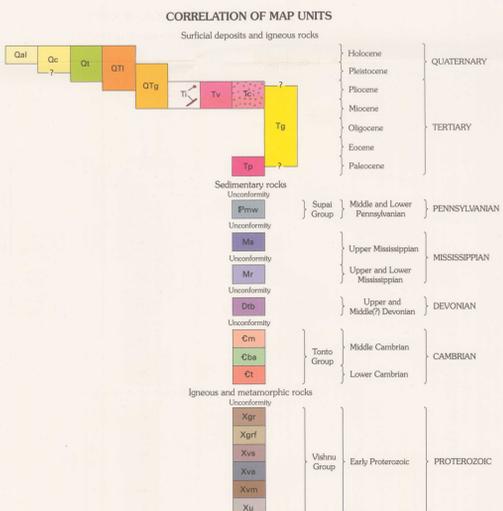
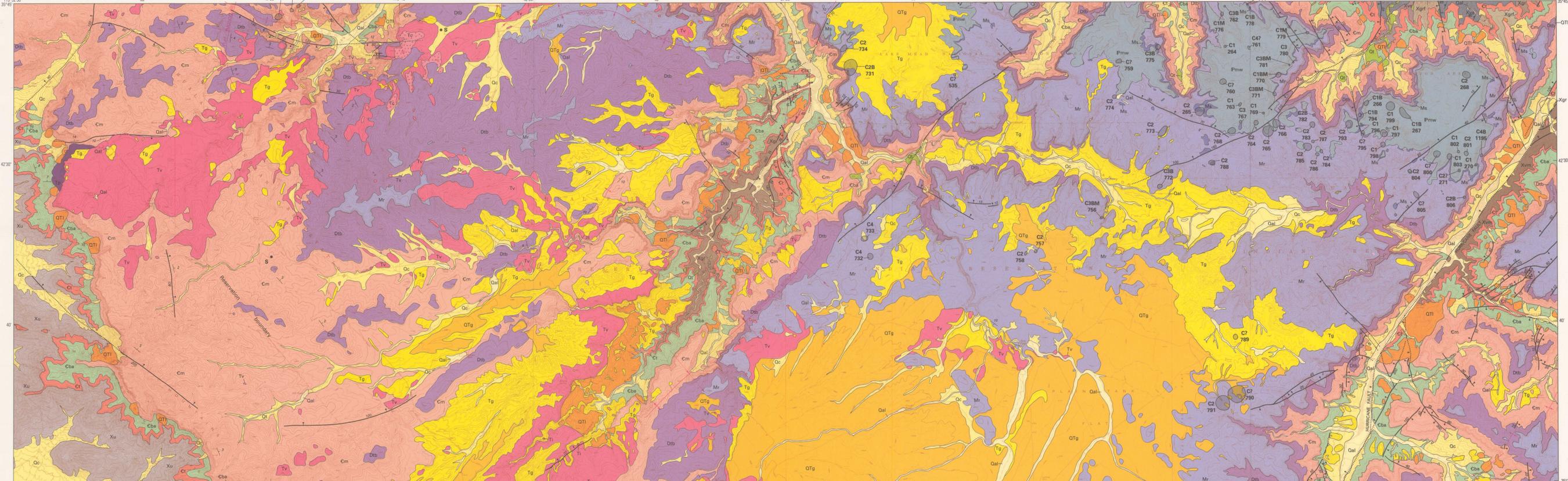


