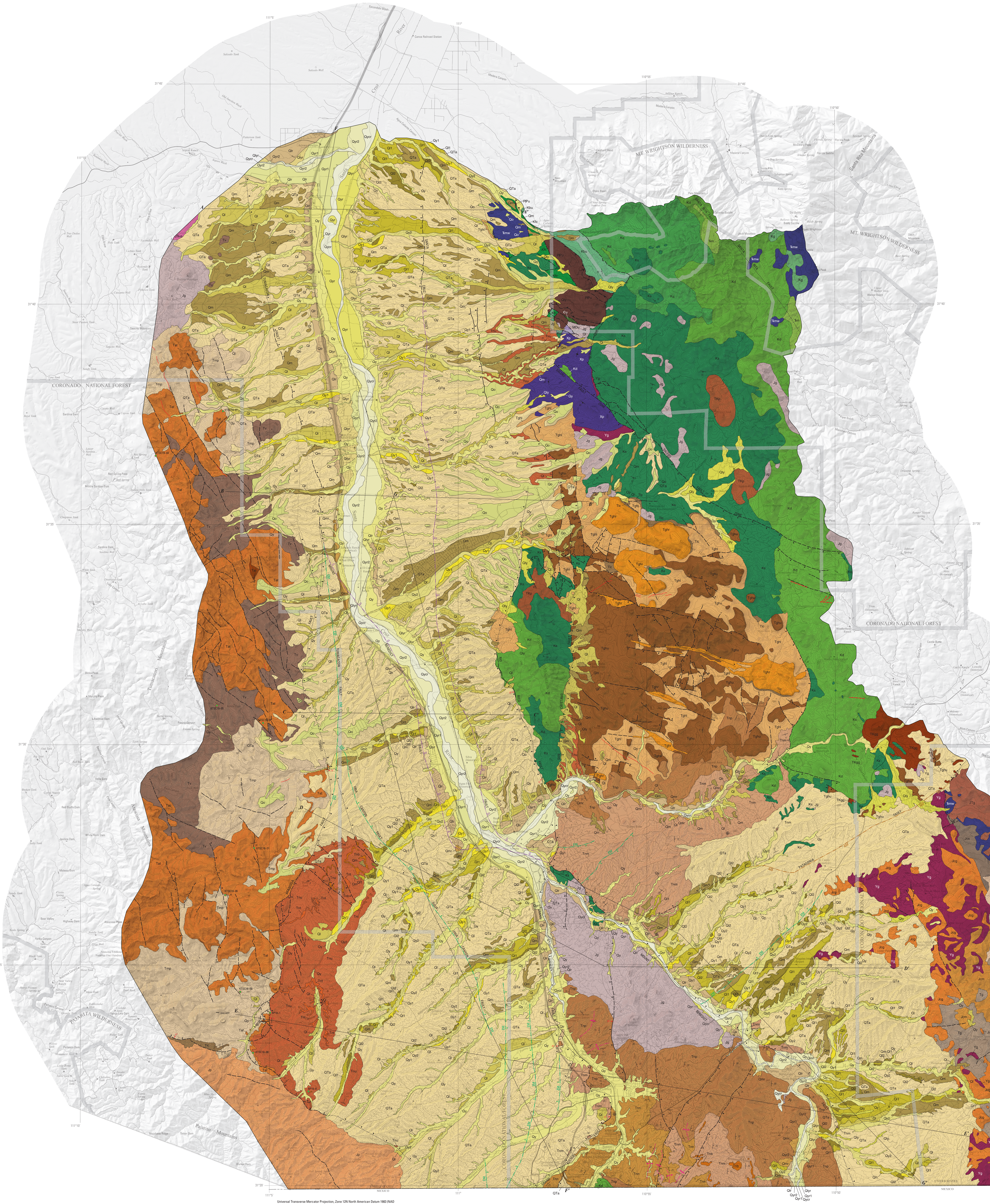
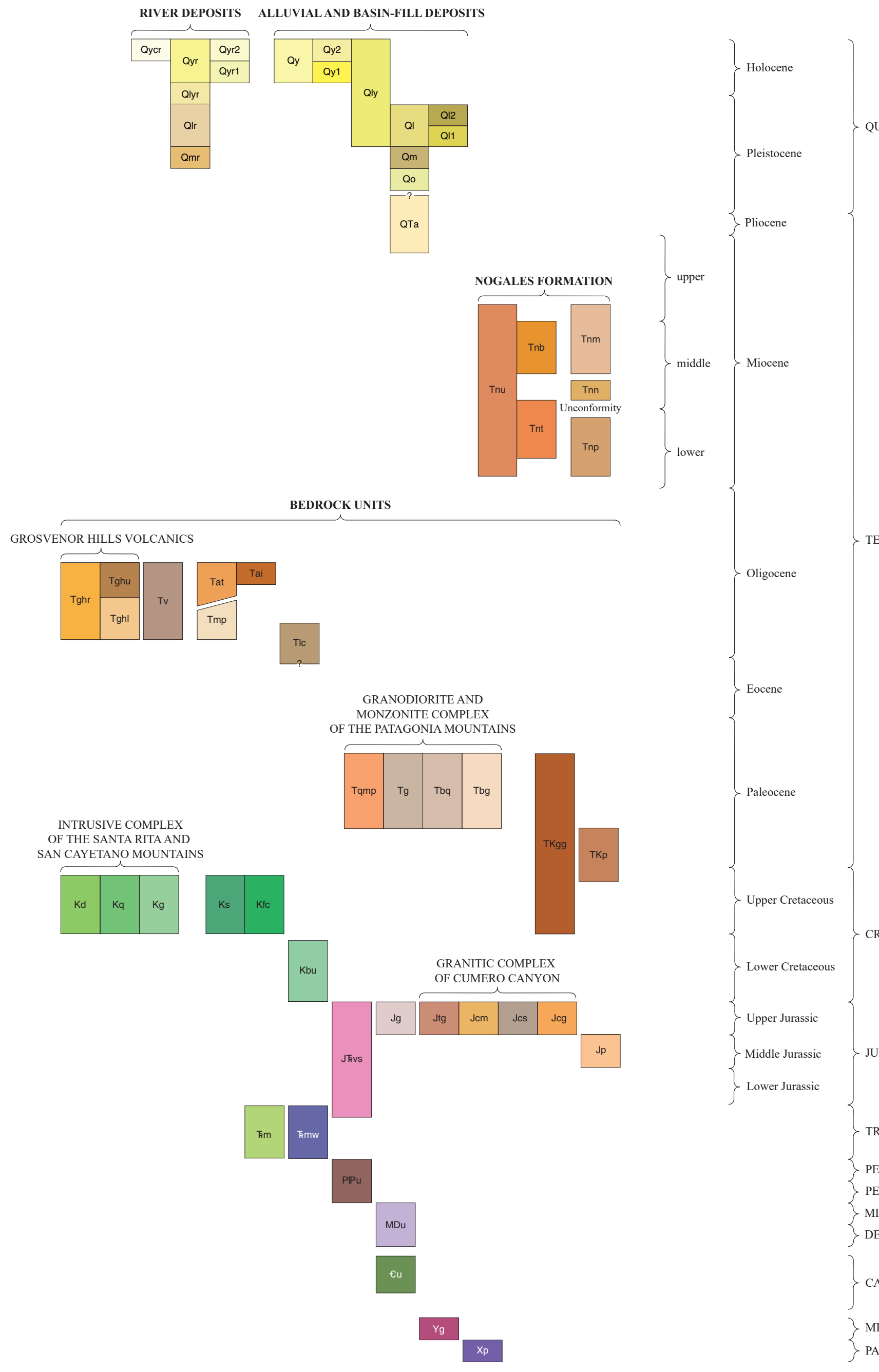
U.S. Department of the Interior
U.S. Geological Survey

