**Identification Information**

Citation:

Originator: Stanley A. Mertzman, Richard W. Hazlett, Stephen G. Weaver, Isaac

P. Weaver, Jill M. Baum, Martha S. Gilmore, Travis J. McElfresh, Jonathon L. Nauert, Kirsten E. Nicolaysen, James T. Rowe, Andrew Tittler, and Wayne R. Wright

Publication Date: 2012

Title:

Open-File Report O-12-01: Preliminary Geologic Map of the Lake Mt. McLoughlin 7.5′ Quadrangle, Jackson and Klamath Counties, Oregon

Publication Information:

Publication Place: Portland, Oregon

Publisher: Oregon Department of Geology and Mineral Industries

Description:

Abstract: This data set contains the information used to create the Preliminary

Geologic Map of the Mt. McLoughlin 7.5′ Quadrangle for Open-File Report O-12-01. This map is one of a series of geologic maps created for quadrangles in south-central Oregon in the area of the Cascade Mountains just to the west of Klamath Lake in Jackson and Klamath Counties (and and including a small area of northern California at the Oregon and California border).

The digital raster Graphic (DRG) of the 1988 provisional edition of the U.S. Geological Survey (USGS) 7.5′ Mt. McLoughlin quadrangle provides the base map on top of which have been placed geospatial vector format layers of the geologic units and unit boundaries/contacts; and point data format layers of the analyzed rock sample collection locations and volcanic centers. The geologic units and their boundaries were determined based on a combination of observations from the field and of hand-sample, thin-section, and geochemical analyses of 85 samples collected from within the Mt. McLoughlin USGS 7.5′ quadrangle as well as of relevant samples collected from surrounding USGS 7.5′ quadrangles. Although the chemistry data and thin-section observations were used in creating the map, the units are meant to be field-mappable, that is, recognizable by the study of outcrops in the field.

The various layers (*i.e.*, geologic units, samples, etc.) of the map were digitized in MapInfo Professional v.7.0 from drawings on paper quadrangles, UTM coordinates, or maps from student research reports. Rock samples were collected and analyzed by X-ray fluorescence (XRF) in 1984, 1991, 1992, 2004, 2006, and 2009. A total of 14 samples from within the Mt. McLoughlin 7.5′ quadrangle, plus several from surrounding quadrangles (but from units found in the Lake of the Woods North quadrangle), were dated using K-Ar dating methods. The major and trace elemental chemistry data and ages (if dated) of specimens collected within the Lake of the Woods North quadrangle are made available in the samples table of this data set.

Purpose: These data were collected and compiled in order to better

understand the local geology and geologic history, to create a field-

mappable geologic map of the U.S. Geological Survey 7.5′ Mt. McLoughlin quadrangle to be published as Open-File Report O-12-01, and to make available the collected chemical and age information that may be useful in various forms of study of this volcanic region. The map is intended for a diverse audience with varying amounts of geologic understanding. This is one of a series of geologic maps of USGS 7.5′ quadrangles in the south-central region of Oregon to be published by the Oregon Department of Geology and Mineral Industries.

Supplemental Information: There are several different files and file formats in

this data set. The geologic units table, unit boundaries/contacts table, samples table, and volcanic centers table were created in MapInfo Professional versions 7.0 and/or 8.0 the .TAB files can be opened using MapInfo software. These data were later translated to ESRI compatible file formats using the MapInfo Universal Translator extension. These translated files were then arranged and set up to properly display the data when opened in the ESRI ArcMap software.

There is a MapInfo workspace (.WOR) file that opens the georeferenced USGS Mt. McLoughlin 7.5′ quadrangle raster image and the other Mt. McLoughlin quadrangle tables mentioned above (MtMcLoughlin.WOR). There is also an ArcMap file (.MXD) which contains the georeferenced USGS Mt. McLoughlin 7.5′ quadrangle and the geologic units, unit boundaries, samples, and volcanic centers shapefiles and accompanying attribute tables (MtMcLoughlin.MXD).

Time Period of Content:

Multiple Dates/Times:

Calendar Date: 1984, 1991, 1992, 2004, 2006, and 2009.

Currentness Reference: ground condition and 2012 is the publication date

Status:

Progress: Complete

Maintenance and Update Frequency: Unknown

Spatial Domain:

Bounding Coordinates:

West Bounding Coordinate: -122.375

East Bounding Coordinate: -122.25

North Bounding Coordinate: 42.5

South Bounding Coordinate: 42.375

Keywords:

Theme:

Theme Keyword Thesaurus: none

Theme Keyword: geologic map

Theme Keyword: map of surface geology

Theme Keyword: surface geology

Theme Keyword: volcanoes

Theme Keyword: Oregon volcanoes

Theme Keyword: volcanic flows

Theme Keyword: lava flows

Theme Keyword: units

Theme Keyword: formations

Theme Keyword: formation boundary

Theme Keyword: contact

Theme Keyword: samples

Theme Keyword: rock samples

Theme Keyword: geochemistry

Theme Keyword: chemistry

Theme Keyword: age-dated

Theme Keyword: volcanic center

Theme Keyword: geospatial vector format

Theme Keyword: digital raster graphic

Theme Keyword: drg

Theme Keyword: topographic map

Theme Keyword: topographic quadrangle

Theme Keyword: USGS quadrangle

Theme Keyword: Open-File Report

Theme Keyword: Open-File Report 11-18

Place:

Place Keyword Thesaurus: none

Place Keyword: Oregon

Place Keyword: south-central Oregon

Place Keyword: Southern Oregon

Place Keyword: Jackson County

Place Keyword: Klamath County

Place Keyword: Jackson and Klamath Counties

Place Keyword: Oregon volcanoes

Place Keyword: Mt. McLoughlin USGS 7.5′ quadrangle

Place Keyword: Mt. McLoughlin quadrangle

Place Keyword: Mt. McLoughlin

Place Keyword: Mount McLoughlin

Place Keyword: Fish Lake

Place Keyword: North Fork Little Butte Creek

Place Keyword: Rye Flat

Place Keyword: West Branch Willow Creek

Place Keyword: Rye Spring

Place Keyword: Bourbon Spring

Place Keyword: Dogwood Spring

Place Keyword: Skeeters Creek

Place Keyword: South Squaw Tip

Place Keyword: North Squaw Tip

Place Keyword: Twin Ponds

Place Keyword: Summit Lake

Place Keyword: Squaw Lake

Place Keyword: Norris Pond

Place Keyword: Orris Pond

Place Keyword: South Fork Fourbit Creek

Place Keyword: Swan Creek

Place Keyword: Fourmile Lake

Place Keyword: Mirror Pond

Place Keyword: Freye Lake

Place Keyword: Cascade Canal

Place Keyword: Dry Creek

Place Keyword: Pacific Crest National Scenic Trail

Place Keyword: Fish Lake Resort

Place Keyword: Fish Lake Campground

Place Keyword: North Park Campground

Place Keyword: Doe Point Campground

Place Keyword: Camp 76

Place Keyword: Fourmile Lake Campground

Place Keyword: Oregon Route 140

Place Keyword: Sky Lakes Wilderness

Place Keyword: Winema National Forest

Stratum:

Stratum Keyword Thesaurus: none

Stratum Keyword: surface

Stratum Keyword: surface geology

Stratum Keyword: surficial

Stratum Keyword: surficial formations

Stratum Keyword: surface formations

Stratum Keyword: surface units

Stratum Keyword: surficial units

Stratum Keyword: upper strata

Stratum Keyword: surface strata

Stratum Keyword: volcanic strata

Stratum Keyword: volcanic

Stratum Keyword: surficial volcanic deposits

Stratum Keyword: lava flows

Stratum Keyword: surficial lava flow

Stratum Keyword: Quaternary sediments

Stratum Keyword: Quaternary landslides

Temporal:

Temporal Keyword Thesaurus: none

Temporal Keyword: 6.58 Ma

Temporal Keyword: 6.58 million years

Temporal Keyword: present

Temporal Keyword: 6.58 million years ago to the present

Temporal Keyword: late Cenozoic

Temporal Keyword: upper Cenozoic

Temporal Keyword: Quaternary

Temporal Keyword: 11.608 Ma

Temporal Keyword: 11.608 million years

Temporal Keyword: Less than 11.608 million years

Temporal Keyword: 11.608 million years ago to the present

Temporal Keyword: Upper Miocene to Holocene

Temporal Keyword: Miocene to Holocene

Temporal Keyword: Miocene

Temporal Keyword: Pliocene

Temporal Keyword: Tertiary

Temporal Keyword: Neogene

Temporal Keyword: Pleistocene

Temporal Keyword: Holocene

Access Constraints: none

Use Constraints: Acknowledgement of the authors and the Oregon Department of

Geology and Mineral Industries would be appreciated in products derived

from these data.

