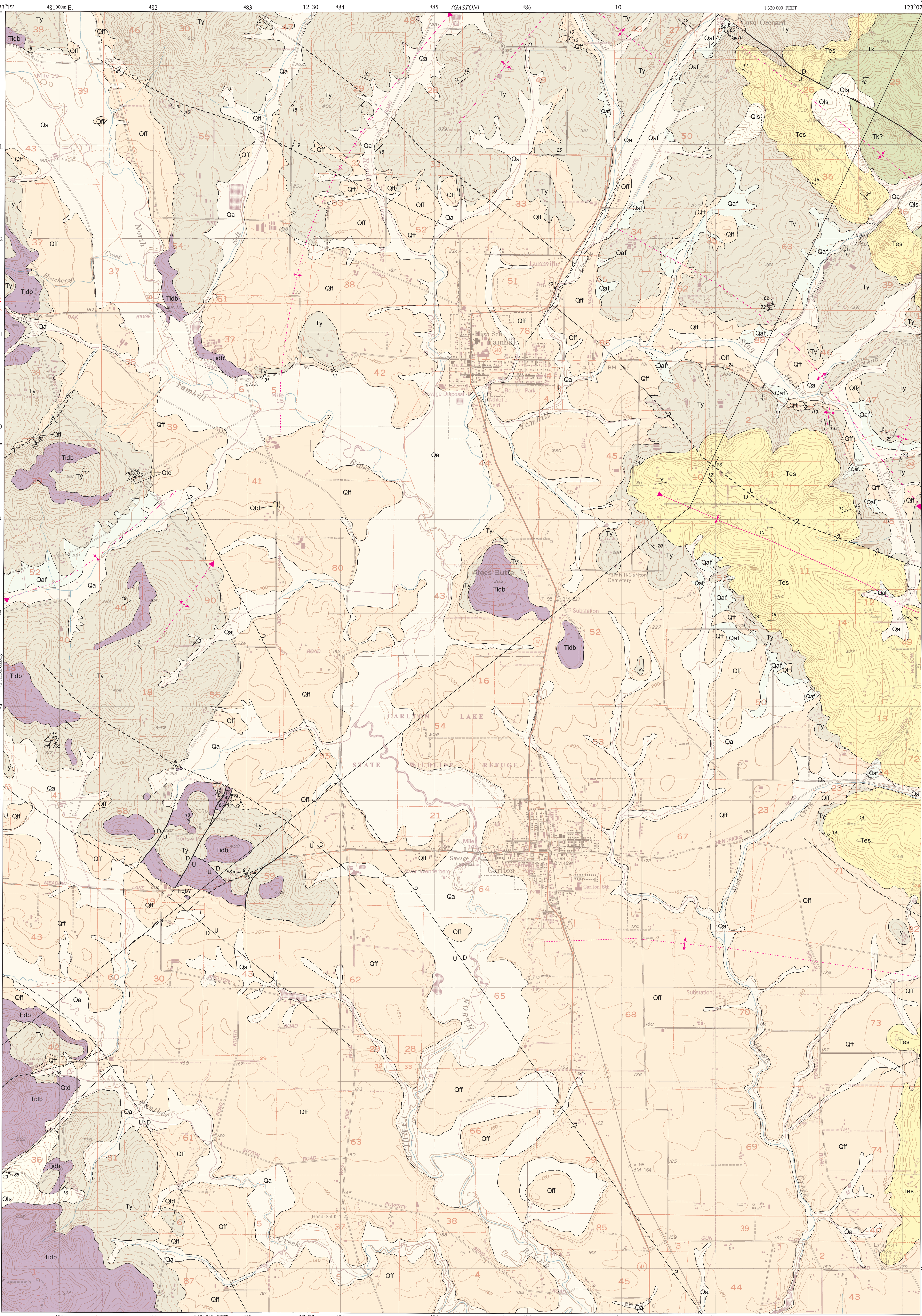


Base from U.S. Geological Survey, Carlton, OR, 1993.
Universal Transverse Mercator projection, zone 10