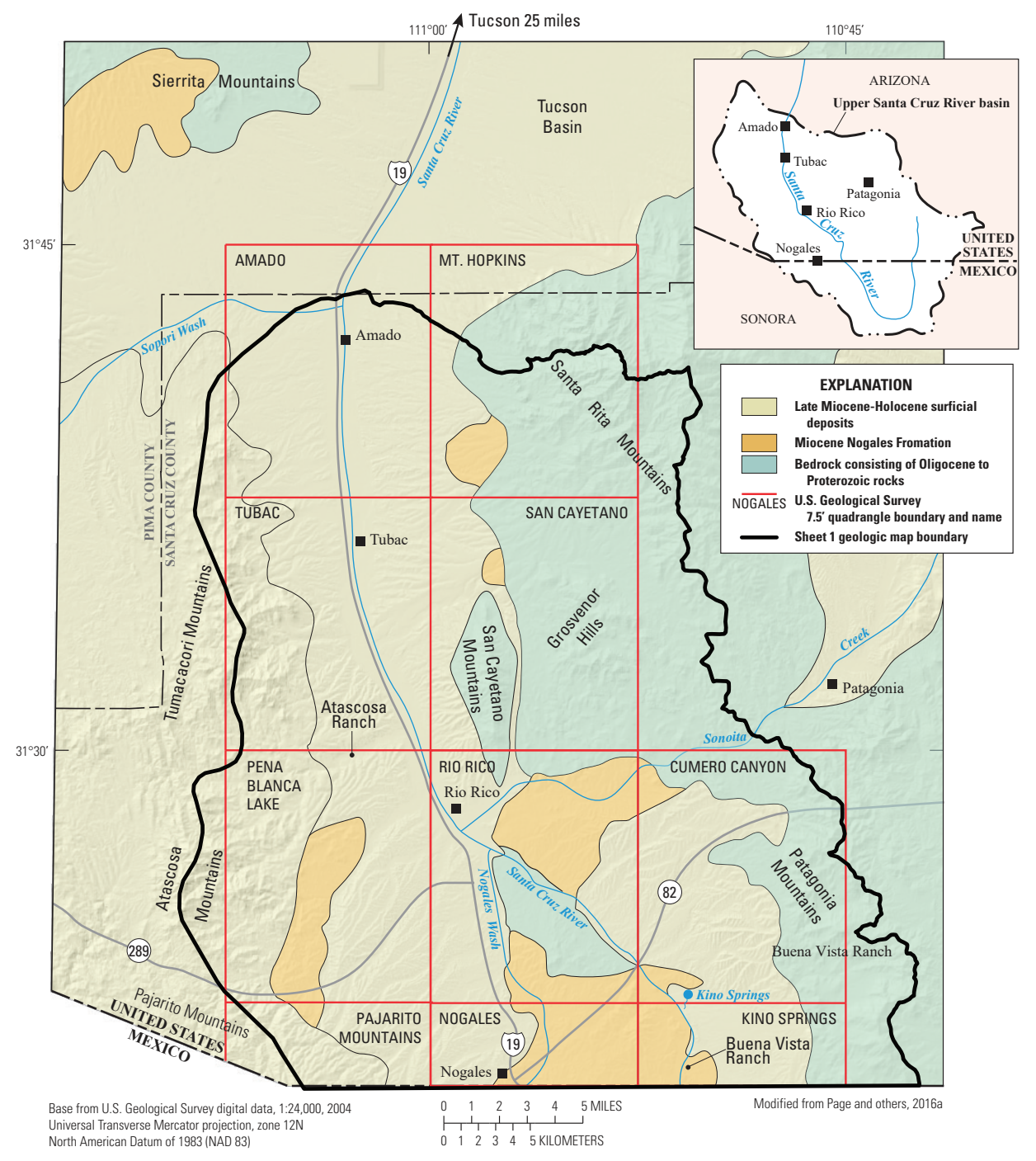
Scientific Investigations Map 3490
Sheet 1 of 2
Pamphlet accompanies map



