Final Technical Report

USGS National Earthquake Hazard Program (NEHRP) External Research Support

Award #	**08HQAG0140**
Title	**Portland Urban Geologic Database**
Principal Investigator	**Ian Madin** **Chief Scientist** **Oregon Department of Geology and Mineral Industries** **800 NE Oregon St. #28** **Portland, OR 97232** **971-673-1542 (office), 971 673 1562 (fax)** **Ian.madin@dogami.state.or.us**
Start Date	**9/01/2008**
End Date	**8/31/2010**

Abstract

The Oregon Department of Geology and Mineral Industries (DOGAMI) has been collaborating with the USGS since 2003 to develop a new geologic map and digital geologic model of the greater Portland, Oregon urban area. The purpose of the new map and model is to support earthquake and landslide hazard studies. In the first phase of the project, DOGAMI compiled existing data and mapped three quadrangles. In the phase of the project reported here, DOGAMI compiled all existing mapping and developed a new digital geologic map and database using high resolution lidar topography to map surficial deposits in detail. The resulting digital map and geodatabase have been published by DOGAMI (Open-File Report O-12-02), and are being used in the third phase of the project which is building a 3D geologic model of the area.

Introduction

Since 2003, Oregon Department of Geology and Mineral Industries (DOGAMI) has been working with the US Geological Survey (USGS) to develop modern digital geologic maps of the greater Portland urban area in Oregon (Figure 1). The maps are needed to support earthquake and landslide hazard and risk studies for the region. The USGS has provided funding to DOGAMI from the National Earthquake Hazard Reduction Program (NEHRP) through assistance awards 03HQAG0013 and 08AG0140. USGS and DOGAMI geologists have been collaborating on the regional mapping with USGS focused west of the Tualatin Mountains, and DOGAMI working to the east. Quadrangles published by DOGAMI to date include an initial regional compilation (Madin, 2004), the Oregon City quadrangle (Madin, 2009), Dixie

Mountain quadrangle (Madin and Niewendorp, 2008) and Linnton quadrangle (Madin and others, 2008) In addition, new mapping was prepared for the Gladstone, Estacada, Redlands and Sandy quadrangles. Those maps were not published but were directly incorporated into the surficial map described below... Oregon quadrangles published by the USGS include the Camas quadrangle (Evarts and O'Connor, 2008), with numerous other quadrangles in preparation.

The eventual goal of the collaborative project is a published digital geologic map and database and accompanying paper map covering 54 quadrangles in Oregon and Washington (Figure 1).

An additional part of the project is the development by DOGAMI of a detailed surficial geologic map and a 3D geologic model describing important geotechnical parameters. This map and database were proposed for completion under Award 08AG0140, and this is the final technical report for that award. The project continues under Award G11AC20312.

The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

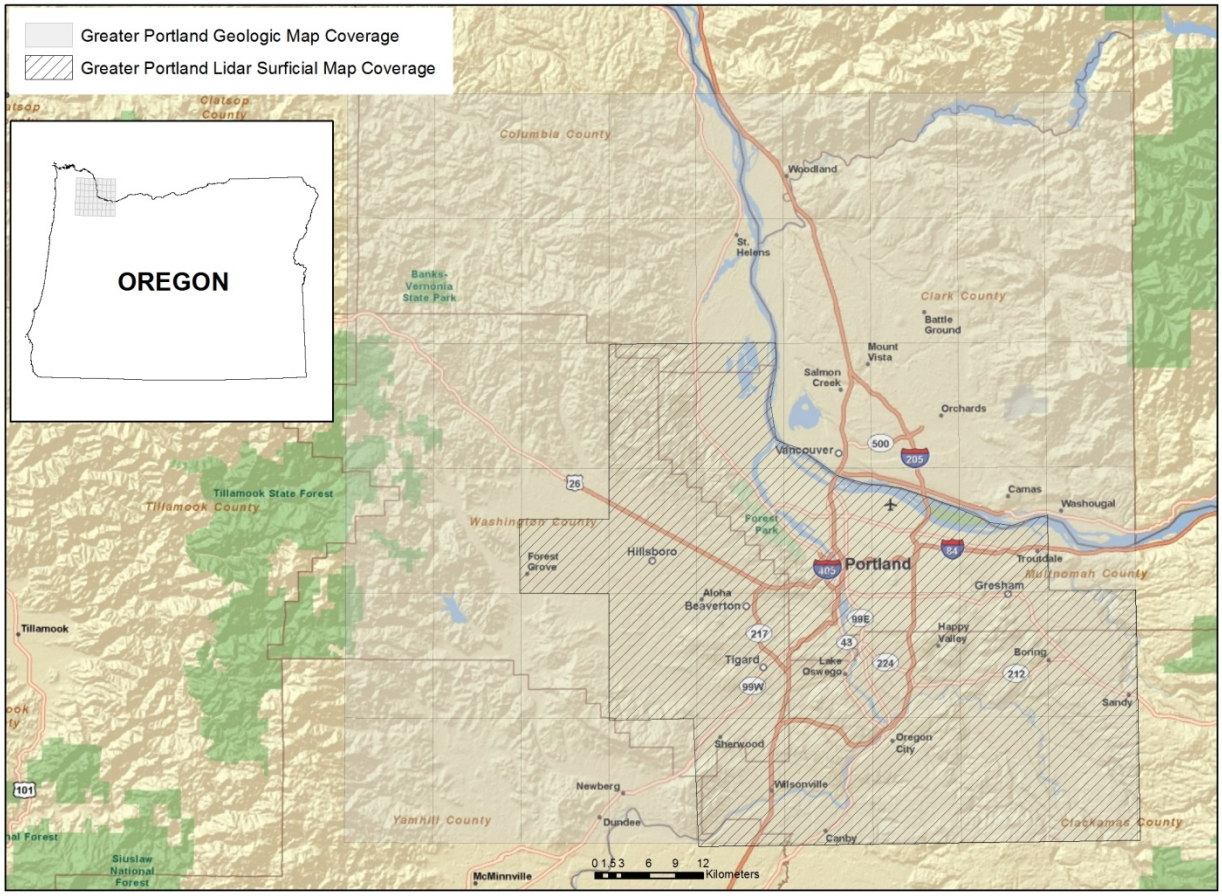

Figure 1 Location map, showing bounds of the USGS-DOGAMI collaborative greater Portland urban area geologic map, and the area covered by this map and report.