Point of Contact:

Contact Person Primary: Stanley A. Mertzman

Contact Address:

Address Type: mailing and physical address

Address: Stanley A. Mertzman, Franklin and Marshall College,

Department of Earth and Environment, PO Box 3003

City: Lancaster

State or Province: Pennsylvania

Postal Code: 17604

Contact Voice Telephone: 1-717-291-3818

Contact Electronic Mail Address: [stan.mertzman@fandm.edu](mailto:stan.mertzman@fandm.edu)

Contact Instructions: contact via electronic mail is preferred

Browse Graphic:

Browse Graphic File Name: MtMcLoughlinMap30x36.pdf

Browse Graphic File Description: The MtMcLoughlinMap30x36.pdf file

contains the Preliminary Geologic Map of the Mt. McLoughlin 7.5′ Quadrangle, Jackson and Klamath Counties, Oregon of Open-File Report O-12-01. This map was made from the data provided in this data set. The basic image in this map (the 1988 Provisional Edition USGS Mt. McLoughlin 7.5′ quadrangle overlain by the formations, formation boundaries/contacts, and sample symbols) was created in MapInfo Professional version 8.0 using the data available in this data set (MtMcLoughlinQuadforTransparent.TAB, MtMcLoughlinUnits.TAB, MtMcLoughlinUnitBounds.TAB, and MtMcLoughlinSamples.TAB). This

image was exported from MapInfo Professional v. 8.0 as a Photoshop Document (.PSD) at a zoom of 1 inch = 1.4 miles, a window size of 8.00 miles (in the export options, the actual window size was doubled from 5.72 inches to 11.44 inches), and with a resolution of 600 pixels per inch. The colors of the resulting .PSD file were adjusted in Adobe Photoshop CS5.1 (64 bit) to match USGS CMYK color standards. The image was then opened in Adobe Illustrator CS5.1 where its size was increased by 184.7999% to make the map scale 1:24,000. The scale was then checked

manually within Adobe Illustrator CS5.1. The samples’ map numbers, the formation labels, and the rest of what is seen on the map sheet, such as the

time rock chart and the legend, were added to the map sheet in Adobe Illustrator CS3 and CS5.1. The resulting 30 inch x 36 inch Adobe Illustrator image was saved as a Portable Document Format (.PDF) file and the result is the image of the geologic map seen in the file MtMcLoughlinMap30x36.pdf.

Browse Graphic File Type: PDF

Native Data Set Environment: The majority of the data files in the data set used to make

the Preliminary Geologic Map of the Mt. McLoughlin 7.5′ Quadrangle, Jackson and Klamath Counties, Oregon of Open-File Report 11-18 was originally created using MapInfo Professional software version 7.0 running under a Microsoft Windows 2000 Professional operating system. The data that were digitized in this environment were the geologic units, the unit boundaries, and the sample locations layers. These files were modified using MapInfo Professional software version 7.0 running under a Microsoft Windows XP Professional version 2002 Service Pack 2 operating system and with MapInfo Professional software version 8.0 running under a Microsoft Windows 7 Ultimate operating system. The volcanic centers layer was created using MapInfo version 8.0 on a system running Microsoft Windows 7 Ultimate. The USGS 7.5′ Mt. McLoughlin quadrangle digital raster graphic (drg) was obtained from an external source (the University of Oregon Libraries website, <http://libweb.uoregon.edu/map/map_section/search.html>) and was produced in a different and unknown environment. However, in order to make a version of this USGS quadrangle drg that would make its white and green areas transparent (so that the map could overlay the formations layer and the formations could show through) the digital USGS quadrangle drg was modified from the state in which it was originally obtained. This modification was done using Adobe Photoshop version 5 and the resulting image of the quadrangle was manually georeferenced in MapInfo Professional version 7.0. The data were at times accessed and modified in MapInfo Professional version 7.0 running under a Microsoft XP operating system or MapInfo Profession version 8.0 running under a Windows 7 Ultimate operating system, and the final files were made on a PC with Windows 7 Ultimate running MapInfo Professional version 8.0. The data from the Mt. McLoughlin quadrangle samples table have been exported from MapInfo Professional version 7.0 and version 8.0 at least one time and opened in Microsoft Excel for addition or modification of certain attributes, particularly chemistry data. The Microsoft Excel file was then reopened in MapInfo Professional version 7.0 or version 8.0. The files of this data set have been saved and backed-up on various hard drives at various times. The most up-to-date MapInfo Professional formatted files (DAT, ID, MAP, PSD, TAB, TFW, TIF, and WOR) have a total size of 61.9 MB.

After the data set had been produced in MapInfo Professional version 7.0 or 8.0, the files were converted using MapInfo’s Universal Translator extension to produce files that could be opened with ESRI ArcMap software version 10.0. This was done by converting the MapInfo TAB files into ESRI SHP format files. The USGS quadrangle drg was reopened within ESRI ArcMap. Further modification of the data files occurred within ESRI ArcMap, such as adjustment of attribute names in the attribute table, adjustment of symbol shapes and colors, and setting of the formation regions’ colors to make these features similar to how they appear in the MapInfo Files and on the Open-File Report geologic maps. The ESRI-formatted files (MXD, DBF, PRJ, SBN, SBX, SHP, SHX, AUX, RRD, TFW, and TIF) have a total size of 319 MB.

**Data Quality Information**

Attribute Accuracy:

Attribute Accuracy Report: The attribute accuracy was tested in several ways.

For sample and unit boundary attributes (UTM coordinates), accuracy was assessed by comparison of on-screen representations of the location (digital maps on the computer screen) to hard copy versions (hand-drawn or similarly-demarcated locations and boundaries on top of paper USGS quadrangles [when available]). On several occasions, the digitized versions of the Mt. McLoughlin 7.5′ quadrangle were saved as PDFs with the symbol locations and formation/unit boundaries demarcated. The PDF was then assessed by the chief geologist of the project, Stanley A. Mertzman. The final digital versions of the geologic map were also assessed by Stanley A. Mertzman.

The UTM coordinates of the samples provided in the attribute table have a precision that does not reflect that with which their locations on the map were determined. The precision reflects the values that were assigned using MapInfo Professional version 7.0’s or 8.0's Coordinate Extractor extension after manual placement (digitization) of the sample locations on the drg of the USGS 7.5′ Mt. McLoughlin quadrangle based on comparison with the original paper quadrangles or other maps on which locations were drawn, or in some cases, based on previously-rounded (to the nearest 10 m) UTM coordinates for samples not shown on the original paper map(s). The accuracy and precision of the locations drawn on the original paper maps may vary. Prior to the year 2000, sampling locations were originally determined by use of a Brunton compass in the field and these data were later translated to the 1:24,000 USGS 7.5′ quadrangles using plastic overlay cards marked with 1:24000 scale UTM coordinate grids or tick marks at relevant, repeated intervals. After the year 2000, Magellan GPS units were used in the field to determine a sample’s collection location, and again these coordinates were placed on the 1:24,000 scale USGS quadrangles using the appropriate plastic overlay card with UTM units.

The Public Land Survey System (PLSS) attributes (¼ of ¼ Section, ¼ Section, Section, Township, and Range) in the Mt. McLoughlin samples table were created in a manner so as to be as accurate as possible, but have not been tested for accuracy beyond the checks that occurred during their production. Typically the Township and Range attribute values were assigned by selection of all samples that occurred within either manually created or downloaded polygons of the Township and Range boundaries. Samples near a Township or Range grid line were more carefully studied on the screen to check that the sample really did lie within the supposed Township. The Section attribute was assigned based on a sample’s location in relation to the PLSS section grid as represented on the drg of the Mt. McLoughlin quadrangle in MapInfo (the sections are the small quadrangles demarcated by dashed red lines with the section numbers in their centers [where possible]).

The ¼ of ¼ Section and ¼ Section attributes were assigned for each sample based on downloaded grids ([http://www.geocommunicator.gov/](http://www.geocommunicator.gov/GeoComm/lsis_home/home/index.shtm)

[GeoComm/lsis\_home/home/index.shtm](http://www.geocommunicator.gov/GeoComm/lsis_home/home/index.shtm)) which displayed the boundaries of the ¼ of ¼ Sections and ¼ Sections of Townships. Because the Section and Township boundaries did not always line up perfectly with those of the underlying quadrangle DRG, at times attributes of samples close to lines in this grid had to be assigned based on mental adjustments, or at times the use of MapInfo Professional version 7.0’s Ruler tool, by a technician. For this reason, the accuracy of the ¼ of ¼ Section and ¼ Section attributes may be questionable in some cases, particularly in those samples which lie close to the boundaries which demarcate these location descriptors.

The accuracy of a sample’s Unit attribute was tested by a visual check of the sample’s location in relation to the unit boundaries as displayed in MapInfo Professional version 8.0 and by analysis of the chemical data.

The accuracy of the chemical data is dependent on many factors not discussed here. The samples were analyzed by X-ray fluorescence (XRF) at various times and possibly by different machines. All that will be said is that the accuracy of the XRF chemical data is monitored and assessed during the measurement procedure by using an instrument monitor (to account for local climate and machine conditions on the day of measurement), by running several well-measured standards in every batch, and by analyzing the totals counts. That the chemical attributes of each sample in the data table match the originally assigned data from the XRF instrument was insured by copying the data from the original Excel data files that contained the chemistry information provided by the XRF spectrometer and pasting them into an Excel spreadsheet which eventually became the attribute table of the MtMcLoughlinSamples.TAB MapInfo table. All of the chemical data were derived from these original Excel files, except for those of several of the age-dated samples, which may have values copied from a previous publication in Oregon Geology by Stanley A. Mertzman (2000). That the chemistries of the dated samples were correctly copied into the data table was checked by comparison of the digital data to the data printed in the publication. In cases where there were differences between the values in the original XRF results and those in the 2000 publication (Mertzman, 2000), the values in the data table were changed to match those of the 2000 publication.

The colors of the units are consistent between adjacent quadrangles mapped in this project and were created as the RGB (only color mode allowed in MapInfo Professional version 7.0) equivalents of standard USGS CMYK colors.