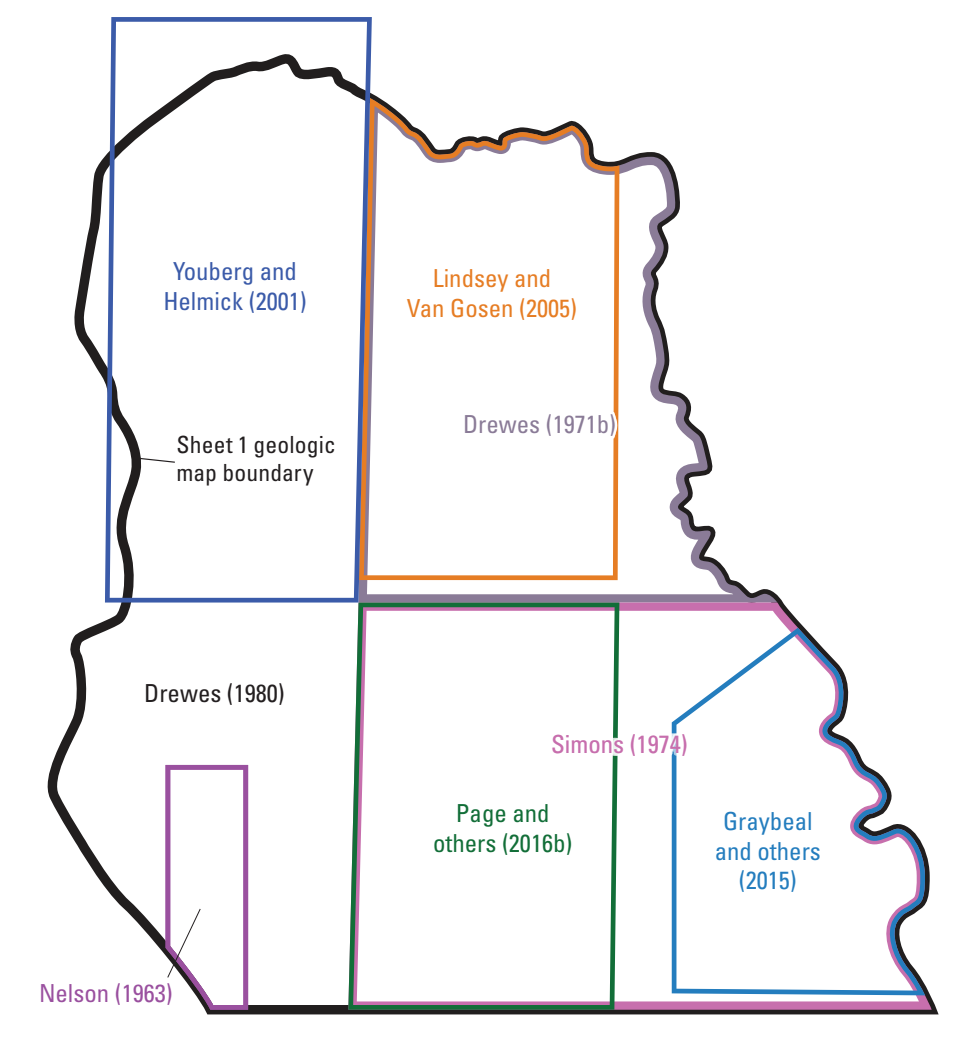
CORRELATION OF MAP UNITS

[See Description of Map Units (in pamphlet) for refined unit ages and complete unit descriptions. Colors on the map may appear darker due to the hillshade transparency]





Index map of the upper Santa Cruz River basin showing major physiographic, geologic, and hydrogeologic features in the map region. Black squares are town locations. Inset map in upper right shows location of upper Santa Cruz River basin with dashed boundary and Santa Cruz River in blue.


Youberg and Helmick (2001)
Lindsey and Van Gosen (2005)
Drewes (1971b)
Sheet 1 geologic map boundary
Drewes (1980)
Simons (1974)
Page and others (2016b)
Graybeal and others (2015)
Nelson (1963)

Geologic map sources used in the compilation of sheet 1 (Nelson, 1963; Drewes, 1971b; Simons, 1974; Drewes, 1980 [a contribution including and extending beyond the mapped limit]; Youberg and Helmick, 2001; Lindsey and Van Gosen, 2005; Graybeal and others, 2015; Page and others, 2016b).

