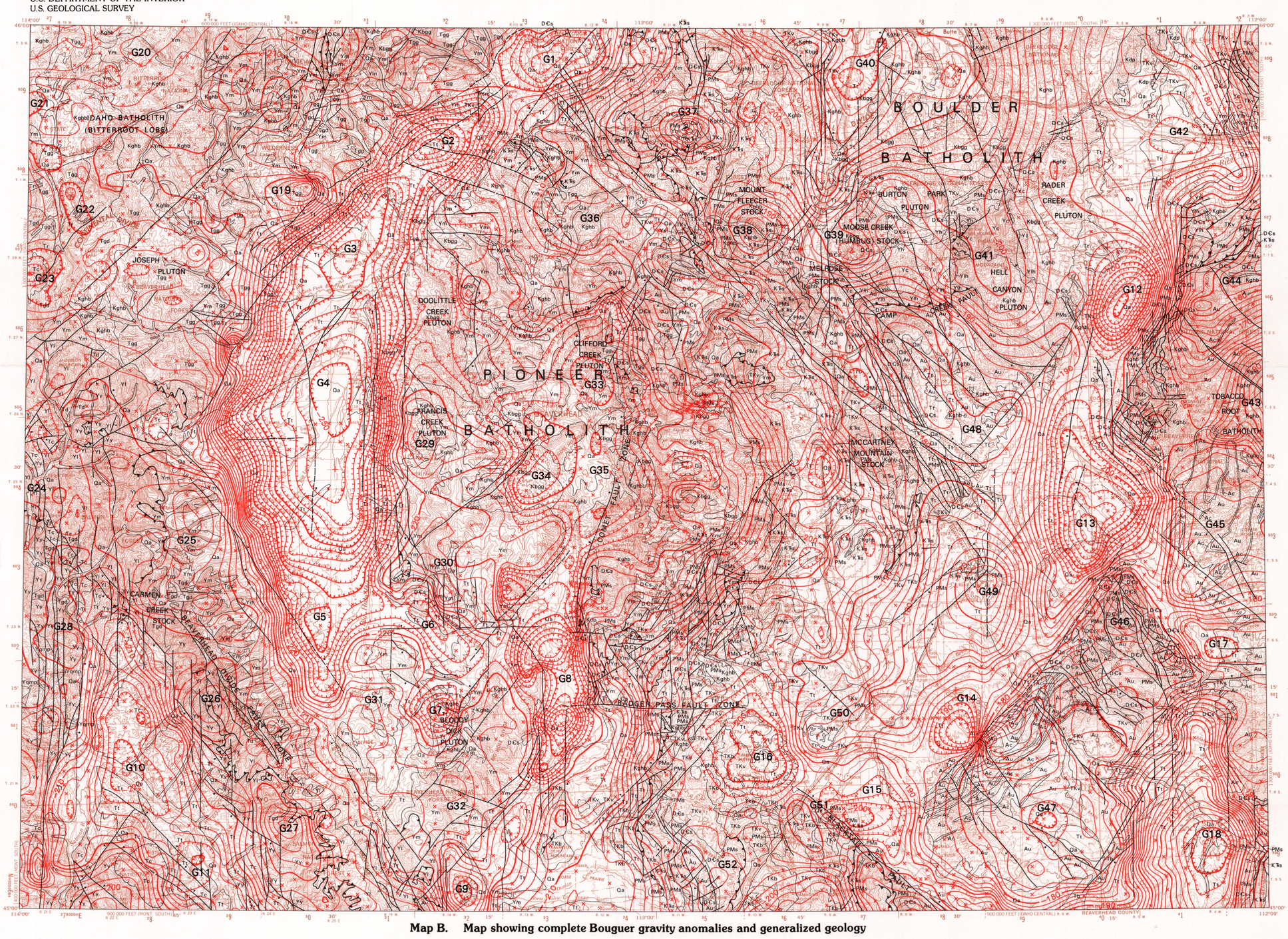
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I–1803–I (SHEET 2 OF 2)
Explanatory pamphlet accompanies map