Logical Consistency Report: The boundaries of the Mt. McLoughlin unit

polygons within the units table (MtMcLoughlinUnits) have been checked for self- intersections, overlaps, and gaps using MapInfo Professional version 8.0 and no self-intersections, overlaps, or gap problems were detected. The edges of unit polygons have also been checked against those mapped in adjacent USGS 7.5′ quadrangles as part of this project, but available in other data sets (the incomplete Willow Lake quadrangle to the west [unpublished at the time of editing this document (06/21/11)], the Lake of the Woods North quadrangle to the east [OFR O-11-03 (Mertzman *et al.*, 2011)], and the Brown Mtn. quadrangle to the south [OFR O-07-09 (Mertzman *et al.*, 2007)] (the Rustler Peak quadrangle to the north currently has no digitized rock units). All of the boundaries (where present) were found to fit, and all of the points at the quadrangle corners were found to align perfectly if unit layers were present (including those of units in the Lake of the Woods South quadrangle to the southeast [OFR O-07-13 (Mertzman *et al.*, 2007)], the Robinson Butte quadrangle to the southwest [OFR O-09-02 (Mertzman *et al.*, 2009)], and the Pelican Butte quadrangle to the northeast [unpublished at the time of editing this document (06/21/11)]) (the Big Butte Springs quadrangle to the northwest currently has no digitized rock units). The unit boundaries polylines (from the file MtMcLoughlinUnitBounds) were drawn in a separate layer on top of the formations/units layer using the trace function that is available in the MapInfo Professional version 7.0 software.

There is one pair of samples with duplicate coordinates in the Mt. McLoughlin samples data table (MtMcLoughlinSamples) due to the collection of more than one sample from the same location or possibly from multiple XRF analyses of different parts of the same sample.

Completeness Report: All field-mappable units (and thus unit boundaries) in the USGS

7.5′ Mt. McLoughlin quadrangle have been mapped. At least one sample (not necessarily within the USGS Mt. McLoughlin 7.5′ quadrangle) from each volcanic unit present in the quadrangle has been age-dated (except for the Andesite of Brown Mountain [Qabm]). All known faults and volcanic centers within the Mt. McLoughlin quadrangle have been mapped, and the layer containing the volcanic centers’ locations has been included in this data set. All samples known to have been collected within this quadrangle and analyzed by X-ray fluorescence (XRF) by Professor Stanley A. Mertzman, students, or a lab technician have been mapped and are included within this data set. All chemistry results from the XRF analyses have been included in the attribute table of the samples data file (MtMcLoughlinSamples). All map numbers, sample numbers, ages (applicable only to dated samples) in millions of years (Ma), Public Land Survey System (PLSS: ¼ of ¼ Section, ¼ Section, Section, Township, and Range according to the Willamette meridian and base line), UTM coordinates (North American Datum of 1927: Zone 10), unit membership, and lithology (based on the total alkalis versus silica [TAS] classification method for volcanic rocks described by Le Maitre [2002]) have been included in the attribute table of the samples data file. The unit's symbol, name, geologic time scale age, and radiometrically-determined age(s) are the attributes of the Mt. McLoughlin units table (MtMcLoughlinUnits). The number attribute in the MtMcLoughlinUnits table allows the stratigraphically accurate listing of the units in the table. The attributes of the volcanic centers table provide their UTM Easting and Northing locations (UTM\_E\_m and UTM\_N\_m) according to the North American Datum of 1927 for the US: Zone 10 (NAD 27: Zone 10) as determined using the Coordinate Extractor extension in MapInfo Professional v. 8.0. As with the sample location coordinates, the precision of the UTM coordinates of the volcanic centers is greater than that with which the locations were assigned due to the precision of the results the Coordinate Extractor produces.

Positional Accuracy:

Horizontal Positional Accuracy:

Horizontal Positional Accuracy Report: The horizontal positional

accuracy of the digitized data with regard to the original paper maps has been checked by visual comparison of the digitized sample locations and formation boundaries to the original paper maps when possible. The positional accuracy of the original sample locations on the original paper maps may vary depending on the location-determining methods used as discussed above (Brunton compass before 2000 or Magellan GPS thereafter). The positions of the unit boundaries are approximate and their accuracy has not necessarily been field tested. Analysis of the collected samples (chemistry, hand-sample, and thin sections) and familiarity with the area from lots of time spent in the field by experienced geologists ought to ensure reasonable accuracy of the mapped unit boundaries, although this is not quantifiable.

Lineage:

Source Information:

Source Citation:

Originator: U.S. Geological Survey

Publication Date: 1988

Title: Mt. McLoughlin Quadrangle: Oregon: 7.5 Minute Series

(Topographic)

Edition: Provisional Edition 1988

Geospatial Data Presentation Form: map and raster

digital data (digital raster graphic [drg]) of map

Series Information:

Series Name: U.S. Geological Survey 7.5 Minute

Series Topographic Quadrangles

Series Issue: Mt. McLoughlin, Oreg.: Provisional

Edition 1988: 42122-D3-TF-024

Publication Information:

Publication Place: Denver, CO or Reston, VA

Publisher: U.S. Geological Survey

Other Citation Details: A drg of this map can be downloaded from

the University of Oregon Libraries website.

Online Linkage: UO Libraries website:

[http://libweb.uoregon.edu/dc/24k\_lookup/](http://libweb.uoregon.edu/dc/24k_lookup/displaymap.php?ohio_code=42122d3)

[displaymap.php?ohio\_code=42122d3](http://libweb.uoregon.edu/dc/24k_lookup/displaymap.php?ohio_code=42122d3)

Source Scale Denominator: 24,000

Type of Source Media: Paper and Online

Source Time Period of Content:

Time Period Information:

Multiple Dates/Times:

Calendar Dates: 1983, 1985, 1988

Source Currentness Reference: 1983 corresponds to the

year in which aerial photographs were taken; the map was field checked in 1985; and the map was edited and published in 1988. The year of production of the particular drg used in the data set is not currently known.

Source Citation Abbreviation: 42122d3

Source Contribution: The USGS Mt. McLoughlin 7.5

minute paper quadrangle was used as the base map on which the geology of the quadrangle was mapped by Stanley A. Mertzman, his colleagues, and students (the exact version[s] of the map[s] used as the original base maps is not currently known). A downloaded drg of the Mt. McLoughlin 7.5 minute quadrangle (42122d3) was used as the base map for this data set onto which the sample locations, and units were copied (digitized) from a paper version (or versions) of the map(s) produced by the geologists involved in this project. It is also possible that the sample collection locations came from UTM coordinates provided in a report by one of the geologists.

The volcanic centers were added near the end of the production of the Mt. McLoughlin Open-File Report.

Process Step:

Process Description: The first step in the production of this data set was

the collection of rock samples and observations from the field. The

samples’ chemistries were determined by X-ray fluorescence

(XRF) spectroscopy (see <http://fandm.edu/x7985.xml> for an overview of the XRF spectroscopy preparation and analysis

procedure at Franklin & Marshall College’s XRF laboratory). The hand-samples were carefully analyzed and described. Thin sections of the rocks allowed further description of certain samples by analysis with a petrographic microscope.

A sample’s collection location was determined in the field using a Brunton compass prior to 2000, and with a Magellan GPS unit after 2000. The sample locations were marked on paper versions of the USGS 7.5′ Mt. McLoughlin quadrangle (and in some cases, only the UTM coordinates were recorded or retrievable for use in digitization). These locations were digitized using a georeferenced (to the North American Datum of 1927 [NAD 27] zone 10 horizontal datum) drg of the quadrangle in MapInfo Professional version 7.0 by placing a point (node) in a layer above the drg at the location identical to the sample’s location on the paper map. If a sample was not present on a map, but the UTM coordinates of its collection location were known, these coordinate values were used to plot the sample’s collection location in MapInfo. This process was the first step in the production of the Mt. McLoughlin samples table (MtMcLoughlinSamples); it produced point data from which the UTM coordinates, if not already known, could be extracted to the attribute table. Please note that the precision of the UTM coordinates does not necessarily reflect the precision with which they were originally obtained, but represents the precision obtained when extracting the coordinates of the points (with MapInfo Professional version 7.0’s Coordinate Extractor tool) after they were digitized from the paper maps.

The MtMcLoughlinSamples attribute table was exported from MapInfo Professional v. 7.0 or 8.0 at least one time to Microsoft Excel, where other sample attributes were added and or modified (such as lithology and chemistry data). These Excel spreadsheets were then imported back into MapInfo Professional version 7.0 or 8.0 and the previously extracted UTM coordinates were used to re-plot the sample locations over the 7.5′ quadrangle drg. The drg of the quadrangle was also used in assigning some of the Township, Range, and Section attributes to the samples. Downloaded PLSS grids also aided in assigning these and other PLSS attributes (¼ of ¼ section, ¼ section) to the samples table.

The combination of the analyses of collected samples and a

familiarity with the area from a lot of time spent in the field

allowed Stanley A. Mertzman to determine and discriminate between the units present within the Mt. McLoughlin 7.5′ quadrangle and to draw the approximate locations of their boundaries on the paper USGS 7.5′ topographic maps. These boundaries were then digitized in the same manner as sample locations, by copying their locations from the paper map to a MapInfo layer on top of a drg of the same map (USGS 7.5′ Mt. McLoughlin (42122d3)). This was done using the polygon tool in MapInfo Professional version 7.0. The boundary of the unit on the map (contact) (MtMcLoughlinUnitBounds MapInfo Table) was digitized as the boundary of the polygon in MapInfo. The unit polygons were colored based on RGB equivalents of standard USGS CMYK colors. The unit ages, names, and symbols (abbreviated names) were added to the attribute table at a later stage of the process. It was decided that a separate layer (file) should be made for the unit boundaries (contacts) within the quadrangle because the edges of the unit polygons did not necessarily correspond to the actual unit boundaries. The edges of the unit polygons were limited by the quadrangle boundaries, so although many units extend beyond the boundaries of the Mt. McLoughlin USGS 7.5′ quadrangle, the polygons for this data set were limited to the area of the quadrangle.

