WASHINGTON STATE DEPARTMENT OF
Natural Resources
Doug Sutherland - Commissioner of Public Lands

DGER NEWS

DIVISION OF GEOLOGY AND EARTH RESOURCES
"Washington State's Geological Survey since 1890"

Website: http://www.dnr.wa.gov/geology/ Vol. 2, No. 3, Fall 2005

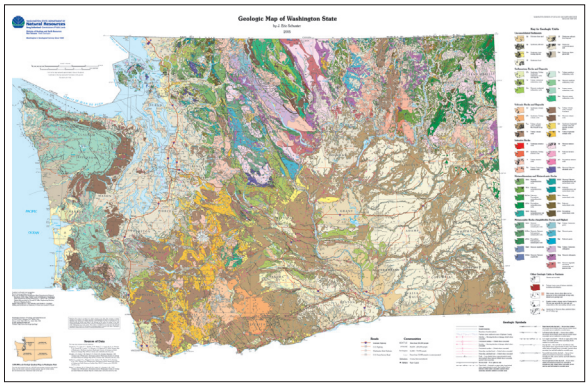
GEOLOGIC MAP OF WASHINGTON STATE NOW AVAILABLE

The Division has just published the first new 1:500,000-scale geologic map of Washington since 1961. Eric Schuster compiled this map from the previously published 1:250,000-scale geologic quadrant maps of Washington. The level of detail was simplified by combining the 1:250,000 units into units that have broader lithologic and age ranges and deleting small polygons.

In the 'Key to Geologic Units', small index maps of the State of Washington accompany each unit symbol and brief unit description. These index maps show the color of the map unit as well as its distribution. To prepare the map, digital versions of the 1:250,000 quadrant maps were merged and simplified in ESRI's ArcInfo and ArcGIS, and the plate was then laid out using Avenza MAPublisher and Adobe Illustrator.

The map is accompanied by a 44-page pamphlet that provides more detailed unit descriptions, a list of named units, and a table of the 1:250,000 units that are in the 1:500,000 units.

The Geologic Map of Washington State is a 55.5 x 36-inch full-color map. It may be purchased flat or folded. The flat map is printed on heavy, coated white stock and is suitable for framing. The folded map comes with an envelope for storage. This map and the geologic quadrant maps may be ordered from the Washington Department of Printing at http://www.prt.wa.gov/. PDFs of the map and pamphlet are online at http://www.dnr.wa. gov/geology/pdf/gm53.zip.



References

Dragovich, J. D.; Logan, R. L.; Schasse, H. W.; Walsh, T. J.; Lingley, W. S., Jr.; Norman, D. K.; Gerstel, W. J.; Lapen, T. J.; Schuster, J. E.; Meyers, K. D.; 2002, Geologic map of Washington—Northwest quadrant: Washington Division of Geology and Earth Resources Geologic Map GM-50, 3 sheets, scale 1:250,000, with 72 p. text.

Huntting, M. T.; Bennett, W. A. G.; Livingston, V. E., Jr.; Moen, W. S., 1961, Geologic map of Washington: Washington Division of Mines and Geology Geologic Map, 2 sheets, scale 1:500,000.

Schuster, J. E., 2005, Geologic map of Washington State: Washington Division of Geology and Earth Resources Geologic Map GM-53, 1 sheet, scale 1:500,000, with 44 p. text.

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MESSAGE FROM THE STATE GEOLOGIST

Ron Teissere
State Geologist

The Division had a very successful STATEMAP program during the 04-05 fiscal year, which ended June 30th. Our grant award was the largest dollar amount we have ever received. We tied with California and New Mexico for the highest dollar award among state surveys. The geologic mapping section, led by Josh Logan, completed eight 1:24,000-scale quadrangles. The STATEMAP grant award for the current fiscal year is slightly higher (we are second in the nation behind California). We expect to complete seven 1:24,000 quadrangles this fiscal year.

