U.S. DEPARTMENT OF THE INTERIOR
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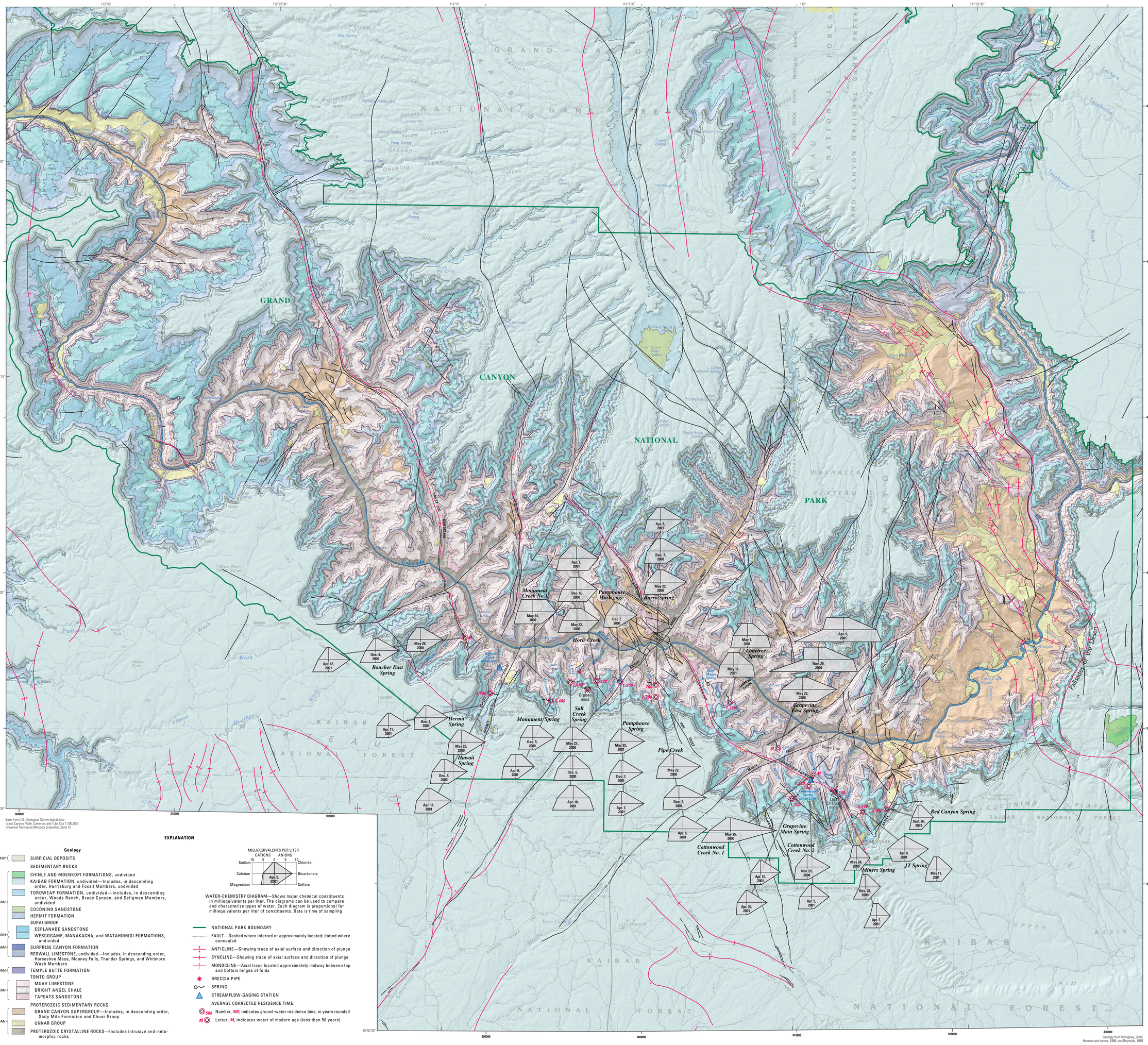
Surficial geology, geologic structure, and chemical characteristics of ground-water disharge at springs—PLATE 1
Monroe, S.A., Antweiler, R.C., Hart, R.J., Taylor, H.E., Truini, Margot, Rihs, J.R., and Felger, T.J., 2005, Chemical characteristics of ground-water discharge along the south rim of Grand Canyon in Grand Canyon National Park, Arizona, 2000–2001



EXPLANATION

Geology

QUATERNARY
- SURFICIAL DEPOSITS

SEDIMENTARY ROCKS

PERMIAN
- CHINLE AND MOENKOPI FORMATIONS, undivided
- KAIBAB FORMATION, undivided—Includes, in descending order, Harrisburg and Fossil Members, undivided
- TOROWEAP FORMATION, undivided—Includes, in descending order, Woods Ranch, Brady Canyon, and Seligman Members, undivided
- COCONINO SANDSTONE
- HERMIT FORMATION
- SUPAI GROUP

PENNSYLVANIAN
- ESPLANADE SANDSTONE

MISSISSIPPIAN
- WESCOGAME, MANAKACHA, and WATAHOMIGI FORMATIONS, undivided
- SURPRISE CANYON FORMATION
- REDWALL LIMESTONE, undivided—Includes, in descending order, Horseshoe Mesa, Mooney Falls, Thunder Springs, and Whitmore Wash Members

DEVONIAN
- TEMPLE BUTTE FORMATION

CAMBRIAN
- TONTO GROUP
  - MUAV LIMESTONE
  - BRIGHT ANGEL SHALE
  - TAPEATS SANDSTONE

PRECAMBRIAN
- PROTEROZOIC SEDIMENTARY ROCKS
  - GRAND CANYON SUPERGROUP—Includes, in descending order, Sixty Mile Formation and Chuar Group
  - UNKAR GROUP
- PROTEROZOIC CRYSTALLINE ROCKS—Includes intrusive and metamorphic rocks

MILLIEQUIVALENTS PER LITER
CATIONS ANIONS
10 5 0 5 10
Sodium, Calcium, Magnesium — Chloride, Bicarbonate, Sulfate
Apr. 9, 2001

WATER-CHEMISTRY DIAGRAM—Shows major chemical constituents in milliequivalents per liter. The diagrams can be used to compare and characterize types of water. Each diagram is proportional for milliequivalents per liter of constituents. Date is time of sampling

- NATIONAL PARK BOUNDARY
- FAULT—Dashed where inferred or approximately located; dotted where concealed
- ANTICLINE—Showing trace of axial surface and direction of plunge
- SYNCLINE—Showing trace of axial surface and direction of plunge
- MONOCLINE—Axial trace located approximately midway between top and bottom hinges of folds
- BRECCIA PIPE
- SPRING
- STREAMFLOW-GAGING STATION

AVERAGE CORRECTED RESIDENCE TIME:
- 500 Number, 500, indicates ground-water residence time, in years rounded
- M Letter, M, indicates water of modern age (less than 50 years)

SCALE 1:100 000
1 0 1 2 3 4 5 6 7 8 9 10 KILOMETERS
1 0 1 2 3 4 5 6 MILES

TRUE NORTH
MAGNETIC NORTH
12½°
APPROXIMATE MEAN DECLINATION, 1993

MAP SHOWING SURFICIAL GEOLOGY, GEOLOGIC STRUCTURE, AND CHEMICAL CHARACTERISTICS OF GROUND-WATER DISCHARGE AT SELECTED SPRINGS AND CREEKS ALONG THE SOUTH RIM OF GRAND CANYON IN GRAND CANYON NATIONAL PARK, ARIZONA, 2000–2001

By
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2005