In order to make a layer (MtMcLoughlinUnitBounds) that corresponded to the actual unit boundaries (ground-surface contacts between two rock units), the true unit boundaries (not those cut off at the quadrangle’s edges) were made by tracing (using MapInfo’s trace function) all of the unit polygons’ edges, except those that corresponded with the 4 sides of the quadrangle. This process created the polylines that now represent the unit

boundaries/contacts in this data set (MtMcLoughlinUnitBounds).

The volcanic centers’ locations (MtMcLoughlinVolcCenters) were originally determined from field observations and sample analyses. Their locations were digitized close to the time of the OFR's final production and checked by Stanley A. Mertzman. The UTM coordinates of these locations have been extracted into the volcanic centers attribute table using MapInfo version 8.0’s Coordinate Extractor tool. Please note that, like the precision of the samples’ UTM coordinates, the precision of the volcanic centers' UTM coordinates does not reflect that with which the locations were determined, but is the result of using MapInfo v. 8.0’s Coordinate Extractor Extension that outputs the data in a certain format.

After the creation of final forms of all of the necessary files in

MapInfo, the MapInfo Universal Translator Extension was used to convert the MapInfo-formatted data set to ESRI-format files. This involved converting the mapinfo TAB files of the unit polygons, unit boundary (contact) polylines, sample points, and volcanic center points to shapefiles (SHPs). These files were opened and adjusted in ESRI ArcMap version 9.2. It should be noted that two additional fields (attributes) were created when the

MapInfo TAB files were converted to ESRI-format files. These two fields are the “FID” and the “Shape\*.” The “FID” numbers all of the objects in the data tables and the “Shape\*” attribute tells what kind of data an object is (i.e., multipoint, polyline, or polygon). These added fields are not discussed with the rest of the attributes below. It should also be noted that certain attribute names of the ESRI-format files were changed by the program during their creation and were not able to be modified by the technician. In such cases, the alias of the attribute was changed to fit the original attribute titles (as shown below), but the names had to be left as they were converted.

The digital versions of the sample collection locations; units and

unit boundaries; and the volcanic centers locations were checked by visual assessment of the digital data on the computer

screen (in MapInfo) or on printed copies to the original source paper maps. Furthermore, final printed or digital (PDF) versions of the resulting map(s) were assessed by the chief geologist of this project, Stanley A. Mertzman.

Source Used Citation Abbreviation: 42122d3

Process Date: 2012

Process Contact:

Contact Information:

Contact Person Primary:

Contact Person: Isaac Weaver

Contact Position: Research Assistant

Contact Address:

Address Type: mailing and physical address

Address: Isaac Weaver, Franklin and

Marshall College, Department of Earth and Environment, PO Box 3003

City: Lancaster

State or Province: Pennsylvania

Postal Code: 17604

Contact Voice Telephone: Unavailable

Contact Electronic Mail Address:

[iweavertz@gmail.com](mailto:iweavertz@gmail.com)

# Spatial Data Organization Information

Indirect Spatial Reference: This data set contains the drg of the USGS 7.5′ Mt. McLoughlin quadrangle and files with point data locations at which rock samples were collected from outcrops, polygons of the geologic units, polylines of the unit boundaries (contacts), and point data volcanic center locations for the U.S. Geological Survey 7.5 minute Mt. McLoughlin quadrangle.

Direct Spatial Reference Method: Point, Vector, and Raster

## Spatial Reference Information

Horizontal Coordinate System Definition:

Planar:

Grid Coordinate System:

Grid Coordinate System Name: Universal Transverse Mercator

Universal Transverse Mercator:

UTM Zone Number: 10

Transverse Mercator:

Scale Factor at Central Meridian: 0.999600

Longitude of Central Meridian: -123.000000

Latitude of Projection Origin: 0.000000

False Easting: 500000.000000

False Northing: 0.000000

Planar Coordinate Information:

Planar Coordinate Encoding Method: coordinate pair

Coordinate Representation:

Abscissa Resolution: 0.000000

Ordinate Resolution: 0.000000

Planar Distance Units: meters

Geodetic Model:

Horizontal Datum Name: North American Datum of 1927

Ellipsoid Name: Clarke 1866

Semi-major Axis: 6378206.4

Denominator of Flattening Ratio: 294.978698214

### Entity and Attribute Information

Detailed Description:

Entity Type:

Entity Type Label: Unit

Entity Type Definition: A rock unit (or simply unit), with regard to this

data set, is a body of rock with a limited range of lithological

characteristics (as determined by analyses of outcrops and samples in the field and in the laboratory) that can be distinguished from other bodies of rocks by observations made in the field (such as analysis of outcrops or hand-samples collected from them). That is to say, a unit is field-mappable according to the definition used in the creation of this data set. Nevertheless, the chemistry data and other observations not possible in the field were still considered in determining and discriminating the units. In the Mt. McLoughlin 7.5′ quadrangle, a unit may represent one or more volcanic flows; vent deposits; or quaternary alluvium, landslide plus glacial, or glacial deposits. A unit has an age (or age-range), which has been determined by radiometric dating of collected samples from each unit (except for the Quaternary alluvium [Qal], Quaternary undifferentiated colluvium and alluvium [Qg], and Andesite of Brown Mountain [Qabm]). It should be noted that the vent deposit unit (Qbv) could perhaps best described as a sub-unit of the unit in which it is found (Basaltic Andesite of Mount McLoughlin [Qbam]), but it is classified separately due to the difference in lithology.

Detailed descriptions of the units found within the USGS 7.5′ Mt. McLoughlin quadrangle are found in the Open-File Report O-12-01 (Mertzman *et al.*, 2012). In this data set, the units are found in the MtMcLoughlinUnits file and are colored polygons with their edges placed at the approximate locations of the contacts, except when limited by the quadrangle boundaries.

Entity Type Definition Source: See Mertzman *et al.* (2012) for detailed

descriptions of the units found within the Mt. McLoughlin quadrangle.

Attribute:

Attribute Label: number

Attribute Definition: This numbering system was used to order the

geologic units stratigraphically in the MapInfo attribute table.

Attribute Definition Source: See Mertzman *et al.* (2012).

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 1

Range Domain Maximum: 20

Attribute Units of Measure: unitless

Attribute:

Attribute Label: Symbol

Attribute Definition: The symbol is a form of shorthand text, specific to a

unit, that is created by combining age and lithology information with an abbreviated form of the unit’s name. The symbol attribute is meant to be displayed on the pdf versions of the geologic map to save space while identifying the unit, or it can be displayed when viewing the data in MapInfo or ArcMap on a computer. It is intended that the symbol convey age, lithology, and unit name information. The first letter is capitalized and represents the period-age of the formation (T=Tertiary and Q=Quaternary). If the first letter of the symbol is a capital T, then the second letter represents the epoch-age of the formation (p=Pliocene and m=Miocene). It should be noted that these first two letters only represent the oldest dated age of the formation; that is, a unit’s age may span from period to period or epoch to epoch, but this cannot be discerned from the symbol. The remaining letters in the symbol indicate the dominant lithology of the formation and its name. The lithology (for volcanic units, b=basalt, ba= basaltic andesite, and a=andesite [based on weight percent silica(SiO2)]) comes first after the age information in the abbreviation of the unit’s name, which is usually based on an outstanding geographic or topographic feature present in the area of the unit. The vent deposits (Qbv) and the Quaternary sedimentary units (Qal and Qg) do not follow this pattern, are treated more generally, and only have the age information followed by a general lithology abbreviation because these units and sub-units (vent deposits) do not have specific names based on a geographic feature.

Attribute Definition Source: None

Attribute Domain Values:

Enumerated Domain:

Enumerated Domain Value: Qal

Enumerated Domain Value Definition: Alluvium

(Holocene).

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Qg

Enumerated Domain Value Definition: Undifferentiated

colluvium and alluvium (Pleistocene to Holocene).

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Qbv

Enumerated Domain Value Definition: Basaltic/basaltic

andesite/andesite vent deposits (Pleistocene). This unit should be considered a sub-unit of the unit in which it is found. Qbv is present in one unit of the Mt. McLoughlin 7.5 minute quadrangle: Basaltic Andesite of Mount McLoughlin (Qbam).

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Qabm

Enumerated Domain Value Definition: Andesite of Brown

Mountain (Upper Pleistocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Qbrb

Enumerated Domain Value Definition: Basalt of Robinson

Butte (Middle Pleistocene).

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Qbam

Enumerated Domain Value Definition: Basaltic Andesite

of Mount McLoughlin (Middle to Upper

Pleistocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Qbwl

Enumerated Domain Value Definition: Basalt of

Woodpecker Lake (Lower Pleistocene).