LIST OF MAP UNITS

[See Description of Map Units (in pamphlet) for complete unit descriptions. Colors on the map may appear darker due to the hillshade transparency]

RIVER DEPOSITS

Qycr	**Active river-channel deposits (latest Holocene)**
Qyr	**Young river floodplain and terrace deposits, undifferentiated (Holocene)**
Qyr2	**Young river floodplain and terrace deposits (late Holocene)**
Qyr1	**Young river terrace deposits (Holocene)**
Qlyr	**Young to young-intermediate river terrace deposits (Holocene to late Pleistocene)**
Qlr	**Young-intermediate river terrace deposits (late Pleistocene)**
Qmr	**Older-intermediate river terrace deposits (middle Pleistocene)**

ALLUVIAL AND BASIN-FILL DEPOSITS

Qy	**Young alluvial deposits, undifferentiated (Holocene)**
Qy2	**Younger of young alluvial deposits (late Holocene)**
Qy1	**Older of young alluvial deposits (Holocene)**
Qly	**Young and young-intermediate alluvial deposits, undifferentiated (Holocene and late Pleistocene)**
Ql	**Young-intermediate alluvial deposits, undifferentiated (late Pleistocene)**
Ql2	**Younger of young-intermediate alluvial deposits (late Pleistocene)**
Ql1	**Older of young-intermediate alluvial deposits (late Pleistocene)**
Qm	**Older intermediate alluvial deposits (middle Pleistocene)**
Qo	**Old alluvial deposits (early Pleistocene)**
QTa	**Alluvial basin fill (early Pleistocene? to latest Miocene)**

NOGALES FORMATION (MIOCENE)

Tnu	**Nogales Formation, undivided (lower to upper Miocene)**
Tnb	**Nogales Formation basalt (middle Miocene)**
Tnt	**Nogales Formation tuff (lower to middle Miocene)**
Tnm	**Mariposa member (upper Miocene)**
Tnn	**Nogales Wash member (middle to upper Miocene)**
Tnp	**Proto Canyon member (lower Miocene)**

BEDROCK

GROSVENOR HILLS VOLCANICS (OLIGOCENE)

Tghr	**Rhyolite to rhyodacite intrusive-extrusive rocks**
Tghu	**Rhyodacite member**
Tghl	**Rhyolite member**
Tv	**Atascosa and Montana Peak Formation, undivided (Oligocene)**
Tat	**Atascosa Formation (Oligocene)**
Tai	**Intrusive rocks of the Atascosa Formation (Oligocene)**
Tmp	**Montana Peak Formation (Oligocene)**
Tlc	**Sedimentary deposits (Oligocene and Eocene?)**

GRANODIORITE AND MONZONITE COMPLEX OF THE PATAGONIA MOUNTAINS (PALEOCENE)

Tqmp	**Quartz monzonite porphyry**
Tg	**Granodiorite**
Tbq	**Biotite quartz monzonite**
Tbg	**Biotite granodiorite**
TKgg	**Gringo Gulch Volcanics (Paleocene and Upper Cretaceous)**
TKp	**Latitic to dacitic porphyry (Paleocene and Late Cretaceous)**

INTRUSIVE COMPLEX OF THE SANTA RITA AND SAN CAYETANO MOUNTAINS (LATE CRETACEOUS)

Kd	**Diorite and quartz diorite**
Kq	**Quartz monzonite**
Kg	**Granodiorite**
Ks	**Salero Formation (Upper Cretaceous)**
Kfc	**Fort Crittenden Formation (Upper Cretaceous)**
Kbu	**Bisbee Group, undivided (Lower Cretaceous)**
JTRvs	**Volcanic and sedimentary rocks in the southeastern part of the Patagonia Mountains and northern Tucamacori Mountains (Jurassic and Triassic)**
Jg	**Granite and quartz monzonite, undifferentiated, of the Santa Rita and Tumacacori Mountains and Mount Benedict horst block (Late Jurassic)**

GRANITIC COMPLEX OF CUMERO CANYON (LATE JURASSIC)

Jtg	**Granite of Three R Canyon**
Jcm	**Porphyritic granite**
Jcs	**Equigranular alkali syenite**
Jcg	**Equigranular granite**
Jp	**Tuff of Pajarito Mountains (Middle Jurassic)**
TRm	**Monzonitic rocks in the Santa Rita and Patagonia Mountains (Triassic)**
TRmw	**Mount Wrightson Formation (Triassic)**
PIPu	**Permian and Pennsylvanian rocks, undifferentiated**
MDu	**Mississippian and Devonian rocks, undifferentiated**
Єu	**Cambrian rocks, undifferentiated (Upper and Middle Cambrian)**
Yg	**Granitoid rocks (Mesoproterozoic rocks)**
Xp	**Pinal Schist (Paleoproterozoic rocks)**