APPROXIMATE MEAN DECLINATION, 2009

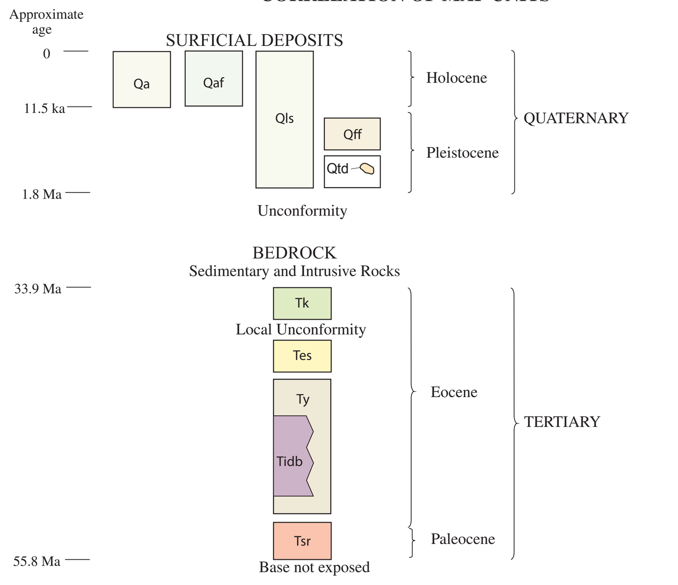
SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

MAP LOCATION

Geology mapped by Karen L. Wheeler, Joseph M. Minervini, Jessica L. Block, and Ray E. Wells, 2002, 2003
Digital database by Karen L. Wheeler, Joseph M. Minervini, Jessica L. Block
Manuscript approved for publication August 14, 2009

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qa — **Alluvial deposits (Holocene)**—Unconsolidated clay, silt, sand, and gravel deposited on floodplains and in channels of rivers and streams; locally includes colluvium and terrace deposits along valley margins

Qaf — **Alluvial fan and colluvial deposits (Holocene and Pleistocene)**—Unconsolidated sand and gravel deposited at the mouths of steep tributary streams. Includes colluvial aprons

Qls — **Landslide deposits (Holocene and Pleistocene)**—Accumulation of angular to subrounded clasts of weathered bedrock, commonly in a mud-dominated matrix, transported from upslope. Forms hummocky topography and may include thick colluvial and debris-fan deposits. Many small unmapped landslides exist

Qff — **Missoula Flood deposits (upper Pleistocene)**—Unconsolidated clay, silt, and fine sand, finely micaceous, deposited by glacial outburst floods that flowed down the Columbia River from glacial Lake Missoula. Floods filled the Willamette Valley to a depth of about 120 m (Glenn, 1965; Allison, 1978; O'Connor and others, 2001; Minervini and others, 2003) and back flooded up the Yamhill River. Deposits are commonly 2-3 m thick on uplands in this map area, thickening to 30 m elsewhere in the Willamette Valley. Ice-rafted exotic boulders to pebbles of plutonic and metamorphic rocks occur locally up to 120 m elevation. Radiocarbon dating, tephrochronology, and stratigraphic relations outside the map area indicate a ^{14}C age of 15 to 12.7 ka (approximately 18-15 ka; O'Connor and others, 2001)

Qtd — **Terrace deposits (upper Pleistocene)**—Unconsolidated to semiconsolidated sand and gravel from Coast Range in terraces along the North Yamhill River. Gravel consists of basalt and silicic volcanic clasts. Forms planar to slightly undulating surfaces up to 20 m above the modern floodplain. Deposits exposed in hand-auger holes and a few small outcrops along the west side of North Yamhill River

BEDROCK

Sedimentary and Volcanic Rocks

Tk — **Keasey Formation (upper Eocene)**—Siltstone, silty claystone, and mudstone; tuffaceous, light gray to buff, laminated to bioturbated and massive; found only near northeast corner of map. West of the map area, in the Tillamook Highlands, the Keasey Formation contains foraminifera correlating to the Refugian stage of Schenck and Kleinpell (1936) (W.W. Rau, written commun., 1988) and a molluscan assemblage correlating to the type Keasey Formation (Warren and others, 1945; Wells and others, 1995)