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Tpbbcl

Enumerated Domain Value Definition: Basalt of Blue

Canyon Lake (Upper Pliocene to Lower

Pleistocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Tpbaf

Enumerated Domain Value Definition: Basaltic Andesite

Freye Lake (Upper Pliocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Tpbad

Enumerated Domain Value Definition: Basaltic Andesite

of Dry Creek (Middle Pliocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Tpafl

Enumerated Domain Value Definition: Andesite of Fish

Lake (Lower Pliocene to Lower Pleistocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Tmbrf

Enumerated Domain Value Definition: Basalt of Rye Flat

(Upper Miocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Tmbads

Enumerated Domain Value Definition: Basaltic Andesite

of Dogwood Spring (Upper Miocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Attribute:

Attribute Label: Name

Attribute Definition: The Name attribute represents the name of the

unit of which the entity is a part. The name combines information on the lithology of the unit with a geographic feature located within or near the unit’s boundary, such as a mountain or a body of

water. Detailed descriptions of the units found within the Mt. McLoughlin USGS 7.5′ quadrangle are available in Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Attribute Definition Source: See Mertzman *et al.*, 2012.

Attribute Domain Values:

Enumerated Domain:

Enumerated Domain Value: Alluvium

Enumerated Domain Value Definition:

See Open-File Report O-12-01 (Mertzman *et al.*, 2012) for a detailed description of this unit.

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Undifferentiated colluvium

and alluvium

Enumerated Domain Value Definition:

See Open-File Report O-12-01 (Mertzman *et al.*, 2012) for a detailed description of this unit.

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Basaltic/basaltic andesite/

andesite vent deposits

Enumerated Domain Value Definition: Poorly lithified to

unconsolidated lapilli- to ash-sized cinders, black to brown to red with lesser amounts of similarly colored lava spatter, bombs, and scoria. These deposits mark volcanic vent areas that are often cinder cones. These areas should be considered sub- units of the units in which they are found, and samples found within areas of basaltic/basaltic andesite/andesite vent deposits are classified as part of the complimentary unit.

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Andesite of Brown Mountain

Enumerated Domain Value Definition: See Open-File

Report O-12-01 (Mertzman *et al.*, 2012) for a detailed description of this unit.

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Basalt of Robinson Butte

Enumerated Domain Value Definition: See Open-File

Report O-12-01 (Mertzman *et al.*, 2012) for a detailed description of this unit.

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Basaltic Andesite of Mount

McLoughlin

Enumerated Domain Value Definition: See Open-File

Report O-12-01 (Mertzman *et al.*, 2012) for a detailed description of this unit.

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Basalt of Woodpecker Lake

Enumerated Domain Value Definition: See Open-File

Report O-12-01 (Mertzman *et al.*, 2012) for a detailed description of this unit.

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Basalt of Blue Canyon Lake

Enumerated Domain Value Definition: See Open-File

Report O-12-01 (Mertzman *et al.*, 2012) for a detailed description of this unit.

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Basaltic Andesite of Freye

Lake

Enumerated Domain Value Definition: See Open-File

Report O-12-01 (Mertzman *et al.*, 2012) for a detailed description of this unit.

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Basaltic Andesite of Dry

Creek

Enumerated Domain Value Definition: See Open-File

Report O-12-01 (Mertzman *et al.*, 2012) for a detailed description of this unit.

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Andesite of Fish Lake

Enumerated Domain Value Definition: See Open-File

Report O-12-01 (Mertzman *et al.*, 2012) for a detailed description of this unit.

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Basalt of Rye Flat

Enumerated Domain Value Definition: See Open-File

Report O-12-01 (Mertzman *et al.*, 2012) for a detailed description of this unit.

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Basaltic Andesite of

Dogwood Spring

Enumerated Domain Value Definition: See Open-File

Report O-12-01 (Mertzman *et al.*, 2012) for a detailed description of this unit.

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Attribute:

Attribute Label: Age\_Geologic\_Time\_Scale

Attribute Definition: The Age\_Geologic\_Time\_Scale represents

the age of a unit in terms of the “Stage Age” (convention not completely followed, only Lower, Middle, and Upper are used as classes in this naming category) and “Series Epoch” classifiers of the 2007 International Stratigraphic Chart (International Commission on Stratigraphy, 2007) as defined by dates calculated by Gradstein *et al.* (2004). The attribute value was determined by a comparison of a unit’s dated age(s) to the stratigraphic age boundaries in the 2007 International Stratigraphic Chart (International Commission on Stratigraphy, 2007). A range of geologic time scale ages may be provided for a unit due to a range of ages calculated for one or more samples therein by K-Ar or 40Ar/39Ar dating methods. This attribute provides a low resolution representation of the age of a unit.

Attribute Definition Source: See Open-File Report O-12-01 (Mertzman et

al., 2012), International Convention on Stratigraphy (2007), and Gradstein *et al.* (2004).

Attribute Domain Values:

Enumerated Domain:

Enumerated Domain Value: Holocene

Enumerated Domain Value Definition: Unknown

Holocene (<0.0115 Ma).

Enumerated Domain Value Definition Source:

Gradstein *et al.* (2004), International Convention

on Stratigraphy (2007), and Open-File Report

O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Pleistocene to Holocene

Enumerated Domain Value Definition: Unknown

Pleistocene to Holocene (<1.806 Ma).

Enumerated Domain Value Definition Source:

Gradstein *et al.* (2004), International Convention

on Stratigraphy (2007), and Open-File Report

O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Upper Pleistocene

Enumerated Domain Value Definition: 0.126 – 0.0115

million years ago (Ma)

Enumerated Domain Value Definition Source:

Gradstein *et al.* (2004), International Convention

on Stratigraphy (2007), and Open-File Report

O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Middle Pleistocene

Enumerated Domain Value Definition: 0.781 – 0.126

million years ago (Ma)

Enumerated Domain Value Definition Source:

Gradstein *et al.* (2004), International Convention

on Stratigraphy (2007), and Open-File Report

O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Middle to Upper Pleistocene

Enumerated Domain Value Definition: 0.781 – 0.0115

million years ago (Ma)

Enumerated Domain Value Definition Source:

Gradstein *et al.* (2004), International Convention

on Stratigraphy (2007), and Open-File Report

O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Lower Pleistocene

Enumerated Domain Value Definition: 1.806 – 0.781

million years ago (Ma)

Enumerated Domain Value Definition Source:

Gradstein *et al.* (2004), International Convention

on Stratigraphy (2007), and Open-File Report

O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Upper Pliocene to Lower

Pleistocene

Enumerated Domain Value Definition: 2.588 – 0.781

million years ago (Ma)

Enumerated Domain Value Definition Source:

Gradstein *et al.* (2004), International Convention

on Stratigraphy (2007), and Open-File Report

O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Upper Pliocene

Enumerated Domain Value Definition: 2.588 – 1.806

million years ago (Ma)

Enumerated Domain Value Definition Source:

Gradstein *et al.* (2004), International Convention

on Stratigraphy (2007), and Open-File Report

O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Middle Pliocene

Enumerated Domain Value Definition: 3.600 – 2.588

million years ago (Ma)

Enumerated Domain Value Definition Source:

Gradstein *et al.* (2004), International Convention

on Stratigraphy (2007), and Open-File Report

O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Lower Pliocene to Lower

Pleistocene

Enumerated Domain Value Definition: 5.332 – 0.781

million years ago (Ma)

Enumerated Domain Value Definition Source:

Gradstein *et al.* (2004), International Convention

on Stratigraphy (2007), and Open-File Report

O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Upper Miocene

Enumerated Domain Value Definition: 11.608 – 5.332

million years ago (Ma)

Enumerated Domain Value Definition Source:

Gradstein *et al.* (2004), International Convention

on Stratigraphy (2007), and Open-File Report

O-12-01 (Mertzman *et al.*, 2012).

Attribute:

Attribute Label: Age\_Ma

Attribute Definition: The Age\_Ma attribute describes the

absolute age or age-range of a unit in millions of years as determined by the dating of collected rock samples with K-Ar or 40Ar/39Ar methods. The values are presented with the calculated ages and their error ranges. All units have been age-dated using either of the two aforementioned radiometric dating methods, except for the Qal (Alluvium), Qg (Undifferentiated colluvium and alluvium), and Qabm (Andesite of Brown Mountain) units. The Range Domain described below pertains to the radiometrically dated samples. The value for the Qal unit is “unknown Holocene (<0.0115 Ma);” the value for the Qg unit is “unknown Quaternary (<1.806 Ma);” the value for the Qabm unit is "un-dated upper Pleistocene (~0.075 to 0.020 Ma)." Each Qbv unit (sub-unit) is tentatively given the age of the unit of which it is considered part; therefore, a question mark is displayed with each Qbv area's age values to imply its tentative nature.

Attribute Definition Source: See Mertzman *et al.* (2012).

Attribute Domain Values:

Range Domain:

Range Domain Minimum: <0.0115 Ma

Range Domain Maximum: 6.48 ± 0.10 Ma

Attribute Units of Measure: Millions of years (Ma)

Detailed Description:

Entity Type:

Entity Type Label: Unit Boundary

Entity Type Definition: A unit boundary is the same as a

contact. It is the ground-surface (or its trace on the surface, if buried/concealed) boundary between two rock units. In this data set, the unit boundaries are polylines traced on the unit polygon boundaries (except on the boundaries that corresponded with the edges of the quadrangle and were not the true unit boundaries). The contacts have been approximately located. The unit boundaries are contained in the MtMcLoughlinUnitBounds file.

Entity Type Definition Source: None

Attribute:

Attribute Label: Unconformity\_YorN

Attribute Definition: This attribute indicates whether a contact is an

unconformity or not. None of the contacts in the Mt. McLoughlin quadrangle is classified as an unconformity.