The 05-07 Biennium budget allotments are now final. The Division again suffered a net reduction in both our geology and surface mining programs. The reduction in funding for the geology program resulted in the layoff of another geologist. The remaining activities are the STATEMAP program and a small amount of tsunami inundation and evacuation mapping. The surface mining program reductions are a result of fixed income and rising costs. The funds for this program come exclusively from permit fees. These are in statute and have not been adjusted since the 2001 legislative session. At that time, only part of our request was approved. We have reached the point where the available funds cannot support the program for the entire biennium, even after the elimination of another inspector position. We will be asking the 2006 Legislature to address the situation.

The Division has installed a new earthquake display in the rotunda of the Natural Resources Building. The 42-inch plasma screen is in place, and we are now working on the software. The screen will show a worldwide, real-time earthquake monitor based on the California Integrated Seismic Display system.

EARTH SCIENCE WEEK

October 9-15
http://www.dnr.wa.gov/geology/esweek/

The first of the Division's Decision-Maker Field Conferences was held Sept. 17. (*See article in the next DGER News.*) Many of Washington's elected officials and business representatives were invited. We addressed Washington's geologic hazards at several stops in King County. Future conferences may address issues like mineral resources, energy, and subsurface geology.

Representatives from the Division will be at several conferences this fall, including the Washington State Association of Counties meeting in Vancouver, the Washington State Emergency Managers Association meeting in Chelan, a meeting of local government permitting technicians in Wenatchee, and the Northwest Mining Association meeting in Spokane. If you are at any of these meetings, please take a few minutes to talk with Division staff. ■