Tes — **Spencer Formation (upper Eocene)**—Quartzofeldspathic and lithofeldspathic sandstone; fine to medium grained, light gray to tan, friable, plane laminated to hummocky cross stratified, very micaceous, carbonaceous, and locally concretionary; lesser amounts of laminated thin-bedded mudstone becoming more massive and locally tuffaceous upsection. Forms ridge tops along east side of map area. In adjacent Tillamook Highlands, contains foraminifera correlating to the uppermost Narizian stage (W.W. Rau, written commun., 1988; Wells and others, 1995). Weathers to golden yellow, friable sand; case-hardened with many burrows, fractures, and spheroidal weathering that obscure internal bedding. Contact with underlying Yamhill Formation locally gradational or unconformable; springs along contact

Ty — **Yamhill Formation (upper middle Eocene)**—Siltstone and mudstone, dark gray, laminated, finely micaceous and carbonaceous, thin to massively bedded, with calcareous and iron-stained concretions and carbonaceous plant fragments. Unit contains minor lithic sandstone, submarine basaltic lapilli breccia, and white, crossbedded and ripple-laminated, silicic tuff beds. Lower part of unit is intruded by thick regional diabase sill complex (Tidb). Thin, graded, arkosic sandstone beds occur in upper part of unit. Forms lowlands and low hills covered by thin mantle of Missoula flood silt below 400 ft elevation. Exposure is poor; weathered, yellowish-tan siltstone exposed in roadside ditches and animal burrows. Rare foraminifera in adjacent Tillamook Highlands correlates with the upper Ulatisian-lower Narizian stages, and coccoliths from the Gales Creek quadrangle to the north are assigned to the CP 13c subzone (D. Bukry, written commun., 1997)

Tsr — **Siletz River Volcanics (early Eocene and late Paleocene)**—Found only in cross section. Aphyric to plagioclase- and pyroxene-phyric pillow basalt, subaerial basalt flows, basalt breccia, submarine basaltic tuffs, and interbedded lithic sandstone and mudstone. Presence at depth inferred from proprietary seismic line in adjacent Gaston Quadrangle (Jack Meyer, written commun., 2001)

Intrusive Rocks

Tidb — **Diabase (middle Eocene)**—Aphyric to plagioclase-phyric, amygdaloidal diabase with smectite, zeolite, and calcite vesicle fillings. Forms sills with well-developed columnar joints and locally layered appearance. Intrudes late middle Eocene Yamhill Formation; west of the map area, sills are hundreds of meters thick and are cut by Tillamook-age dikes at 41.0 Ma (Wells and others, 1995), suggesting an age of about 42-45 Ma; as mapped, may include some basalt and diabase correlative with the Tillamook Volcanics (Wells and others, 1995). Contact relations with Yamhill Formation sedimentary rocks poorly exposed beneath thick colluvium of weathered diabase and sediment. Weathers to a reddish-orange clay-rich soil containing spheroidally weathered diabase clasts. Multiple sills are inferred, and complex interfingering relations with Yamhill Formation are not shown on maps or cross section

INTRODUCTION

The Carlton, Oregon, 7.5-minute quadrangle is located in northwestern Oregon, about 35 miles (57 km) southwest of Portland (Fig. 1a). It encompasses the towns of Yamhill and Carlton in the northwestern Willamette Valley and extends into the eastern flank of the Oregon Coast Range.

The Carlton quadrangle is one of several dozen quadrangles being mapped by the U.S. Geological Survey (USGS) and the Oregon Department of Geology and Mineral Industries (DOGAMI) to provide a framework for earthquake- hazard assessments in the greater Portland, Oregon, metropolitan area. The focus of USGS mapping is on the structural setting of the northern Willamette Valley and its relation to the Coast Range uplift. Mapping was done in collaboration with soil scientists from the National Resource Conservation Service, and the distribution of geologic units is refined over earlier regional mapping (Schlicker and Deacon, 1967).

Geologic mapping was done on 7.5-minute topographic base maps and digitized in ArcGIS to produce ArcGIS geodatabases and PDFs of the map and text. The geologic contacts are based on numerous observations and samples collected in 2002 and 2003, National Resource Conservation Service soils maps, and interpretations of 7.5-minute topography. The map was completed before new, high-resolution laser terrain mapping was flown for parts of the northern Willamette Valley in 2008. The Oregon LiDAR Consortium provides details of available laser terrain surveys and mapping plans at their website, numerous images for viewing, as well as (http://www.oregongeology.org/sub/projects/olc/default.htm). Revised geologic mapping of surficial deposits is ongoing as more laser terrain mapping becomes available.

