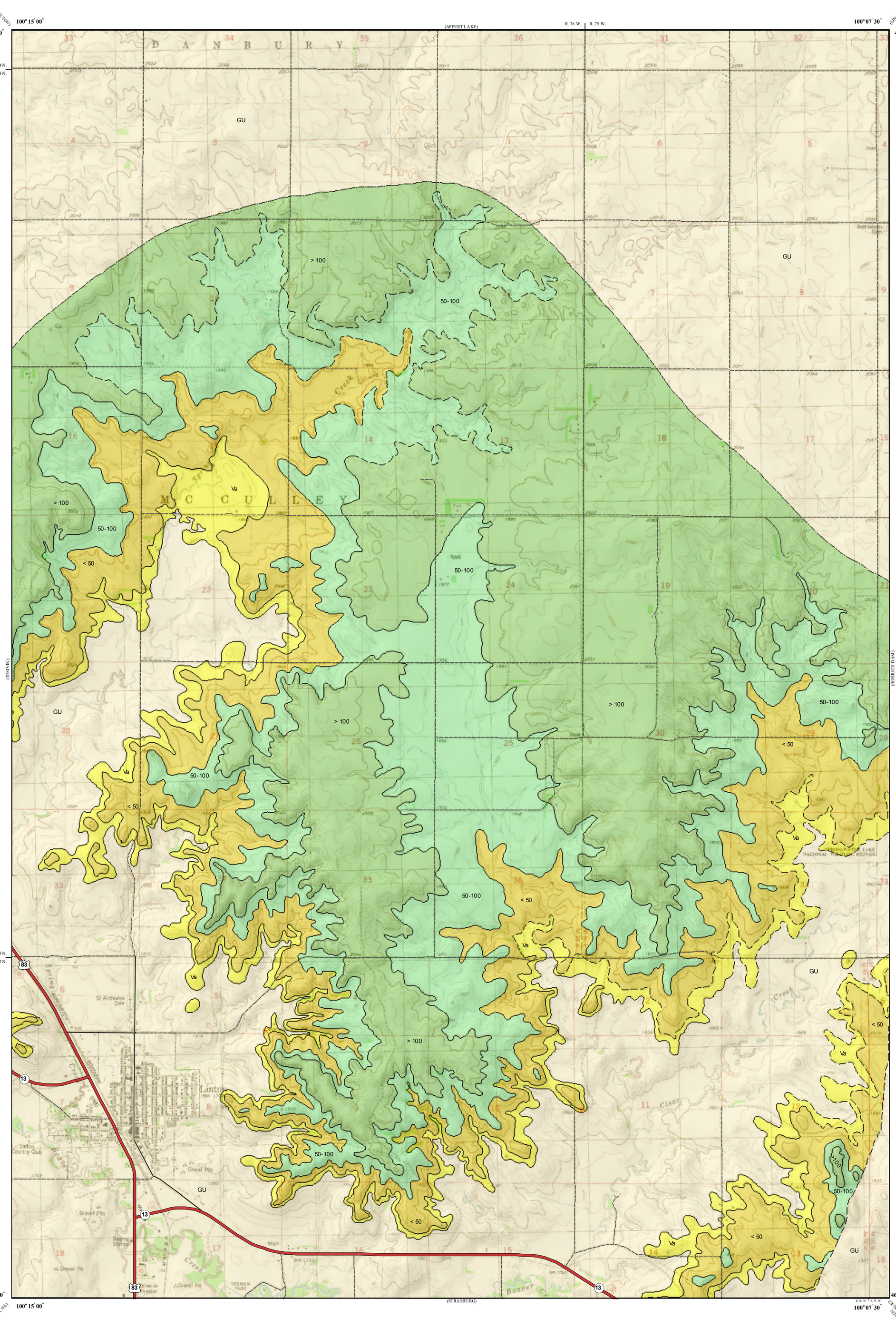
North Dakota Geological Survey
Edward C. Murphy, Acting State Geologist

Volcanic Ash

Linton Quadrangle, North Dakota



Edward C. Murphy
2005

Introduction

Tuffaceous sandstone and siltstone are present in central Emmons County, in south-central North Dakota. Typically, only a few feet of ash is visible at the surface in these localities, but up to 27 feet of ash was measured in a handful of larger exposures.