Attribute Definition Source: None

Attribute Domain Values:

Enumerated Domain:

Enumerated Domain Value: N

Enumerated Domain Value Definition: A “N” indicates

that this contact is not an unconformity. These are

solid lines on the geologic map, representing

an approximately located unit boundary/contact.

Enumerated Domain Value Definition Source: None

Enumerated Domain:

Enumerated Domain Value: Y

Enumerated Domain Value Definition: A “Y” indicates

that the contact is an unconformity. There are no

unconformities on the Mt. McLoughlin quadrangle

geologic map.

Enumerated Domain Value Definition Source: None

Detailed Description:

Entity Type:

Entity Type Label: Sample

Entity Type Definition: A sample, with regard to this data set, is a field-

collected rock specimen from an in situ outcrop (lava flows or vent deposits) located within the boundaries of the Mt. McLoughlin USGS 7.5′ quadrangle (42122d3). The goal was to collect a representative suite of samples for each unit. A sample may have been apportioned for the following possible types of analysis: hand-sample analysis with possible use of a hand lens and other tools; heating to measure the loss on ignition (LOI); chemical analysis by X-ray fluorescence (XRF) spectroscopy (all samples); and thin section analysis; age-dating by either K-Ar or 40Ar/39Ar methods. Samples can be displayed as point data.

In the MtMcLoughlinSamples file, sample collection locations are indicated with either a black triangle or with a yellow square with a black outline. The black triangles represent samples for which there is available chemistry data in the attributes table. The yellow squares represent samples that have been age-dated by K-Ar or 40Ar/39Ar dating methods and also have chemistry data in the data table (attribute table).

Entity Type Definition Source: See Mertzman *et al.* (2012).

Attribute:

Attribute Label: Map\_No

Attribute Definition: The Map\_No is the map number. The map number is

displayed on the geologic maps made using this dataset, such as

the MtMcLoughlinMap30x36.pdf discussed above. Map numbers were assigned sequentially to all of the samples after they were organized by age, formation, and silica content. The samples and their data were organized first by the formation, from oldest to youngest formation. Within each formation the data were further organized by placing age-dated samples before samples that were not age-dated. The age-dated samples for each formation were arranged by silica content, from lowest to highest silica content. Then the non-age-dated samples for each formation were arranged by silica content, from lowest to highest. After the data were organized, the map numbers were assigned sequentially down the data table from 1 to 85.

Attribute Definition Source: None

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 1

Range Domain Maximum: 85

Attribute:

Attribute Label: Sample\_No

Attribute Definition: The Sample\_No is the number or combination of

numbers and letters that was assigned to a sample when it was collected in the field, or shortly thereafter. The letters, if present, indicate the initials of the person who collected the sample, and the first two numbers (if present) usually represent the last two digits of the year in which the sample was collected. After the first two numbers (possibly with on or two letters, the naming scheme may vary for some samples) is a dash followed by a number that usually indicates a sample’s place in the order of collection for a particular year. For example, the thirty-fifth sample collected by Stanley Mertzman in 2009 has the sample number 09SM-35.

Attribute Definition Source: None

Attribute Domain Values:

Unpresentable Domain: The values of this attribute were created

systematically (mostly), but they are not all numerical and there is no very easy way to describe the domain of these values without creating a sizeable list of the actual values. It is best to understand how the Sample\_No attribute was assigned as discussed in the Attribute Definition above.

Attribute:

Attribute Label: KAr\_Age\_Ma

Attribute Definition: The KAr\_Age\_Ma is a sample’s absolute age

in millions of years as determined by K-Ar or 40Ar/39Ar dating methods. Not all samples collected in the Mt. McLoughlin 7.5′ quadrangle have been age-dated; a total of 14 samples collected from outcrops within this quadrangle have been age-dated. Also provided is the error range of the dated age of a sample.

Attribute Definition Source: Consult Mertzman *et al.* (2012).

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.05 ± 0.03

Range Domain Maximum: 6.43 ± 0.10

Attribute Units of Measure: Millions of years (Ma)

Attribute:

Attribute Label: Qtr\_of\_Qtr

Attribute Definition: The Qtr\_of\_Qtr attribute is the quarter-quarter

section classifier of the Public Land Survey System (PLSS). This attribute describes in what quarter (NW, NE, SE, SW) of a quarter section of a section of a township a sample was collected. In this data set, all Township descriptors are according to the grid defined by the Willamette Meridian and Willamette Base Line of the PLSS.

Attribute Definition Source: Consult [http://www.nationalatlas.gov/ articles/boundaries/a\_plss.html](http://www.nationalatlas.gov/articles/boundaries/a_plss.html) and <http://www.blm.gov/or/landrecords/legaldescrip.php> Attribute Domain Values:

Enumerated Domain:

Enumerated Domain Value: NW

Enumerated Domain Value Definition: The northwest

quarter of a quarter section of a section of a

township.

Enumerated Domain Value Definition Source:

Consult [http://www.nationalatlas.gov/](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

[articles/boundaries/a\_plss.html](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

Enumerated Domain:

Enumerated Domain Value: NE

Enumerated Domain Value Definition: The northeast

quarter of a quarter section of a section of a township.

Enumerated Domain Value Definition Source:

Consult [http://www.nationalatlas.gov/](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

[articles/boundaries/a\_plss.html](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

Enumerated Domain:

Enumerated Domain Value: SE

Enumerated Domain Value Definition: The southeast

quarter of a quarter section of a section of a

township.

Enumerated Domain Value Definition Source:

Consult [http://www.nationalatlas.gov/](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

[articles/boundaries/a\_plss.html](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

Enumerated Domain:

Enumerated Domain Value: SW

Enumerated Domain Value Definition: The southwest

quarter of a quarter section of a section of a township.

Enumerated Domain Value Definition Source:

Consult [http://www.nationalatlas.gov/](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

[articles/boundaries/a\_plss.html](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

Attribute:

Attribute Label: Qtr\_of\_Sec

Attribute Definition: The Qtr\_of\_Sec attribute is the quarter section

classifier of the (PLSS). This attribute describes in what quarter section (NW, NE, SE, SW) of a section of a township a sample was collected. In this data set, all Township descriptors are according to the grid defined by the Willamette Meridian and Willamette Base Line of the PLSS.

Attribute Definition Source: Consult [http://www.nationalatlas.gov/ articles/boundaries/a\_plss.html](http://www.nationalatlas.gov/articles/boundaries/a_plss.html) and <http://www.blm.gov/or/landrecords/legaldescrip.php>

Attribute Domain Values:

Enumerated Domain:

Enumerated Domain Value: NW

Enumerated Domain Value Definition: The northwest

quarter section of a section of a township.

Enumerated Domain Value Definition Source:

Consult [http://www.nationalatlas.gov/](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

[articles/boundaries/a\_plss.html](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

Enumerated Domain:

Enumerated Domain Value: NE

Enumerated Domain Value Definition: The northeast

quarter section of a section of a township.

Enumerated Domain Value Definition Source:

Consult [http://www.nationalatlas.gov/](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

[articles/boundaries/a\_plss.html](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

Enumerated Domain:

Enumerated Domain Value: SE

Enumerated Domain Value Definition: The southeast

quarter section of a section of a township.

Enumerated Domain Value Definition Source:

Consult [http://www.nationalatlas.gov/](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

[articles/boundaries/a\_plss.html](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

Enumerated Domain:

Enumerated Domain Value: SW

Enumerated Domain Value Definition: The southwest

quarter section of a section of a township.

Enumerated Domain Value Definition Source:

Consult [http://www.nationalatlas.gov/](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

[articles/boundaries/a\_plss.html](http://www.nationalatlas.gov/articles/boundaries/a_plss.html)

Attribute:

Attribute Label: Sec

Attribute Definition: The Sec is the Section of the Township (according to

the PLSS grid) in which the sample was collected. The Section is “[a] one-square-mile block of land, containing 640 acres, or approximately one thirty-sixth of a township. Due to the curvature of the Earth, sections may occasionally be slightly smaller than one square mile” ([http://en.wikipedia.org/wiki/Public\_Land\_Survey\_ System](http://en.wikipedia.org/wiki/Public_Land_Survey_System)) In this data set, all Township descriptors are according to the grid defined by the Willamette Meridian and Willamette Base Line of the PLSS.

Attribute Definition Source: Consult [http://www.nationalatlas.gov/ articles/boundaries/a\_plss.html](http://www.nationalatlas.gov/articles/boundaries/a_plss.html) and <http://www.blm.gov/or/landrecords/legaldescrip.php> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 1

Range Domain Maximum: 35

Attribute Units of Measure: section number

Attribute:

Attribute Label: T\_S

Attribute Definition: The T\_S (Township\_South) is the value of

the horizontal row of townships in the PLSS grid (Willamette Meridian and Willamette Base Line for all samples in this data set) in which the sample was collected. The “S” (South) descriptor indicates that the township rows that pertain to this data set are south of the Willamette Base Line of the PLSS. When combined with the R\_E (Range) attribute value, this information provides the specific ~36 square mile Township in the Willamette Meridian and Base Line defined grid of the PLSS in which the sample was collected. The other more specific PLSS descriptor attributes were described and discussed above.

Attribute Definition Source: Consult [http://www.nationalatlas.gov/ articles/boundaries/a\_plss.html](http://www.nationalatlas.gov/articles/boundaries/a_plss.html) and <http://www.blm.gov/or/landrecords/legaldescrip.php> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 35

Range Domain Maximum: 37

Attribute Units of Measure: township number

Attribute:

Attribute Label: R\_E

Attribute Definition: The R\_E (Range\_East) is the value of the

vertical column of townships in the PLSS grid (Willamette

Meridian and Willamette Base Line for this data set) in which the

sample was collected. The “E” (East) descriptor indicates that the

township columns that pertain to this data set are to the

east of the Willamette Meridian. When combined with the

T\_S attribute value, this information provides the specific

~36 square mile Township in the Willamette Meridian and

Base Line defined grid of the PLSS in which the sample was collected. The other more specific PLSS descriptor attributes were described above.