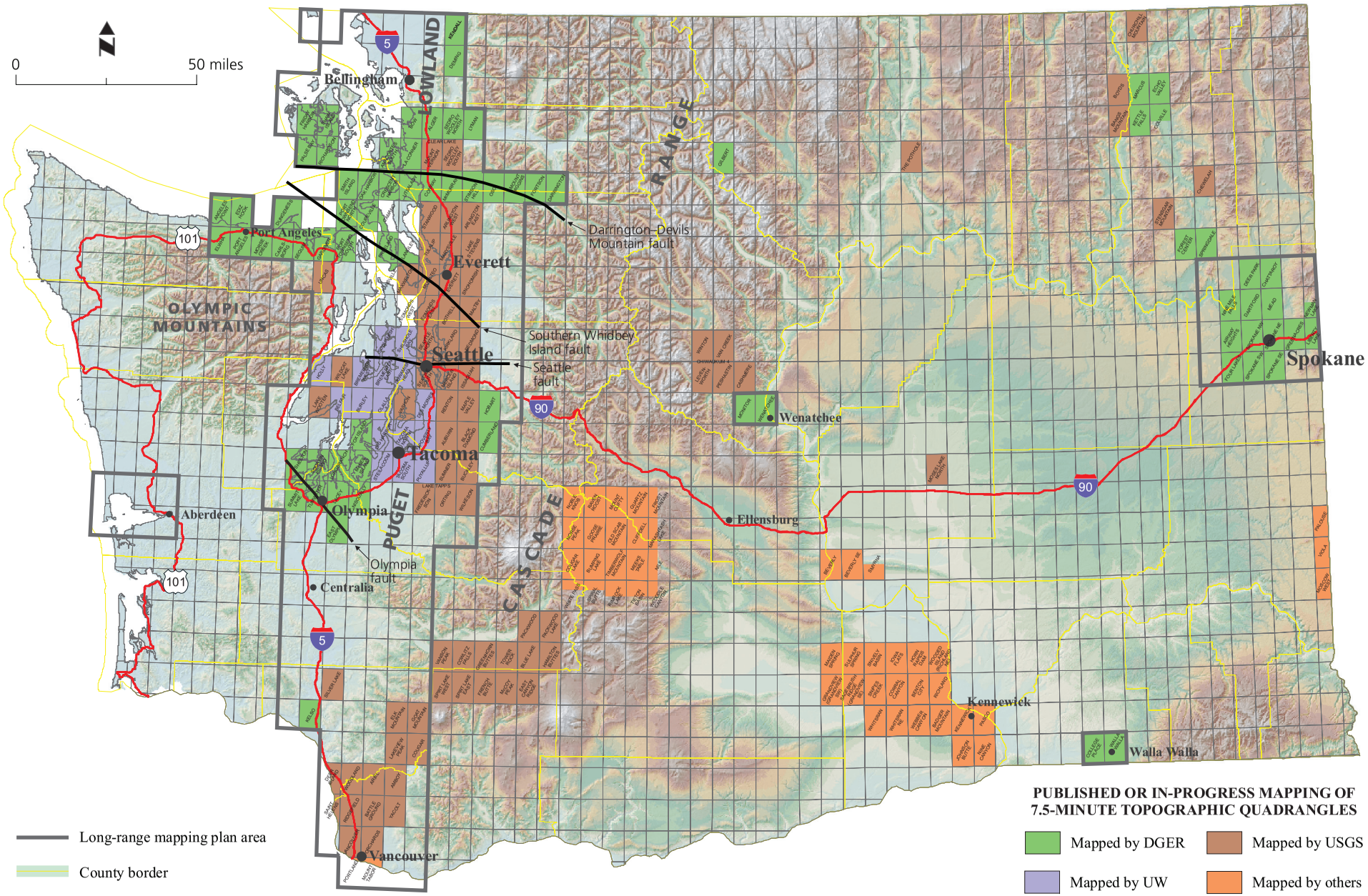

Figure 1. Shaded relief map showing Washington State's 1500 7.5-minute quadrangles, the long-range mapping plan areas, and 1:24,000-scale mapping by DGER and other organizations. Since its inception in 1992 when authorized by the National Cooperative Geologic Mapping Act, the STATEMAP Program has enabled the Washington Division of Geology and Earth Resources to improve map quality and coverage throughout the state. We have completed the whole state at 1:100,000 scale [http://www.dnr.wa.gov/geology/gmaps100.htm] and have made a good start on 1:24,000-scale mapping. More information on completed geologic maps can be found in the DGER online bibliography [http://www2.wadnr.gov/dbtw-wpd/washbib.htm] or map index [http://www.dnr.wa.gov/geology/mapindex.htm], the USGS National Geologic Map Database [http://ngmdb.usgs.gov/], or the University of Washington Pacific Northwest Center for Geologic Mapping Studies [http://geomapnw.ess.washington.edu/index.php].

1:24,000-SCALE MAPPING IN WASHINGTON

Geologic maps are basic to understanding Washington's complex geology and are a vital tool for informed decision-making on many issues that affect our safety and economy. Skyrocketing population growth is depleting our natural resources and multiplying the risks associated with the state's many geologic hazards. Geologic maps are essential tools for mitigating the negative effects of rapid growth through their use in growth management planning; infrastructure building and maintenance; dam safety; earthquake, volcano, and landslide risk assessment; water-resource appraisals; mineral resource exploitation and protection; education; recreation; and scientific research.

The State Geologist and the State Geologic Mapping Advisory Committee have established a long-range plan (Fig. 1) to prioritize which USGS 1:24,000-scale topographic quadrangles to map based on perceived need. In this geologically complex and diverse state, need is primarily equated with public safety and natural resource issues. Therefore, the long-range plan focuses on areas of high population density and important public infrastructure, such as transportation corridors, as well as areas of lower population density where important scientific or resource issues may exist. The plan is designed to be adjustable as new information becomes available.

Mapping in the densely populated Puget Lowland in cooperation with the USGS and the University of Washington has been the mainstay of our mapping program. This area still has many important issues to be addressed and an abundance of quadrangles worth mapping. However, other parts of the state also have important local issues ranging from earth resources to geologic hazards.