Previous Work

Volcanic ash deposits were first identified in the Linton area in 1917 by T.W. Stanton. This deposit has been informally referred to as the Linton ash. Stanton noted the ash was 26 feet thick and occurred in the lower part of the Fox Hills Formation. In 1952, S.P. Fisher greatly expanded the known extent of the ash identifying it in several localities in both central and southern Emmons County. Manz (1962) investigated the pozzolanic properties of 22 samples within a 35 square-mile area at Linton and estimated the deposit contains 500 million tons of volcanic ash. Artzner (1974) determined the Linton ash is 80% volcanic glass, 10% quartz, 7% feldspar, 1% hornblende, and 2% minor constituents. Forsman (1992) reported less volcanic glass and more clay; 67% volcanic glass, 9% phenocrysts and/or admixed detrital grains, and 24% secondary clay. Forsman noted his samples came from a weathered outcrop which might explain the decrease in glass grains and the increase in clay. He determined the glass is rhyolitic and the glass grains, except where coated by montmorillonite, appear unaltered and reveal no birefringence. Bluemle plotted the locations of a dozen ash outcrops near Linton on topographic maps (unpublished) and included several photographs of ash outcrops in his geologic report of Emmons County (1984). Erickson (1992) constructed an isopach of the Linton ash. He suggested the shape of the ash body was the result of having been deposited in a distributary channel and portions of an estuarine embayment of the Western Interior Seaway.

This Study

This field investigation identified 37 outcrops of volcanic ash within the Linton quadrangle. The ash deposit extends over at least 19,000 acres (30 sections) within this map. A number of ash samples were collected in the Linton area, three were submitted for analysis. On average, the ash contains 60% silica and 12.8 % aluminum oxide (Murphy, 2005). A PIXE analysis of two Linton ash samples detected concentrations for 21 elements, including titanium (0.16 %), copper (7.4 ppm), gallium (13.4 ppm), rubidium (136 ppm), strontium (183 ppm), and barium (628 ppm).

Commercial Uses of Volcanic Ash

Manz (1962) listed many commercial uses of volcanic glass including; abrasives, cleansers, scouring or polishing compounds, concrete admixtures, glazes for pottery, brick and tile, glass wool, enamels, lightweight products, fertilizer, asphalt constituents, acoustical tile, sweeping compounds, paint filler, insecticide carrier, a catalyst carrier in the chemical industry, absorptive packing material, and in purification of lard and tallow. Most of the ash mined in the United States is used in the manufacture of lightweight concrete. Some toothpastes and powders, as well as soaps, contain volcanic ash. Volcanic ash has also been promoted as a surfacing material to create a comfortable, non-slip, minimum-maintenance cow race.

References

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Bluemle, J.P., 1984, Geology of Emmons County, North Dakota: North Dakota Geological Survey Bulletin 66, Part 1, 69 p.
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Linton ash (white rock) exposed along a cutbank of Spring Creek (T.133N., R.76W., s esw section 15). More than 20 feet of ash is exposed in this outcrop. Photo taken looking north.



Closeup of Linton ash outcrop along Spring Creek. Note the blocky nature of the ash.



A small hole excavated through the Linton ash. The ash is white on weathered surfaces, but gray on surfaces that have been recently excavated.

EXPLANATION

GU — **Geology Undifferentiated**
Includes geologic units that are both younger and older than the Linton Ash.

CRETACEOUS SYSTEM

FOX HILLS FORMATION

Va — **Volcanic Ash**
The ash layer occurs at, or just beneath, the surface.

OVERBURDEN

< 50 — The ash layer occurs beneath less than 50 feet of overburden.

50-100 — The ash layer is overlain by 50 to100 feet of overburden.

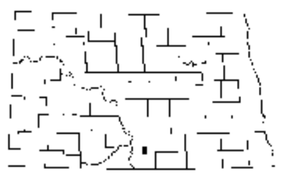
> 100 — Greater than 100 feet of overburden.

Geologic Symbols

- Known contact between two geologic units
- Approximate contact between two geologic units
- Limit of Geologic Control
- Outcrop (control point)
- Ash mine site

Other Features

- 13 — State Highway
- 83 — U. S. Highway
- Paved Road
- Unpaved Road

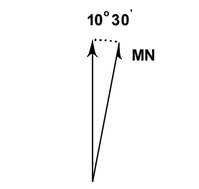


Scale 1:24,000

0 0.5 1

Miles

Lambert Conformal Conic Projection 1927 North American Datum
Standard Parallels 46° 15' 00" and 46° 22' 30"
Contour Interval 20 Feet



1980 Magnetic North
Declination at Center of Sheet

Cartographic Compilation: Elroy L. Kadrmas