Attribute Definition Source: Consult [http://www.nationalatlas.gov/ articles/boundaries/a\_plss.html](http://www.nationalatlas.gov/articles/boundaries/a_plss.html) and <http://www.blm.gov/or/landrecords/legaldescrip.php>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 4

Range Domain Maximum: 5

Attribute Units of Measure: range number

Attribute:

Attribute Label: UTM\_E\_m

Attribute Definition: This is the easting value in meters of a sample’s

collection location according to the NAD 1927 UTM Zone 10 projection system. This value was determined with the MapInfo Professional version 7.0 Coordinate Extractor extension. In cases

in which the UTM coordinates were already known, the coordinate extractor extracted these same coordinates. Please note that the precision indicated by this value does not represent the precision with which a sample’s location was determined. Instead, it represents the precision of the MapInfo v.7.0 or v.8.0 Coordinate

Extractor extension’s results as determined for carefully digitized sample location points (from original paper maps to the drg of the quadrangle, except where coordinates were provided and already rounded to the nearest 10 meters).

Attribute Definition Source: Consult

<http://erg.usgs.gov/isb/pubs/factsheets/fs07701.html>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 551,526.44

Range Domain Maximum: 561,689.95

Attribute Units of Measure: meters

Attribute:

Attribute Label: UTM\_N\_m

Attribute Definition: This is the northing value in meters of a sample’s

collection location according to the NAD 1927 UTM Zone 10 projection system. This value was determined with the MapInfo Professional version 7.0 Coordinate Extractor extension. In cases in which the UTM coordinates were already known, the coordinate extractor extracted these same coordinates. Please note that the precision indicated by this value does not represent the precision with which a sample’s location was determined. Instead, it represents the precision of the MapInfo v.7.0 or v.8.0 Coordinate

Extractor extension’s results as determined for carefully digitized sample location points (from original paper maps to the drg of the quadrangle, except where coordinates were provided and already rounded to the nearest 10 meters).

Attribute Definition Source: Consult

<http://erg.usgs.gov/isb/pubs/factsheets/fs07701.html>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 4,691,519.67

Range Domain Maximum: 4,705,310

Attribute Units of Measure: meters

Attribute:

Attribute Label: Unit

Attribute Definition: This is the unit, indicated by the unit’s symbol, to

which a collected rock sample belongs.

Attribute Definition Source: See Mertzman *et al.* (2012).

Attribute Domain Values:

Enumerated Domain:

Enumerated Domain Value: Tmbads

Enumerated Domain Value Definition: Basaltic Andesite

of Dogwood Spring

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Tmbrf

Enumerated Domain Value Definition: Basalt of Rye Flat

(Upper Miocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Tpafl

Enumerated Domain Value Definition: Andesite of Fish

Lake (Lower Pliocene to Lower Pleistocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Tpbad

Enumerated Domain Value Definition: Basaltic Andesite

of Dry Creek (Middle Pliocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Tpbaf

Enumerated Domain Value Definition: Basaltic Andesite

Freye Lake (Upper Pliocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Tpbbcl

Enumerated Domain Value Definition: Basalt of Blue

Canyon Lake (Upper Pliocene to Lower

Pleistocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Qbam

Enumerated Domain Value Definition: Basaltic Andesite

of Mount McLoughlin (Middle to Upper

Pleistocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Enumerated Domain:

Enumerated Domain Value: Qabm

Enumerated Domain Value Definition: Andesite of Brown

Mountain (Upper Pleistocene)

Enumerated Domain Value Definition Source:

Open-File Report O-12-01 (Mertzman *et al.*, 2012).

Attribute:

Attribute Label: Lith

Attribute Definition: The Lith attribute is an abbreviation of the lithology

of the sample according to the total alkali (Na2O + K2O [weight%(wt%)]) versus silica (SiO2 wt%) classification (TAS classification) for volcanic rocks of Le Maitre (2002). The chemistry of the sample was determined by X-ray fluorescence (XRF) spectroscopy. Macroscopic characteristics of the various lithologies are not discussed here.

Attribute Definition Source: See Mertzman *et al.* (2012) and Le Maitre

(2002)

Attribute Domain Values:

Enumerated Domain:

Enumerated Domain Value: B

Enumerated Domain Value Definition: Basalt: a volcanic

rock with a silica content of 45-52 wt% and less

than 5 wt% total alkali (Na2O + K2O wt%) content.

Enumerated Domain Value Definition Source:

See Mertzman *et al.* (2012), Le Maitre (2002), and

[http://www.geol.lsu.edu/henry/Geology3041/](http://www.geol.lsu.edu/henry/Geology3041/lectures/02IgneousClassify/IUGS-IgneousClassFlowChart.htm)

[lectures/02IgneousClassify/IUGS-IgneousClassFlowChart.htm](http://www.geol.lsu.edu/henry/Geology3041/lectures/02IgneousClassify/IUGS-IgneousClassFlowChart.htm)

Enumerated Domain:

Enumerated Domain Value: BA

Enumerated Domain Value Definition: Basaltic andesite:

a volcanic rock with 52-57 wt% silica content and a

total alkali content of less than 5 wt% at 52 wt%

SiO2 and less than 5.9 wt% at 57 wt% SiO2.

Between 52 and 57 wt% SiO2, the upper total alkali

boundary increases linearly from 5 to 5.9 wt%.

Enumerated Domain Value Definition Source:

See Mertzman *et al.* (2012), Le Maitre (2002), and

[http://www.geol.lsu.edu/henry/Geology3041/](http://www.geol.lsu.edu/henry/Geology3041/lectures/02IgneousClassify/IUGS-IgneousClassFlowChart.htm.)

[lectures/02IgneousClassify/IUGS-IgneousClassFlowChart.htm.](http://www.geol.lsu.edu/henry/Geology3041/lectures/02IgneousClassify/IUGS-IgneousClassFlowChart.htm.)

Enumerated Domain:

Enumerated Domain Value: A

Enumerated Domain Value Definition: Andesite: a

volcanic rock with a silica content of 57-63 wt%

and a total alkali content of less than 5.9 wt% at 57

wt% SiO2 and less than 7 wt% at 63 wt% SiO2.

Between 57 and 63 wt% SiO2, the upper total alkali

boundary increases linearly from 5.9 wt% to 7 wt%.

Enumerated Domain Value Definition Source:

See Mertzman *et al.* (2012), Le Maitre (2002), and

[http://www.geol.lsu.edu/henry/Geology3041/](http://www.geol.lsu.edu/henry/Geology3041/lectures/02IgneousClassify/IUGS-IgneousClassFlowChart.htm)

[lectures/02IgneousClassify/IUGS-IgneousClassFlowChart.htm](http://www.geol.lsu.edu/henry/Geology3041/lectures/02IgneousClassify/IUGS-IgneousClassFlowChart.htm)

Enumerated Domain:

Enumerated Domain Value: BTrA

Enumerated Domain Value Definition: Basaltic

trachyandesite: a volcanic rock with a silica content

of 59.4-57.0 wt% and a total alkali content higher than basalts, trachybasalts, and basaltic andesites in that same silica range. See a TAS plot in Figure 4 of Mertzman *et al.* (2012) or the other cited references.

Enumerated Domain Value Definition Source:

See Mertzman *et al.* (2012), Le Maitre (2002), and

[http://www.geol.lsu.edu/henry/Geology3041/](http://www.geol.lsu.edu/henry/Geology3041/lectures/02IgneousClassify/IUGS-IgneousClassFlowChart.htm)

[lectures/02IgneousClassify/IUGS-IgneousClassFlowChart.htm](http://www.geol.lsu.edu/henry/Geology3041/lectures/02IgneousClassify/IUGS-IgneousClassFlowChart.htm)

Attribute:

Attribute Label: SiO2\_%

Attribute Definition: The weight percent (wt%) of silica (SiO2) in the

sample as measured by XRF spectroscopy.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 50.67

Range Domain Maximum: 61.8 Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: TiO2\_%

Attribute Definition: The weight percent (wt%) of titania (TiO2) in the

sample as measured by XRF spectroscopy.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.64

Range Domain Maximum: 1.32

Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: Al2O3\_%

Attribute Definition: The weight percent (wt%) of alumina (Al2O3) in

the sample as measured by XRF spectroscopy.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 16.1

Range Domain Maximum: 20.73

Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: Fe2O3\_%

Attribute Definition: The weight percent (wt%) of iron(III) oxide

(Fe2O3) in the sample as calculated using results measured by XRF spectroscopy and Iron Titration.

Attribute Definition Source: See <http://fandm.edu/x7991.xml> and

<http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.63

Range Domain Maximum: 4.27

Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: FeO\_%

Attribute Definition: The weight percent (wt%) of iron(II) oxide (FeO) in

the sample determined by Iron Titration.