We have just finished the maps for the 2004/05 fiscal year. In the Puget Lowland, they are the Coupeville, Crescent Harbor, East Olympia, Oak Harbor, Port Townsend North, Port Townsend South, and Smith Island quadrangles; in eastern Washington, the Deer Park and Chattaroy quadrangles.

For the 2005/06 fiscal year, mapping is again concentrated in the Puget Lowland, but our focus in eastern Washington shifts southwestward to Walla Walla County where we will be mapping the College Place and Walla Walla quadrangles to address pressing groundwater and seismic hazard issues and supply requested geologic mapping to the National Park Service.

In the Puget Lowland, the McMurray quadrangle is a continuation and culmination of our mapping along the Darrington–Devils Mountain fault zone, a major regional fault. We will investigate offset of Holocene strata along the fault and continue delineation of volcanic hazards from lahars, documentation of landslide hazards, and characterization of water resources.

The Fox Island quadrangle allows us to map cooperatively with the University of Washington. The emphasis will be on providing a geologic framework to support fault studies and clarify perceived differences in Quaternary stratigraphy between the southern and central Puget Lowland.

Mapping the Whidbey Island portions of the Camano, Freeland, Langley, Tulalip, and Hansville quadrangles will complete the 1:24,000-scale geologic mapping of Whidbey Island. It will allow us to investigate several regional faults that offset late Pleistocene strata on southern Whidbey Island, enhance characterization of regional Quaternary stratigraphy, and support studies related to salt-water intrusion, slope stability, and aggregate resources.

Future projects will likely focus on completing Camano Island and mapping along Hood Canal.

References

Derkey, R. E.; Hamilton, M. M.; Stradling, D. F., 2005, Geologic map of the Deer Park 7.5-minute quadrangle, Spokane County, Washington: Washington Division of Geology and Earth Resources Geologic Map GM-54, 1 sheet, scale 1:24,000. [http://www.dnr.wa. gov/geology/pdf/gm54.pdf]

Derkey, R. E.; Hamilton, M. M.; Stradling, D. F., 2005, Geologic map of the Chattaroy 7.5-minute quadrangle, Spokane County, Washington: Washington Division of Geology and Earth Resources Geologic Map GM-55, 1 sheet, scale 1:24,000. [http://www.dnr.wa.gov/geology/pdf/gm55.pdf]

Dragovich, J. D.; Petro, G. T.; Thorsen, G. W; Larson, S. L.; Foster, G. R.; Norman, D. K., 2005, Geologic map of the 7.5-minute quadrangles, Island County, Washington: Washington Division of Geology and Earth Resources Geologic Map GM-59, 2 sheets, scale 1:24,000. [http://www.dnr.wa. gov/geology/pdf/gm59.zip]

Polenz, Michael; Slaughter, S. L.; Dragovich, J. D.; Thorsen, G. W., 2005, Geologic map of the Ebey's Landing National Historical Reserve, Island County, Washington: Washington Division of Geology and Earth Resource Open File Report 2005-2, 1 sheet, scale 1:24,000. [http://www.dnr.wa.gov/geology/pdf/ofr05-2.pdf]

Polenz, Michael; Slaughter, S. L.; Thorsen, G. W., 2005, Geologic map of the Coupeville and part of the Port Townsend North 7.5-minute quadrangles, Island County, Washington: Washington Division of Geology and Earth Resources Geologic Map GM-58, 1 sheet, scale 1:24,000. [http://www.dnr.wa.gov/geology/pdf/gm58.pdf]

Schasse, H. W.; Slaughter, S. L., 2005, Geologic map of the Port Townsend South and part of the Port Townsend North 7.5-minute quadrangles, Jefferson County, Washington: Washington Division of Geology and Earth Resources Geologic Map GM-57, 1 sheet, scale 1:24,000. [http://www.dnr.wa.gov/geology/pdf/gm57.pdf]