- LIST OF MAP UNITS**  
(See accompanying text pamphlet for expanded descriptions of map units.)
- SURFICIAL AND IGNEOUS DEPOSITS**
- Qal Alluvial deposits (Holocene)
  - Qc Colluvium (Holocene and Pleistocene?)
  - Qtr Travertine deposits (Holocene and Pleistocene?)
  - QTI Landslides (Holocene, Pleistocene and Pleistocene?)
  - QTY Younger gravel, undivided (Pleistocene to Miocene)
  - Ti Intrusive volcanic rocks (Pliocene and Miocene)
  - Tv Volcanic deposits, undivided (Pliocene and Miocene)
  - Tp Basaltic cinder deposits (Pliocene and Miocene)
  - Tg Undifferentiated gravel deposits (Pliocene through Paleocene)
  - Tc Coarsely crystalline intrusive plutonic stock (Paleocene)
- SEDIMENTARY ROCKS**
- Pmw Lower part of Supai Group: Manakacha and Mankowitszi Formations, undivided (Middle and Lower Pennsylvanian)
  - Ms Surprise Canyon Formation (Upper Mississippian)
  - Mr Redwall Limestone (Upper and Lower Mississippian)
  - Ddb Temple Butte Formation (Upper and Middle(?) Devonian)
  - Tonto Group (Middle and Lower Cambrian)
    - Cm Muav Limestone (Middle Cambrian)
    - Cba Bright Angel Shale (Middle Cambrian)
    - Ct Tapeats Sandstone (Lower Cambrian)
- IGNEOUS AND METAMORPHIC ROCKS**
- Xgr Vishnu Group (Early Proterozoic)
    - Xgrf Nonfoliated granitic plutons
    - Xgrf Foliated granitic plutons
    - Xvs Mica schist
    - Xva Mafic schist and amphibolite
    - Xvm Paragneiss
    - Xu Precambrian rocks, undivided
- CONTACTS AND STRUCTURES**
- Contact
  - - - Fault—Dotted where concealed; ball and bar on downthrown side; R, reverse fault; number indicates estimated displacement in feet. Predicts alluvium and colluvium where shown bounding these units.
  - ~ Fold—Showing trace of axial plane and direction of plunge where known; dashed where approximately located; dotted where concealed.
  - Monocline—Axial trace located approximately midway between anticlinal and synclinal hinges of fold. Distance between arrows indicates approximate map distance between fold hinges.
  - Syncline—Arrow indicates direction of plunge.
  - Anticline—Arrow indicates direction of plunge.
  - Strike and dip of beds
  - Strike and dip of schistosity
  - \* Volcanic vent
- CLASSIFICATION OF COLLAPSE FEATURES AND BRECCIA PIPES**  
(Also refer to map 8, where characteristics of each feature and pipe are color coded.)
- C4 Collapse feature or breccia pipe—Selected features and pipes have one or more of the following alphanumeric symbols. Features and pipes also have identification numbers (identification number range is from 200 to 1,365, assigned in order of field discovery). Numbers correspond to those used for geochemical analyses (K.J. Wenrich, unpub. data, 1982-94).
  - B—Brecciated rock (indicating the structure is a breccia pipe)
  - M—Mineralized rock containing copper minerals or surface radiation greater than 2.5 times background
  - C1—Radially inward-dipping beds and alteration (bleaching or limonite staining)
  - C2—Radially inward-dipping beds, no alteration
  - C3—Usable alteration, no dipping beds
  - C4—Circular topography or circular vegetation or soil pattern, no alteration or dipping beds
  - C7—Questionable circular feature. A few recognizable inward-dipping beds, and (or) little alteration, vegetation change, or topographic change. Feature appears vaguely circular
  - S—Sinkhole



**CONVERSION FACTORS**

Multiply	By	To obtain
inches (in.)	2.54	centimeters (cm)
feet (ft)	0.3048	meters (m)
miles (mi)	1.609	kilometers (km)



Base from U.S. Geological Survey, 1:24,000 Hualapai Canyon, Milne Canyon NW, Milne Canyon SE, Milne Canyon SW, Peach Springs, Peach Springs Canyon, 1957; Music Mountains NE, 1958

SCALE 1:48,000

1 1/2 0 2 3 MILES

1 1/2 0 2 3 KILOMETERS

CONTOUR INTERVALS 20 AND 40 FEET NATIONAL GEODETIC VERTICAL DATUM OF 1929

APPROXIMATE MEAN ELEVATION, 1986

Geology mapped from 1983 to 1987. Breccia-pipe geology by K.J. Wenrich; stratigraphy by G.H. Billingsley; structural geology by P.W. Huntoon; Proterozoic geology by M.O. Clark. Edited by J. Craig Brunton. Color selection and graphics design by Danny Whip. Cartography by Springfield & Springfield. Manuscript approved for publication June 9, 1995.

**MAP A. BRECCIA-PIPE AND GEOLOGIC MAP**  
**BRECCIA-PIPE AND GEOLOGIC MAP OF THE SOUTHWESTERN PART OF THE HUALAPAI INDIAN RESERVATION AND VICINITY, ARIZONA**

By  
G.H. Billingsley, K.J. Wenrich, P.W. Huntoon, and R.A. Young  
1999

ISBN 0-607-86551-3  
9 780607 865514