EXPLANATION OF MAP SYMBOLS

Contact—Solid where location is accurate; dashed where location is approximate

Faults—Solid where location is accurate; dashed where location is approximate; dotted where location is concealed

Normal fault—Ball and bar on downthrown block; solid where location is accurate; dashed where location is approximate; dotted where location is concealed

Strikeslip fault—Right-lateral motion indicated by arrows; dashed where location is approximate; dotted where location is concealed

Thrust fault—Sawteeth on upper plate; dashed where location is approximate; dotted where location is concealed

Geophysically located faults

AM **Fault located by aeromagnetic survey**

EM **Fault located by electromagnetic survey**—Where interpreted, ball and bar on downthrown block

G **Fault located by gravity survey**

Anticline—Long-dashed where location approximate

Syncline—Long-dashed where location approximate

Dike

Quartz vein

A — A′ **Cross section line**

PLANAR POINT FEATURES

Strike and dip of bedding

⊕ **Horizontal**

20 **Inclined**—Showing strike and dip

Foliation

15 **Inclined foliation**—Showing strike and dip

50 **Inclined compact foliation**—Showing strike and dip

45 **Inclined metamorphic foliation**—Showing strike and dip

Vertical metamorphic foliation—Showing strike

Vertical flow banding—Showing strike

● KTSC19–05 **Geochronological sample**—Showing sample locations with sample number

TOPOGRAPHIC FEATURES

- ▪ **Building**
- ■ **Populated place**
- ⚒ **Quarry**
- **Schools and churches**
- **Spring**
- * **Summit**
- ▫ **Tank**
- ⊙ **Tower**
- ○ **Well**
- **International border**
- **Primary railroad tracks**
- **Roads: Major**
- **Roads: Minor**
- **Hydrologic lines: Major**
- **Hydrologic lines: Minor**
- **Bodies of water**
- **National Forest and National Wilderness**

Photograph of Peck Canyon Creek looking east of Atascosa Ranch. During periods of moderate streamflow, water simply disappears into the ground near the test well and the Lowell and Tumacacori faults. Photograph by William R. Page, U.S. Geological Survey.

Southeast view of the dry river bed in the headwaters of the Santa Cruz River in San Rafael Valley, Arizona in 2019. The United States-Mexico border is approximately 10 kilometers to the south.

Universal Transverse Mercator Projection, Zone 12N North American Datum 1983 (NAD 83)

Topographic and shaded-relief base created from U.S. Geological Survey 10 meter elevation USGS 3DEP, https://www.usgs.gov/3d-elevation-program

Additional hydrography and transportation from U.S. Census 2021, https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.html; geographic names and locations from U.S. Board on Geographic Names, https://www.usgs.gov/us-board-on-geographic-names; national forest and wilderness boundaries from U.S. Department of Agriculture, https://data.fs.usda.gov/geodata/edw/datasets.php.

APPROXIMATE MEAN DECLINATION, 2021

SCALE 1:50 000

CONTOUR INTERVAL 40 FEET
INDEX CONTOURS AT 400 FEET

MAP LOCATION

Geology mapped from 2010–2018 by Ric Page, Kenzie Turner, Margaret Berry, Christopher Menges, and Floyd Gray

GIS database support and digital cartography by Paco VanSistine

Publishing support provided by Denver Publishing Service Center
Digital cartographic production and editing by Julie Herrick and Alejandra Angulo

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Geologic Map and Hydrogeology of the Upper Santa Cruz River Basin, Southern Arizona

By

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D. Paco VanSistine[1], Leah E. Morgan[1], and Jeremy C. Havens[2]

2023

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Morgan, L.E., 2021, Argon data for Santa Cruz Basin, Arizona (ver. 1.1, November 2022): U.S. Geological Survey data release, accessed December 1, 2022, at https://doi.org/10.5066/P94NR0D9.

Paces, J.B., 2021, Sr-, U-, H- and O-isotope data used to evaluate water sources in the Potrero Creek wetlands, upper Santa Cruz basin, southern Arizona, USA: U.S. Geological Survey data release, accessed January 5, 2022, at https://doi.org/10.5066/P9XXW25T.

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