GEOLOGIC SKETCH

The Carlton area is largely underlain by Tertiary (mostly Eocene) marine strata tilted gently to the northeast by uplift of the Coast Range. The broad North Yamhill River valley in the center of the quadrangle is cut into soft, marine siltstone and basaltic sandstone of the middle Eocene Yamhill Formation (Ty), which are the oldest rocks exposed at the surface in the quadrangle. The Coast Range foothills to the south and west are held up by basalt and diabase sills of Eocene age (Tidb). The sills intruded and baked the Yamhill Formation, making it resistant to erosion. North and east of Yamhill and Carlton, the ridges are held up by sandstone of the Eocene Spencer Formation (Tes), which overlies the Yamhill Formation. It is composed of shallow-water micaceous sandstone with marine fossils that commonly weathers to a yellow, buff color and forms sandy soils. Overlying the Spencer Formation is tuffaceous siltstone of the Keasey Formation (Tk), which crops out near the northeast corner of the quadrangle. It is poorly exposed, but in surrounding quadrangles, the Keasey Formation contains marine fossils that indicate deposition on the outer continental shelf. Sand, silt, and clay of the Pleistocene Missoula Flood deposits (Qff) blanket surfaces at elevations below 120 m, except where removed by erosion along modern streams.

Three periods of folding are recorded in the rocks of the Carlton quadrangle: (1) Eocene (post-Yamhill and pre-Spencer); (2) Oligocene or early Miocene? (post-Spencer Formation and pre-Columbia River Basalt Group (CRBG)), and (3) late Miocene or younger (post-CRBG). The gentle east dip of strata in the Carlton quadrangle is interrupted by significant west-northwest-trending faults and folds and minor conjugate faults and folds trending northeast. The Yamhill Formation is folded and fractured along northeast trends prior to Spencer deposition, after which it was folded along with the Spencer and overlying units in northwest trending folds. Late Eocene normal faulting observed elsewhere in the Coast Range (Niem and Niem, 1985) is not obvious in the Carlton quadrangle. The small-wavelength northeast-trending folds in the Yamhill Formation appear to predate the overlying Spencer Formation, which exhibits folds that trend west-northwest, subparallel to the major faults. The folds in the Spencer Formation plunge to the east-southeast and are tighter than the broad syncline developed in the overlying Columbia River Basalt Group (CRBG) to the east of the map area near Dundee. The CRBG is tilted to the east by the uplift of the Coast Range, and the first two episodes of this folding in the Carlton area predates uplift of the Coast Range, which caused the eastward tilting of the CRBG. The west-northwest faults correlate with pronounced aeromagnetic gradients (Fig. 2), interpreted to be boundaries of blocks of magnetic Siletz River Volcanics and diabase in the shallow subsurface. These faults may accommodate clockwise rotation of crustal blocks between the major northwest faults, such as the Mount Angel and Gales Creek Fault Zones (Fig. 1a, Wells and Coe, 1985). Clockwise tectonic rotation of the Coast Range and Willamette Valley at about 1°/million years has been documented by GPS and paleomagnetic studies (McCaffery and others, 2007).

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Contact—Dashed where approximately located; short-dashed where inferred; dotted where concealed

52 U D 65 — **Fault**—Short dashed where inferred; dotted where concealed; queried where uncertain. U on upthrown side and D on downthrown side. Arrows show relative horizontal movement; tick mark shows fault dip

Strike and dip of beds
25 — Inclined
Horizontal

12 — **Joint**

22 — **Slickensides or fault surfaces**—some too small to map

Anticline—Showing plunge, short dashed where inferred, dotted where concealed, queried where uncertain

Syncline—Showing plunge, short dashed where inferred, dotted where concealed, queried where uncertain

