

Period	Epoch	Units	Description
QUATERNARY	Holocene	Qyr2	Active river-channel deposits (late Holocene)
		Qyr1	Young river floodplain and terrace deposits (late Holocene)
TERTIARY	Pliocene	Qy	Young alluvial deposits, undivided (Holocene)
		Qy2	Younger of the young alluvial deposits (late Holocene)
		Qy1	Older of the young alluvial deposits (late Holocene)
		Qm	Young intermediate river-terrace deposits, undivided (late Pleistocene)
		Qm2	Younger of the young intermediate river-terrace deposits (late Pleistocene)
		Qm1	Older of the young intermediate river-terrace deposits (late Pleistocene)
		Ql	Young intermediate alluvial deposits, undivided (late Pleistocene)
		Ql2	Younger of the young intermediate alluvial deposits (late Pleistocene)
		Ql1	Older of the young intermediate alluvial deposits (late Pleistocene)
		Qm	Older intermediate alluvial deposits (middle Pleistocene)
TERTIARY	Miocene	Qm	Old alluvial deposits (early Pleistocene)
		Qm2	Older alluvial deposits (early Pleistocene)
		Qm1	Alluvial basin fill (early Pleistocene to Miocene)
		Qm	Alluvium and basin-fill deposits, undivided (Holocene to Miocene)—On cross sections only
		Qm	Nogales Formation (Miocene)
		Qm	Mariposa member—Stipple pattern indicates basalt flows
		Qm	Nogales Wash member
		Qm	Proto Canyon member—Red area indicates location of dacite dikes
		Qm	Grosvonor Hills Volcanics (Oligocene)
		Qm	Upper rhyolite member
TERTIARY	Oligocene	Qm	Rhyolite and rhyolitic intrusives
		Qm	Middle rhyolite member
		Qm	Tertiary volcanic rocks, undivided (Oligocene)—On cross sections only
		Qm	Grosvonor Gulch Volcanics (Paleocene)
		Qm	Diorite (Upper Cretaceous)
		Qm	Salero Formation (Upper Cretaceous)
		Qm	Quartz monzonite of Mount Benedict (Jurassic)
		Qm	Biotite-borohide quartz monzonite
		Qm	Quartz monzonite
		Qm	Cretaceous and Jurassic rocks, undivided—On cross sections only
CRETACEOUS	Upper	Qm	Andesite lava and flow breccia, latite to rhyolitic tuff, andesite, flow breccia, and latite; rhyolite tuff samples dated at 24.9–25.5 Ma, and another at 26.9–28.3 Ma, 75 m thick
		Qm	Middle rhyolite member—Rhyolite tuff, rhyolite lava, rhyolite sandstone and conglomerate, rhyolite plugs dated at 27.8 Ma, 100 m thick
		Qm	Diorite stock—Augite, hypersthene, and biotite, altered
		Qm	Arkose conglomerate and conglomeratic sandstone, argillite, and conglomeratic quartzite; 50–400 m thick
		Qm	Arkose conglomerate and conglomeratic sandstone, argillite, and conglomeratic quartzite; 50–400 m thick
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		Qm	Arkose conglomerate and conglomeratic sandstone, argillite, and conglomeratic quartzite; 50–400 m thick
JURASSIC	Middle	Qm	Porphyritic biotite-hornblende quartz monzonite; lamprophyre, microdiorite, or diabase dikes
		Qm	Porphyritic biotite-hornblende quartz monzonite; lamprophyre, microdiorite, or diabase dikes
		Qm	Porphyritic biotite-hornblende quartz monzonite; lamprophyre, microdiorite, or diabase dikes
		Qm	Porphyritic biotite-hornblende quartz monzonite; lamprophyre, microdiorite, or diabase dikes
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Figure 1. Stratigraphic chart of sediments and rocks in map area. Unconformities and disconformities are indicated by the wavy line.

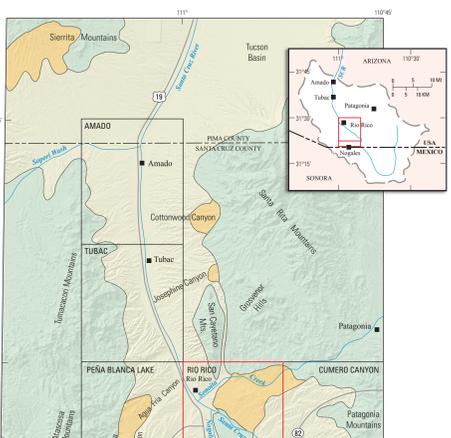


Figure 1. Location map of Rio Rico and Nogales (Arizona) 7.5' quadrangles, showing major physiographic, geologic, and hydrologic features in the map area. Black squares are town locations and black ball and bar symbols indicate the down-slope side of normal faults. Fault dasheding has been simplified from main map.

Figure 2. Location map of upper Santa Cruz basin area, showing major physiographic, geologic, and hydrologic features in the region. Black squares are town locations. Inset map in upper right shows location of upper Santa Cruz River basin with boundary in gray, Santa Cruz River (SCR) in blue, and boundaries of Rio Rico and Nogales quadrangles in red.

Base from U.S. Geological Survey 1:24,000 scale maps, Rio Rico, Arizona, 1996; Nogales, Arizona, 2004 and revised by the U.S. Forest Service January 18, 2013; North American Datum 83 (NAD 83); Universal Transverse Mercator, zone 12; Shaded-relief base from U.S. Geological Survey National Elevation Dataset (NED) (accessed in 2015 at <http://ned.srs.gov>), 10-meter resolution elevation data (UTM grid) and 1/3-degree quadrangle created in 2010 from USGS sources.

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Mapping of the Miocene Nogales Formation was completed from 2011 to 2014 by William R. Page, Christopher M. Menges, Floyd Gray, and Margaret E. Berry. Late Miocene to Holocene alluvial and basin-fill deposits were mapped from 2011 to 2014 by Christopher M. Menges and Margaret E. Berry. Miocene bedrock units and the Oligocene Grosvonor Hills Volcanics were compiled from existing published geologic maps in the area, including those of Sisson (1974) and Drexler (1975, 1980). Mark W. Bultman completed geophysical modeling, which defined the geometry of concealed faults and basin and bedrock geology and constrained the subsurface geology shown in this cross section. Michael A. Cosca completed <sup>40</sup>Ar/<sup>39</sup>Ar geochronology studies resulting in stratigraphic revision of the Oligocene Grosvonor Hills Volcanics and Miocene Nogales Formation. D. Paco VanSistine created cross section profiles and assisted authors in creating, editing, and finalizing the geologic map database and metadata. TR. Brandt produced the digital topographic base map.

SCALE 1:24,000  
SUPPLEMENTARY CONTOUR INTERVAL OF 20 FEET  
NATIONAL GEODETIC DATUM OF 1983

# Geologic map of the Rio Rico and Nogales 7.5' quadrangles, Santa Cruz County, Arizona

By  
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Period	Epoch	Age	
Quaternary	Holocene	late	11.7–12 ka
		middle	126–781 ka
		early	781 ka–2.58 Ma

CONVERSION FACTORS		
Multiply	By	To obtain
millimeter (mm)	0.03937	inch (in.)
centimeter (cm)	0.3937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)