Walsh, T. J.; Logan, R. L., 2005, Geologic map of the East Olympia 7.5-minute quadrangle, Thurston County, Washington: Washington Division of Geology and Earth Resources Geologic Map GM-56, 1 sheet, scale 1:24,000. [http://www.dnr.wa.gov/geology/pdf/gm56.pdf] ■

GEOLOGIC MAP

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Schuster, J. E.; Gulick, C. W.; Reidel, S. P.; Fecht, K. R.; Zurenko, Stephanie, 1997, Geologic map of Washington—Southeast quadrant: Washington Division of Geology and Earth Resources Geologic Map GM-45, 2 sheets, scale 1:250,000, with 20 p. text.

Stoffel, K. L.; Joseph, N. L.; Waggoner, S. Z.; Gulick, C. W.; Korosec, M. A.; Bunning, B. B., 1991, Geologic map of Washington—Northeast quadrant: Washington Division of Geology and Earth Resources Geologic Map GM-39, 3 sheets, scale 1:250,000, with 36 p. text.

Walsh, T. J.; Korosec, M. A.; Phillips, W. M.; Logan, R. L.; Schasse, H. W., 1987, Geologic map of Washington—Southwest quadrant: Washington Division of Geology and Earth Resources Geologic Map 34, 2 sheets, scale 1:250,000, with 28 p. text. ■

DGER STAFF NEWS

Seismologist Steve Palmer left DGER in August when his position with the Geologic Hazards section was eliminated. He is now an associate geologist with GeoDesign in Portland. Dr. Palmer was with the Division for 16 years. Most recently he was lead investigator on the Liquefaction Susceptibility and Site Class Maps of Washington and the International Residential Code Seismic Design Category Maps of Washington [http://www.dnr.wa.gov/geology/hazards/hmgp.htm].

Volcanologist Pat Pringle has left DGER after more than 15 years of service to join the faculty of Centralia College. Pat is best known for his Mount St. Helens guide book, his investigations of lahars at Mounts Rainier and Hood, and his work using tree rings from killed "subfossil" trees to date geologic catastrophes, such as earthquakes, lahars, and landslides. He is currently finishing up a geologic road guide of Mount Rainier National Park for DGER and will continue his investigations of various submerged and buried forests including one on the Bonneville landslide. ■

RECORDS IN ROCK

by Jack Nisbet

EWU geologists used to have to travel a thousand miles to study trilobites; now they can find them a few miles from Cheney

Anyone who looks at rocks in the Columbia Basin south of the Spokane River sees mostly basalt—volcanic magma cooled into a delightful variety of layers, flutes and swirls. Students hear stories of magma bubbling up from cracks in the Snake River country to flow elastically north and blanket the entire region; of layers thousands of feet thick; of Lake Missoula floods crashing down from the northeast to carve the world we see now around Spokane and in the Cheney–Palouse scablands. Teachers place the basalt flows in the Miocene Period, from 17 million to 7 million years before the present. They crack open cakes of clay that built up between eruptions and show off imprints of leaves and needles from familiar trees as proof that a long time ago this was a wet, warm place.

But what lies beneath all those layers of basalt? Steptoes of very old rock in the Palouse hint at limitless possibilities. In the early part of the 20th century, oil wildcatters wondered if black gold might be one of them, and drilled test holes throughout the Columbia Basin. Some years ago, Department of Natural Resources geologist Bob Derkey ran across a 1919 drill log from lower Latah Creek that had broken through the basalt and recorded "shells, fossils" in the middle of the usual notations of clays and gravel. The usual Latah clays yield fossil plants from fresh water environments of the Miocene Period; "shells" hinted at the remains of animals from an ancient saltwater sea, and at dates far earlier than that.