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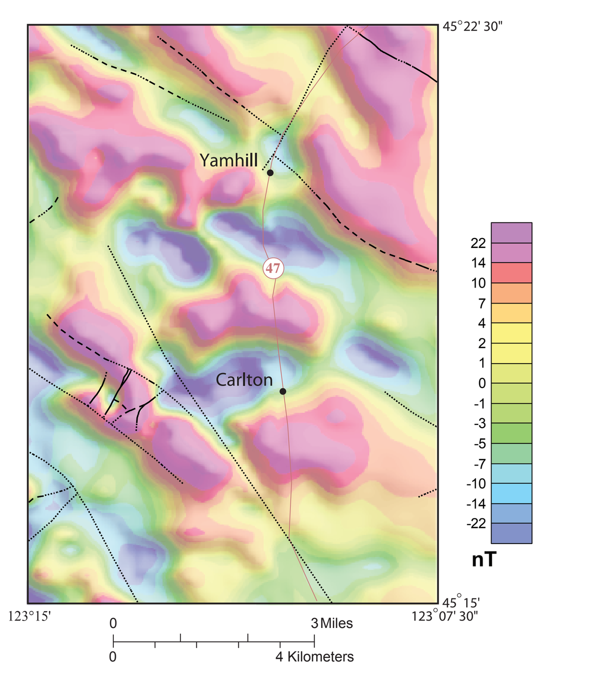


Figure 2. Carlton quadrangle residual aeromagnetic map. Boundaries of magnetic highs (red colors) correlate with mapped faults. Residual anomalies calculated by subtracting upward-continued (100 m) anomalies from original data (R. Blakely, USGS, written commun., 2003; Blakely and others, 2000). nT, nanotesla.

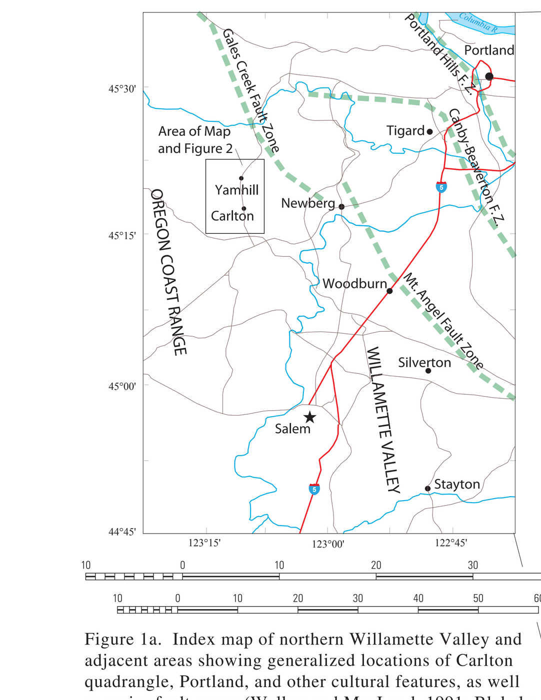


Figure 1a. Index map of northern Willamette Valley and adjacent areas showing generalized locations of Carlton quadrangle, Portland, and other cultural features, as well as major fault zones (Walker and MacLeod, 1991; Blakely and others, 2000). F.Z., fault zone.

