 2.4 million years ago, and ended about 2.1 million years ago. The glacial “C” tills in Nebraska probably were deposited during the maximum of this glaciation. Exposures of this type are rare. One exposure, the Elk Creek Till of Reed and Dreeszen (1965) can be seen at its type locality about 2.5 miles west and 5 miles north of Table Rock, Pawnee County. It also occurs on exposure as the lowermost till resting on glacially striated Pennsylvanian age bedrock in the City Wide quarry about 3 miles west of LaPlatte in Sarpy County.

The “C” tills are unique in that nearly 90 percent of the plus 4mm pebbles found in them are locally derived sedimentary rocks including limestones, sandstones, dolomites, and shales of Paleozoic and Cretaceous ages. There are very few pebbles of granitic rocks or Sioux quartzite. Lapidary material is rare in the “C” tills and consists of occasional pieces of petrified wood and chalcedony.

The interglacial period between the first and second Ice Age was possibly as warm or warmer than today. This was a

period predominated by soil development on relatively stable divide areas and dissection near stream systems. Volcanic ashes carried in by winds from the Yellowstone National Park area were preserved locally in oxbow lakes and ponds. These ashes are about 2.0 and 2.2 million years old.

The Second Ice Age

The second Ice Age occurred between about 1.9 and 1.5 million years ago. This Ice Age is represented in Nebraska by alluvial deposits laid down along ancient stream valleys, which are now buried, and by silt and fine sand that was swept from the flood plains by winds and trapped by vegetation in the uplands to form loess deposits. Soil formed in areas where the landscape was relatively stable. Although glaciers didn’t reach Nebraska during this time the climate was probably considerably colder than today.

The interglacial period between the second and third Ice Ages again was nearly as warm or warmer than today. Again, fluvial processes, dissection, soil formation, and loess deposition dominated. Volcanic ash (Coleridge Ash) was deposited during this interglacial period and is preserved in lakes and ponds. This ash is best exposed about 3 miles west and about 2 miles north of Orleans, Harlan County.

The Third Ice Age

The third Ice Age occurred between about 1.0 to 0.4 million years ago. Glaciers invaded Nebraska and Iowa at least four times, and periods between these advances were of

Sequence of glacial tills exposed in City Wide quarry near LaPlatte, Nebraska.

LIMIT OF GLACIAL DEPOSITS IN EASTERN NEBRASKA AND ADJACENT AREAS

sufficient duration for the formation of paleosols (fossil soil) and gleys (blue-gray, compact, and often structureless soil layers).

The lowermost of the tills associated with this Ice Age is the "B" till. Its only known exposure is at the City Wide Rock quarry where it is found as the middle till. The "B" till is pre-

dominately sedimentary material foreign to Nebraska coming from the James Lowland area of Canada. It is mostly limestone, dolomite, chert, siltstone, shale, and sandstone. Non-sedimentary material consists principally of granites, schists, greenstones, and Sioux quartzite. Occasional pieces of petrified wood, chalcedony, and jasper are present.

QUATERNARY FIELD TRIPS

There are some general rules that can be applied to collecting in Nebraska's glacial deposits. Most good exposures of rock material derived from tills are found in roadcuts or fields along topographic breaks between uplands and streams. Excellent artificial exposures may also occur in pits, construction sites, and feedlots. A day in the field may consist of reconnoitering many ditches along county roads. Gravel and cobble-sized material having a high percentage of green and black rocks are more productive than those rich in pink quartzite. Perseverance is the key to locating agates, chalcedony wood, and other lapidary materials.

Most glacial till outcrops are small and can be examined for lapidary material in a matter of minutes. Thus, looking for

Lake Superior agates in eastern Nebraska is a matter of moving from outcrop to outcrop and checking 20 to 30 outcrops in a day.

Gravel bars on the many streams draining southeastern Nebraska are often excellent collecting sites because the relative small percentage of cobbles occurring in the tills is concentrated. Bars on both the Big and Little Nemaha Rivers, and their tributaries have been very productive in agate, petrified wood, jasper, chalcedony, and occasionally Indian artifacts.

Gravel bars on the Platte River in eastern Nebraska consist largely of sand and are not very productive. Tills having high percentages of quartzite or sedimentary rocks are also usually poor producers of lapidary material.

Of the "A" tills, the youngest is not known to occur in Nebraska, but it is widespread in south-central Iowa. The "A" tills, especially the younger ones, are richest in materials of interest to rock collectors. This material includes Lake Superior agates, chalcedony, petrified wood, jasper, and rarely topaz and jade.

There was a period of about 100,000 years duration (between about 0.6 and 0.7 million years ago) during which continental glaciers receded from this area but not so far as to permit a great warming. Pearlette ash (restricted) and the Hartford ash derived from eruptions in the Yellowstone National Park area were deposited and preserved in lakes and ponds during this period.

Excellent exposures of the Hartford Ash can be seen along the road bordering the Little Sioux River between three and four miles north and one mile east of the village of Little Sioux, Iowa. Along this road the ash stands out as a white bed ranging from about one to four feet thick. The Pearlette Ash can be seen about 1.5 miles west and 1 mile south of the village of Elk Creek on the north side of Highway 62, Johnson County.

The interglacial period between the third and last Ice Age is represented in Nebraska by fluvial and loessic sediments with paleosols on divide areas. There appear to be three cycles of coarse sand to silt loess deposition capped by paleosols during this interglacial. These cycles probably re-

late to advances and retreats of continental glaciers to the north. This interglacial period began about 500,000 years ago and ended about 100,000 years ago when conditions again led to expansion of continental glaciers.

The Fourth Ice Age

The fourth Ice Age, beginning about 100,000 years ago, resulted in numerous advances and retreats of the ice sheet. Glacial deposits representing the fourth Ice Age are not known in Nebraska but occur in central Iowa. In Nebraska this Ice Age is represented mainly by thick accumulations of loess (Peoria and Bignell). Although many scientists consider the fourth Ice Age to have ended about 10,000 years ago, others believe we are still living in it and that today's temperate climate represents only a lull between advances of the continental ice.

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