Attribute Definition Source: See <http://fandm.edu/x7991.xml> and

<http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 2.46

Range Domain Maximum: 6.5

Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: MnO\_%

Attribute Definition: The weight percent (wt%) of manganese(II)

oxide (MnO) in the sample as measured by XRF spectroscopy.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.09

Range Domain Maximum: 0.17

Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: MgO\_%

Attribute Definition: The weight percent (wt%) of magnesia

(MgO) in the sample as measured by XRF spectroscopy.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 2.76

Range Domain Maximum: 7.73

Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: CaO\_%

Attribute Definition: The weight percent (wt%) of calcium oxide

(CaO) in the sample as measured by XRF spectroscopy.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 5.22

Range Domain Maximum: 9.34

Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: Na2O\_%

Attribute Definition: The weight percent (wt%) of sodium oxide

(Na2O) in the sample as measured by XRF spectroscopy.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 3.19

Range Domain Maximum: 4.39

Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: K2O\_%

Attribute Definition: The weight percent (wt%) of potassium oxide

(K2O) in the sample as measured by XRF spectroscopy.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.41

Range Domain Maximum: 1.62

Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: P2O5\_%

Attribute Definition: The weight percent (wt%) of phosphorus pentoxide

(P2O5) in the sample as measured by XRF spectroscopy.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.11

Range Domain Maximum: 0.62

Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: LOI\_%

Attribute Definition: True Loss on Ignition: the amount of weight

lost (weight percent (wt%)) by the sample after heating to between 900ºC and 950ºC for one hour added to a value that accounts for the changes in weight resulting from the oxidation of ferrous iron.

Attribute Definition Source: See <http://fandm.edu/x7991.xml> and

<http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.28

Range Domain Maximum: 1.88

Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: Total\_%

Attribute Definition: The total weight percent (wt%) is the sum of

the weight percent values for SiO2, TiO2, Al2O3, Fe2O3,

FeO, MnO, MgO, CaO, Na2O, K2O, P2O5, and LOI.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 99.27

Range Domain Maximum: 100.69

Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: Fe2O3T\_%

Attribute Definition: The iron(III) iron content (wt%) measured

by XRF spectroscopy. This is not the true amount of iron(III)

iron originally present in the rock sample because it also

accounts for iron(II) iron that was oxidized to iron(III) iron

during the preparation for XRF. The Fe2O3\_% value described

above is the true amount of iron(III) iron present in the rock

sample.

Attribute Definition Source: See <http://fandm.edu/x7991.xml> and

<http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 5.78

Range Domain Maximum: 10.83

Attribute Units of Measure: weight percent (wt%)

Attribute:

Attribute Label: Rb\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of rubidium present in the sample as measured

by XRF spectroscopy. A “--" has been placed where there

is no Rb value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 1.6

Range Domain Maximum: 34.7

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Sr\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of strontium present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Sr value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 583

Range Domain Maximum: 1276

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Y\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of yttrium present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Y value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 7.3

Range Domain Maximum: 227

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Zr\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of zirconium present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Zr value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 42

Range Domain Maximum: 148

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: V\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of vanadium present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no V value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 112

Range Domain Maximum: 252

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Ni\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of nickel present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Ni value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 10

Range Domain Maximum: 168

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Cr\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of chromium present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Cr value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 18

Range Domain Maximum: 252

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Nb\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of niobium present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Nb value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 1.5

Range Domain Maximum: 9.7

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Ga\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of gallium present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Ga value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 18.5

Range Domain Maximum: 197

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Cu\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of copper present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Cu value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 19 Range Domain Maximum: 373

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Zn\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of zinc present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Zn value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 56

Range Domain Maximum: 89

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Co\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of cobalt present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Co value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 11

Range Domain Maximum: 38

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Ba\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of barium present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Ba value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 23.2

Range Domain Maximum: 723

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: La\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of lanthanum present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no La value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 5.1

Range Domain Maximum: 34

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Ce\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of cesium present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Ce value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 12

Range Domain Maximum: 59

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: U\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of uranium present in the sample as measured by XRF

spectroscopy. A “<0.5” has been placed where the U in

a sample was below the limit of the XRF spectrometer’s

sensitivity. A “--" has been placed where there

is no U value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.5

Range Domain Maximum: 2.6

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Th\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of thorium present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Th value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.5

Range Domain Maximum: 8.8

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Sc\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of scandium present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Sc value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 13

Range Domain Maximum: 27

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Pb\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of lead present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Pb value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 1

Range Domain Maximum: 10

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Yb\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of ytterbium present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Yb value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.7

Range Domain Maximum: 2.7

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Be\_ppm

Attribute Definition: The amount (in parts per million [ppm])

of beryllium present in the sample as measured by XRF

spectroscopy. A “--" has been placed where there

is no Be value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml> Attribute Domain Values:

Range Domain:

Range Domain Minimum: 1

Range Domain Maximum: 2

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Hf\_ppm

Attribute Definition: The amount (in parts per million [ppm]) of hafnium

present in the sample as measured by XRF spectroscopy. A

“--" has been placed where there is no Hf value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 1.79

Range Domain Maximum: 3.8

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Ta\_ppm

Attribute Definition: The amount (in parts per million [ppm]) of tantalum

present in the sample as measured by XRF spectroscopy. A “--"

has been placed where there is no Ta value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.14

Range Domain Maximum: 0.6

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Nd\_ppm

Attribute Definition: The amount (in parts per million [ppm]) of

neodymium present in the sample as measured by XRF spectroscopy. A “--" has been placed where there is no Nd value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 11.42

Range Domain Maximum: 30

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Sm\_ppm

Attribute Definition: The amount (in parts per million [ppm]) of

samarium present in the sample as measured by XRF spectroscopy. A “--" has been placed where there is no Sm value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 2.25

Range Domain Maximum: 6.5

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Eu\_ppm

Attribute Definition: The amount (in parts per million [ppm]) of

europium present in the sample as measured by XRF spectroscopy. A “--" has been placed where there is no Eu value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.83

Range Domain Maximum: 2.10

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Tb\_ppm

Attribute Definition: The amount (in parts per million [ppm]) of

terbium present in the sample as measured by XRF spectroscopy.

A “--" has been placed where there is no Tb value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.4

Range Domain Maximum: 1

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: Lu\_ppm

Attribute Definition: The amount (in parts per million [ppm]) of

lutetium present in the sample as measured by XRF spectroscopy. A “--" has been placed where there is no Lu value for a sample.

Attribute Definition Source: See <http://fandm.edu/x7985.xml>

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 0.16

Range Domain Maximum: 0.41

Attribute Units of Measure: parts per million (ppm)

Attribute:

Attribute Label: DatedOrNot

Attribute Definition: This attribute is only present in the ESRI

Shapefile formatted Mt. McLoughlin samples file

(MtMcLoughlinSamples\_point.shp). This attribute indicates if a

sample was age-dated or not.

Attribute Definition Source: None

Attribute Domain Values:

Enumerated Domain:

Enumerated Domain Value: Y

Enumerated Domain Value Definition: The Y stands for

“Yes,” meaning that this rock sample has been

age-dated by K-Ar or 40Ar/39Ar dating methods.

Enumerated Domain Value Definition Source: None

Enumerated Domain:

Enumerated Domain Value: N

Enumerated Domain Value Definition: The N stands for

“No,” meaning that this rock sample has not

been age-dated with radiometric dating methods.

Enumerated Domain Value Definition Source: None

Detailed Description:

Entity Type:

Entity Type Label: Volcanic Center

Entity Type Definition: A volcanic center is a source of volcanic

rocks. In other words, it is a location where subterranean magma

has erupted onto the surface. Observations made in the field helped to locate volcanic centers where there were no vent deposits.

In this data set, the volcanic centers are contained in the MtMcLoughlinVolcCenters file and are point data displayed

as red triangles with a black outline.

Entity Type Definition Source: None

Attribute:

Attribute Label: UTM\_E\_m

Attribute Definition: This is the easting value in meters of a volcanic

center's location according to the NAD 1927 UTM Zone 10 projection system. This value was determined with the MapInfo Professional version 7.0 or v.8.0 Coordinate Extractor tool. The precision of this value does not represent that with which it was determined, but is the precision provided by MapInfo Professional v.7.0's or v.8.0's Coordinate Extractor extension for the points manually digitized to the georeferenced quadrangle drg.

Attribute Definition Source: None

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 554,808.743574

Range Domain Maximum: 556,350.318314

Attribute Units of Measure: meters

Attribute:

Attribute Label: UTM\_N\_m

Attribute Definition: This is the easting value in meters of a volcanic

center's location according to the NAD 1927 UTM Zone 10 projection system. This value was determined with the MapInfo Professional version 7.0 Coordinate Extractor tool. The precision of this value does not represent that with which it was determined, but is the precision provided by MapInfo Professional v.7.0's or v.8.0's Coordinate Extractor extension for the points manually digitized to the georeferenced quadrangle drg.

Attribute Definition Source: None

Attribute Domain Values:

Range Domain:

Range Domain Minimum: 4,695,051.651189

Range Domain Maximum: 4,699,927.19091

Attribute Units of Measure: meters

**Distribution Information**

**Metadata Reference Information**

Metadata Date: 20110629

Metadata Contact:

Contact Information:

Contact Person Primary:

Contact Person: Isaac Weaver

Contact Position: Research Assistant

Contact Address:

Address Type: mailing and physical address

Address: Isaac Weaver, Franklin and Marshall College,

Department of Earth and Environment, PO Box 3003

City: Lancaster

State or Province: Pennsylvania

Postal Code: 17604

Contact Voice Telephone: Unavailable

Contact Electronic Mail Address: [iweaver@fandm.edu](mailto:iweaver@fandm.edu)

Metadata Standard Name: FGDC Content Standards for Digital Geospatial Metadata

Metadata Standard Version: Version 2 – 1998