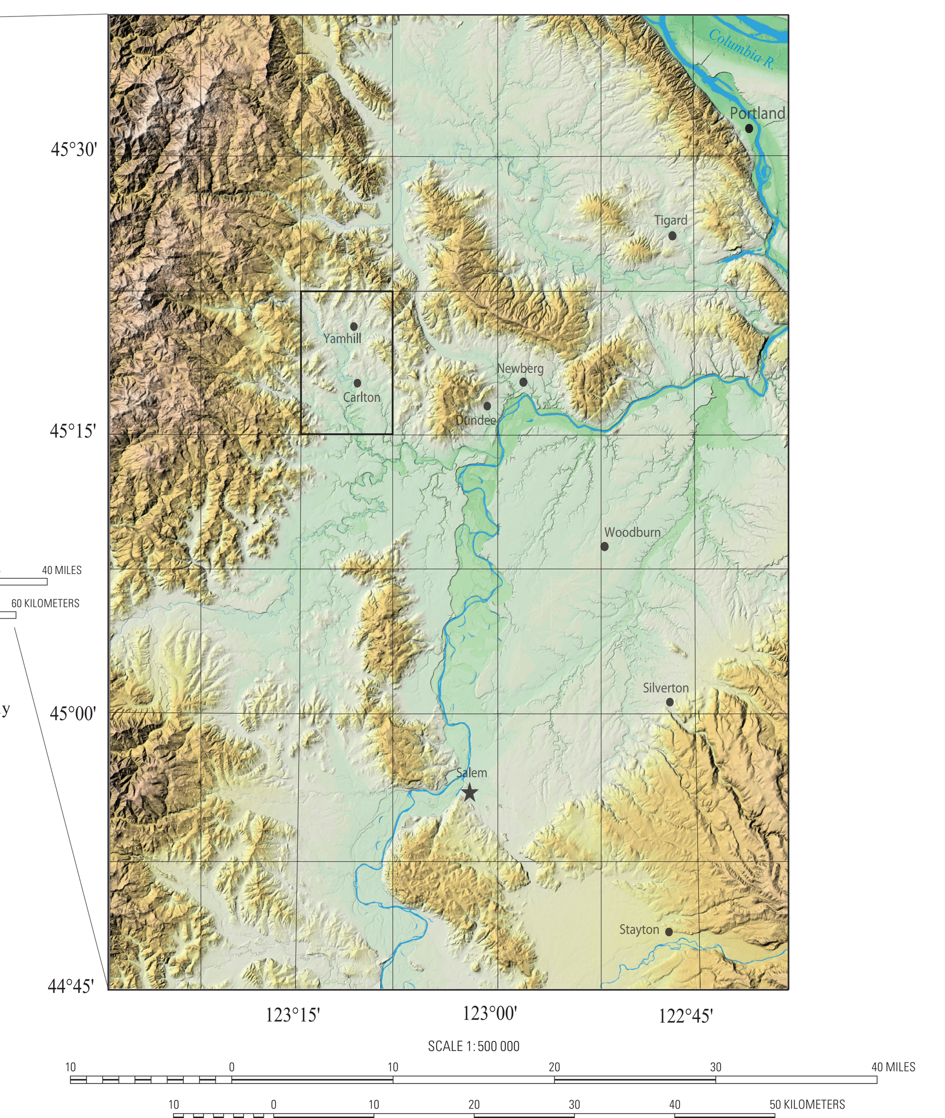
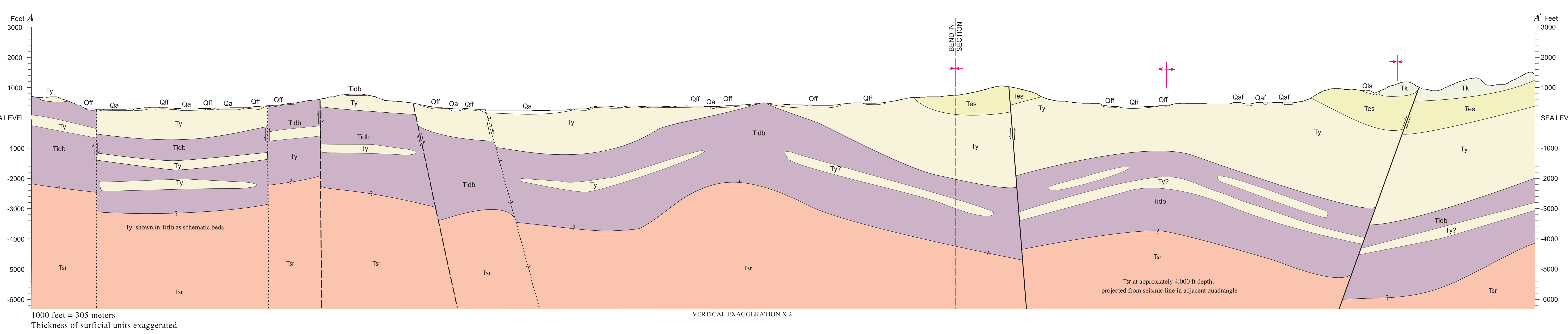


Figure 1b. Shaded relief map of northern Willamette Valley and adjacent areas (modified from Givler and Wells, 2001).



1000 feet = 305 meters
Thickness of surficial units exaggerated

VERTICAL EXAGGERATION X 2

GEOLOGIC MAP OF THE CARLTON QUADRANGLE, YAMHILL COUNTY, OREGON

By

Karen L. Wheeler, Ray E. Wells, Joseph M. Minervini, and Jessica L. Block

2009

Digital files available at http://pubs.usgs.gov/of/2009/1172