Surficial Geologic Database

We started with the Oregon Geologic Data Compilation (OGDC) release 5 (Ma and others 2009), DOGAMI's statewide digital geologic database. We then used high-resolution (nominal 1m cell size) lidar topographic data to revise the locations of previously mapped contacts and units, and to digitize new contacts for surficial geologic units that were expressed in the new topographic imagery. We viewed elevation, hillshade and slopeshade images, singly and in combination at scales from 1:24,000 to 1:4,000, and supplemented these images with digital orthophotography, custom made lidar-based contours, and driller's logs of approximately located water and geotechnical wells. Limited new field work was performed.

Additional digital geologic data were drawn from Evarts and O'Connor (2008) and Simenstad and others, 2011 (unit Hfd).

The geologic unit polygons were digitized or edited on screen using high resolution touch panel monitors, and were subsequently reviewed and edited for topological errors and stored in an Esri format geodatabse. Following the database structure of Ma and others (2009), we attributed each unit in several tables describing age, lithology, origin, thickness etc. The attribution content and format matches the published OGDC-5 standard (Ma and others, 2009) so that the new geologic data can be easily updated in future versions of OGDC. The geologic unit feature class includes 96 units, which are attributed in the feature class with the following fields:

- Map unit label — Project-specific unit label
- Map unit name — Project specific unit name
- Geologic Merge Unit Label — OGDC-standard unit label
- General Geologic Unit — First-order geologic unit (volcanic, marine sedimentary etc)
- Geologic Age
- Group or Terrane — First-order stratigraphic unit
- Formation — Formation level stratigraphic unit
- Member — Member-level stratigraphic unit
- Unit — Bed, flow or other low-level stratigraphic unit
- Rock Type — simplified lithology of unit

A written description of map units (DMU) was also prepared.

The geodatabase includes point feature classes for bedding attitudes and volcanic vents and line feature classes for contacts, faults and folds.

The geodatabase and DMU were published (Ma and others, 2012) as a DOGAMI Open File Report (O-12-02), and copies provided to our USGS collaborators. The publication can be obtained from the Nature of the Northwest information center (http://www.naturenw.org/qs3/products.php?sku=002100).

The primary purpose of this project was to build the geodatabase to support the geologic model. Therefore we did not prepare a traditional geologic map from the database, in part due to the cartographic burden of depicting 96 units. Instead, the publication includes a thematic map derived from the detailed work to provide the general public with a more easily understood description of the dynamic surficial processes at work in the area. We expect that the collaborative regional geologic map will provide a far more detailed and comprehensive description of units and discussion of structure, stratigraphic relationships, geochemistry and geochronology, and geologic history of the area.

The spatial database is provided in the form of an Esri format geodatabase, for version 9.3 and 10 of ArcMap. Metadata is embedded in the geodatabase.

References

Evarts, R.C., and O'Connor, J. E., 2008, Geologic Map of the Camas Quadrangle, Clark County Washington and Multnomah County, Oregon: US Geological Survey Scientific Investigations Map 3017.

Ma, L., Madin, I.P., Olson, K.V., Watzig, R.J., Wells, R.E., Niem, A.R., and Priest G.R. (compilers), 2009, Oregon geologic data compilation (OGDC) release 5 (statewide): Oregon Department of Geology and Mineral Industries Digital Data Series OGDC-5

Madin, I.P., 2004, Geologic mapping and database for Portland area fault studies, final technical report: Oregon Department of Geology Open File Report O-04-02

Madin, I.P., 2009, Geologic Map of the Oregon City 7.5' Quadrangle, Clackamas County, Oregon: 46 p., plus appendices, 1:24,000, Oregon Department of Geology and Mineral Industries GMS-119

Madin, I.P., and Niewendorp, C.A., 2008, Preliminary geologic map of the Dixie Mountain 7.5' quadrangle, Multnomah, Washington and Columbia counties, Oregon: 43 p., 1:24,000, Oregon Department of Geology and Mineral Industries Open-File-Report O-08-07

Madin, I.P., Ma, L. and Niewendorp, C.A., 2008, Preliminary geologic map of the Linnton 7.5' quadrangle, Multnomah and Washington counties, Oregon: 35 p., 1:24,000, Oregon Department of Geology and Mineral Industries Open-File-Report O-08-06

Simenstad, C.A., Burke, J.L., O'Connor ,J.E., Cannon, C., Heatwole, D.W., Ramirez, M.F., Waite, I.R., Counihan, T.D., and Jones, K.L., 2011, Columbia River Estuary Ecosystem Classification—Concept and Application: US Geological Survey Open-File Report 2011-1228

Bibliography

Ma, L., Madin, I.P., Duplantis, S., and Williams, K.J., 2012, Lidar-based surficial geologic map and database of the greater Portland, Oregon, area, Clackamas, Columbia, Marion, Multnomah, Washington, and Yamhill Counties, Oregon, and Clark County, Washington: 30 p., 1:63,360, Oregon Department of Geology and Mineral Industries Open-File Report O-12-02