X Marks the Spot

By Lorraine Manz

After a run of eight years the time has come for X Marks the Spot to retire. Whether or not you chose to participate in the competitions, I hope you have enjoyed them and maybe even learned a thing or two about North Dakota geology besides. My thanks and regrets go especially to those loyal readers (you know who you are) who have given their unfailing support to this competition by responding (not always correctly, mind you!) to every single one. And finally …

Answer to X Marks the Spot #16

The significance of the X in competition #16 is that it marks the approximate epicenter, a few miles southwest of Huff in Morton County, of the first instrumentally located earthquake in North Dakota. With a magnitude of 3.7 or 4.4, depending on your choice of scale (see Table 1), it was felt over an area of more than 3,000 square miles. Intensity IV effects (Modified Mercali Scale) were reported in Bismarck, Fort Rice, Linton, Mandan, Menoken, and Moffit, where dishes and windows rattled, wood frame houses creaked, and a sound like distant thunder was heard. Lesser effects were noted in Almont, Flasher, Halliday, and Saint Anthony.

Four more earthquakes with verified epicenters in North Dakota have been recorded since the "Huff" tremor occurred in July 1968 (Table 1). The most recent, a feeble magnitude 1.5 was recorded earlier this year on January 3 (see Fred Anderson's article on page 14).

For more information on these and other earthquake magnitude scales visit the USGS Earthquake Hazards Program website at http://neic.usgs.gov/neis/epic/code_magnitude.html.

Administrative Assistant Donna Bauer drew Armand Lagasse and Max Tschosik as the competition winners. (Two-time winner Terry Jorgenson graciously requested to be excluded from the drawing.) Both will receive a copy of Dinosaurs, Sharks, and Woolly Mammoths. Congratulations to the winners, honorable mentions to all the folks who gave the correct answers and thanks to everyone who participated in the competition. Correct and partially correct answers were submitted by:

Tony Alkofer	Park River
Brad Bakuska	Calgary, Alberta
Adrian Benz	Hazelton
Gary Brekke	Fargo
BreAnna Brenner	Sauk Center, MN
Judith Dinkins	Hazen
Michael Gunderson	Ten Mile, TN
Brian Hartley	Grand Forks
Terry Jorgenson	**Eden Prairie, MN**
Bill Kirk	Beulah
Armand Lagasse	**Rolla**
Paul Meisel	Sawyer
John Mrozla	Harwood
Sierra Nelson	Bismarck
Ramsey Family*	Crystal
Mark Schields	Dickinson
Rod Stoa	Tower City
Anthony Straquadine, Jr.	Prior Lake, MN
Kevin J. Sullivan	Traverse City, MI
Dennis Tomhave	Vermillion, SD
Max Tschosik	Bismarck
Tina Webb	Minot
Larry Werner	Starkweather
Terrance J. Zich	Sanford, FL

* Ramsey family submitted one response as part of a collective effort.

Table 1. Earthquakes with instrumentally recorded epicenters in North Dakota.

Date	Epicenter location			Depth/km	Intensity	Magnitude
	Lat.	Long.	Nearest town			
07/08/1968	46.588	-100.742	Huff	27	IV	3.7 Mn^1 (4.4 mb^2)
03/09/1982	48.513	-104.030	Grenora	18	III	3.3 Mn^1
11/11/1998	48.548	-104.032	Grenora	5		3.5 Mn^1
11/15/2008	47.461	-100.041	Goodrich	18		2.6 Mn^1
01/03/2009	48.357	-103.946	Grenora	20		1.5 ML^3

1Nuttli magnitude
2Body wave magnitude
3 Local (Richter) magnitude

Further reading
Anderson, F.J., 2005, Earthquake hazards and probabilities in North Dakota: North Dakota Geological Survey Newsletter, v. 32, no. 2, p. 1-6.

Anderson, F.J., 2009, USArray reference seismic station installed in North Dakota: DMR Newsletter, v. 36, no. 1, p. 10-13.

Biek, B., 1997, Earthquakes in North Dakota: North Dakota Geological Survey Newsletter, v. 23, no. 1, p. 17-23.

Bluemle, J.P., 1989, Earthquakes in North Dakota: North Dakota Geological Survey Newsletter, December 1989, p. 20-25.

And a few more words on Bision Trails …
In the previous X Marks the Spot competition (#15) readers were asked to identify the network of mostly northwest-southeast-trending lines that are visible in aerial photographs of North Dakota's grasslands. The general consensus is that these lines are bison trails, created by the movements of the great herds of these animals that once roamed the Great Plains. Shortly after this explanation was published in the January 2009 Newsletter, geologist Michael Iannicelli contacted the NDGS to offer a possible alternative origin for these features.

He suggests that the lines (trenches) may be erosional landforms carved by meltwater derived from snowdrifts oriented transverse to the margin of the Late Wisconsinan glacier and normal to katabatic winds blowing off the ice. Similar landforms have been observed in Germany and in other parts of the glaciated regions of the U.S. including Illinois, Iowa, Nebraska and South Dakota. Modern equivalents have been found on Devon, Resolute, and Cornwallis Islands in the Canadian Arctic.

Further Reading
Iannicelli, M., 2000, Snow dune erosion and landforms: Northeastern Geology and Environmental Sciences, v. 22, no. 4, p. 324-335.

Iannicelli, M., 2003, Devon Island's oriented landforms as an analog to Illinois-type paha: Polar Geography, v. 27, no. 4, p. 339-350.

STAFF NEWS

Summer Hires

The Survey has hired four summer field technicians to canvas the state for evidence of shallow natural gas in ground-water wells that may help pave the way to further exploration by the oil & gas industry. Each of the four technicians is looking for potential methane shows by field screening groundwater monitoring and stock-supply wells using a portable flame ionization detectors (FID). The study is part of the Survey's ongoing Coal-Bed Methane (CBM)/Shallow Gas Field Screening project.

Clockwise from top left: Adam Ries, Allison Christensen, Cassie Gudmunsen, Brian Hall

Geological engineering major Adam Ries is a senior at UND and is covering southwest North Dakota including the Dickinson area. Allison Christensen, a senior in the geoscience department at Minot State University, is collecting data in the north-central part of the state, and recent Dickinson State University graduate (B.S. in agricultural science and natural resources management) Cassie Gudmunsen is sampling wells in the nortwestern counties. Eastern North Dakota is Brian Hall's territory. Brian, also a geoscience major, will be a senior this fall at NDSU.

The field screening team is working under the supervision of shallow gas program principal investigator Fred J. Anderson and State Geologist Ed Murphy. We are happy to welcome them to the Survey and wish them all "good hunting and safe travels" this summer.

The Oil & Gas Division hired Matt Carns as a field temp to help in its Williston and Dickinson Districts this summer. He is based in Williston, but will do some work in Dickinson from time to time. Matt, who is studying geology at UND, will be starting his senior year fall.

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Permanent staff

In July the Oil & Gas Division bid farewell to legal assistant Marge Rixen. It also welcomed Lisa Peterson, a temporary employee who will be helping with several projects in the Bismarck office.