0n a spring afternoon in April 2002, Derkey and DNR colleague Mike Hamilton decided to investigate a wrinkle in the landscape near Clear Lake, just off Interstate 90 in western Spokane county. Derkey, in the midst of reworking the geologic map of the county, was interested in an outcrop of old limestone in the vicinity, but upon their arrival both geologists were struck by a scattering of peculiar red shale visible along the roadside and around some telephone poles. Hamilton, who grew up in the Midwest and was used to associating such shale with fossils, sat down among the red chunks and began to whack at their laminations with his rock hammer. It wasn't long before he found himself staring at the

The ghost of a *Glossopleura* trilobite shimmers from a chunk of red shale, more than 500 million years old, that was found in western Spokane County. (EWU geologist Linda McCollum photo)

tail of a trilobite, one of the most ancient and revealing fossil types. Both geologists knew of trilobite sites to the north, but there were no records of such ancient fossils within several dozen miles of Spokane County.

Hamilton and Derkey took samples of the mudstone back to Eastern Washington University and showed them to Linda McCollum in the geology department. McCollum happens to specialize in trilobites, and for years has taken thousand-mile trips to southern Nevada to study a range of trilobites in very old formations of Great Basin bedrock. She is especially interested in a fossil called *Glossopleura*—a relatively large, distinctive and common trilobite whose life span can be used to determine the boundary between epochs in different strata of Great Basin rocks. When McCollum recognized a *Glossopleura* trilobite peering at her, from a rock collected just a few miles from her classroom in Cheney, it was clear proof that the reddish shale had been formed in a marine environment during what geologists call the Middle Cambrian Period, more than 500 million years ago.

The geologists had to find out exactly where this red shale came from. The rise where they found the scattered chunks was part of a Fairchild Air Force Base recreational site at Clear Lake, so McCollum and her husband Mike applied for a permit to make further investigations. They found no exposed outcrops of the shale because the rock is so soft that if it does reach the surface, its layers soon weather away into mud. What the McCollums did discover was that workers on a sewage containment system had dug a series of holes on the south end of the lake, then dumped that material along the roadside on the rise.

The geologists took a small backhoe to the lakeside site and tried to dig down to the hidden steptoes, but a few trial attempts made it clear that major excavation would be necessary to expose any significant outcrops. Undaunted, the McCollums and a small group of EWU students patiently gathered promising chunks of shale from around telephone poles, rodent burrows, and a single hand-dug pit. Last summer, during further explorations in the same vicinity, the team found some more trilobites in another shale layer exposed by a drainage ditch, dug in 1904 and still in practical use, that ran through a nearby crop field.

Laboratory study of the various shale samples revealed at least four species of trilobites, including *Glossopleura*. The geologists also discovered tiny sponge spicules and a range of small brachiopod fossils—phosphate-based shells related to modern lamp shells. These brachiopods lived as filter feeders that burrowed in the mud or attached to stationary objects in a shallow sea during the middle Cambrian Period, when the edge of our continent ended around the border of the Idaho panhandle. Another group of marine animals called hyolithids left their impressions behind in the shale. Each hyolithid lived inside a cone-shaped shell topped with an operculum, or door, that could close them in for protection like a modern snail. The imprint looks exactly like a small ice cream cone. Hyolithids were also filter feeders; a pair of curious tentacle-like filaments may have acted as stabilizers or oars to give them some range of mobility.

Animals such as trilobites and hyolithids, which have no direct modern descendants, add to the lure of the Cambrian Period. More than half a billion years ago, the Cambrian marked the beginning of life as we know it, with ocean ancestors of every living form except flowering plants appearing in remarkable profusion. Many are elegantly preserved as fossils, and some of the best-known examples—such as the confounding hyolithids—have been described from the Burgess Shale formation in the Canadian Rockies 300 miles or so north of Clear Lake. Thanks to a curious driller, early ditch diggers, a septic holding system, busy gophers and some alert geologists, Spokane County has it own examples of these creatures to ponder, too. ■

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