Map B. Map showing complete Bouguer gravity anomalies and generalized geology

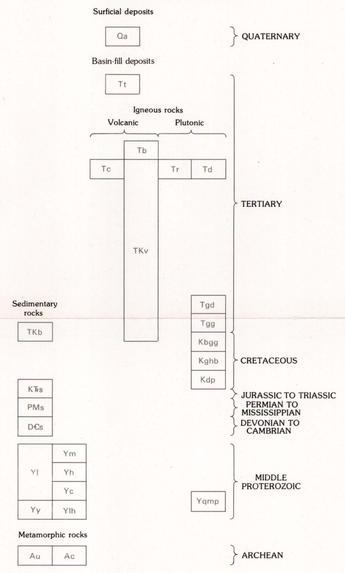
EXPLANATION

–220– **Gravity anomaly contour**—Contour interval 2 mGal; hachures indicate lower values

× **Gravity station location**

G70 **Gravity anomaly referenced in text**

CORRELATION OF MAP UNITS



LIST OF MAP UNITS

Qa	Alluvial deposits, landslides, glacial outwash, and till (Quaternary)
Tt	Tuffaceous sandstone, siltstone, and conglomerate (Tertiary)
Tb	Basalt flows (upper Tertiary)
Tc	Challis Volcanics (Tertiary)
Tr	Rhyodacite and dacitic porphyritic intrusive rocks (Tertiary)
Td	Dioritic intrusive rocks (Tertiary)
Tgd	Granitic rocks of intermediate composition (Tertiary)—Consists mainly of biotite granodiorite; about 46–55 Ma
Tgg	Two-mica granodiorite and granite (Tertiary)—About 56–67 Ma
TKv	Volcanic rocks (Tertiary and Cretaceous)
TKb	Beaverhead Group and associated rocks (Tertiary and Cretaceous)
Kbgg	Biotitic granodiorite and granite (Cretaceous)—About 68–73 Ma
Kghb	Granodiorite, quartz diorite, and tonalite that contain biotite and hornblende (Cretaceous)—About 73–79 Ma
Kdp	Diorite porphyry (Cretaceous)—About 80–83 Ma
K'ks	Sedimentary rocks (Cretaceous to Triassic)—Comprises Cretaceous Colorado Group and Kootenai Formation, Jurassic Morrison Formation and Ellis Group, and, in some places, Triassic Thaynes, Woodside, and Dinwoody Formations
PMs	Sedimentary rocks (Permian to Mississippian)—Comprises Permian Phosphoria Formation, Pennsylvanian Quadrant and Amsden Formations, and Mississippian Big Snowy and Madison Groups
DCs	Sedimentary rocks (Devonian to Cambrian)—Comprises Devonian Three Forks and Jefferson Formations, Cambrian Snowy Range Formation, Pilgrim Limestone, Park Shale, Meagher Limestone, Wolsey Shale, and Flathead Sandstone; in northeastern part of Pioneer Mountains, includes Cambrian Red Lion, Hasmark, and Silver Hill Formations and Black Lion Conglomerate (Zen, 1988)
Yl	Swauger Formation and Lemhi Group (Middle Proterozoic)
Yy	Yellowjacket Formation (Middle Proterozoic)
Ym	Garnet Range and McNamara Formations, Bonner Quartzite, and Mount Shields Formation of Missoula Group of Belt Supergroup (Middle Proterozoic)—Includes Helena Formation in Anaconda Range
Yh	Helena Formation of Belt Supergroup (Middle Proterozoic)
Yc	Greyson Shale of Ravalli Group, Newland Limestone, Chamberlain Shale, and Prichard Formation, all of Belt Supergroup (Middle Proterozoic)
Ylh	LaHood Formation of Belt Supergroup (Middle Proterozoic)
Yqmp	Quartz monzonite porphyry (Middle Proterozoic)
Au	Schist and gneiss (Archean)
Ac	Calc-silicate rocks and marble (Archean)

Contact

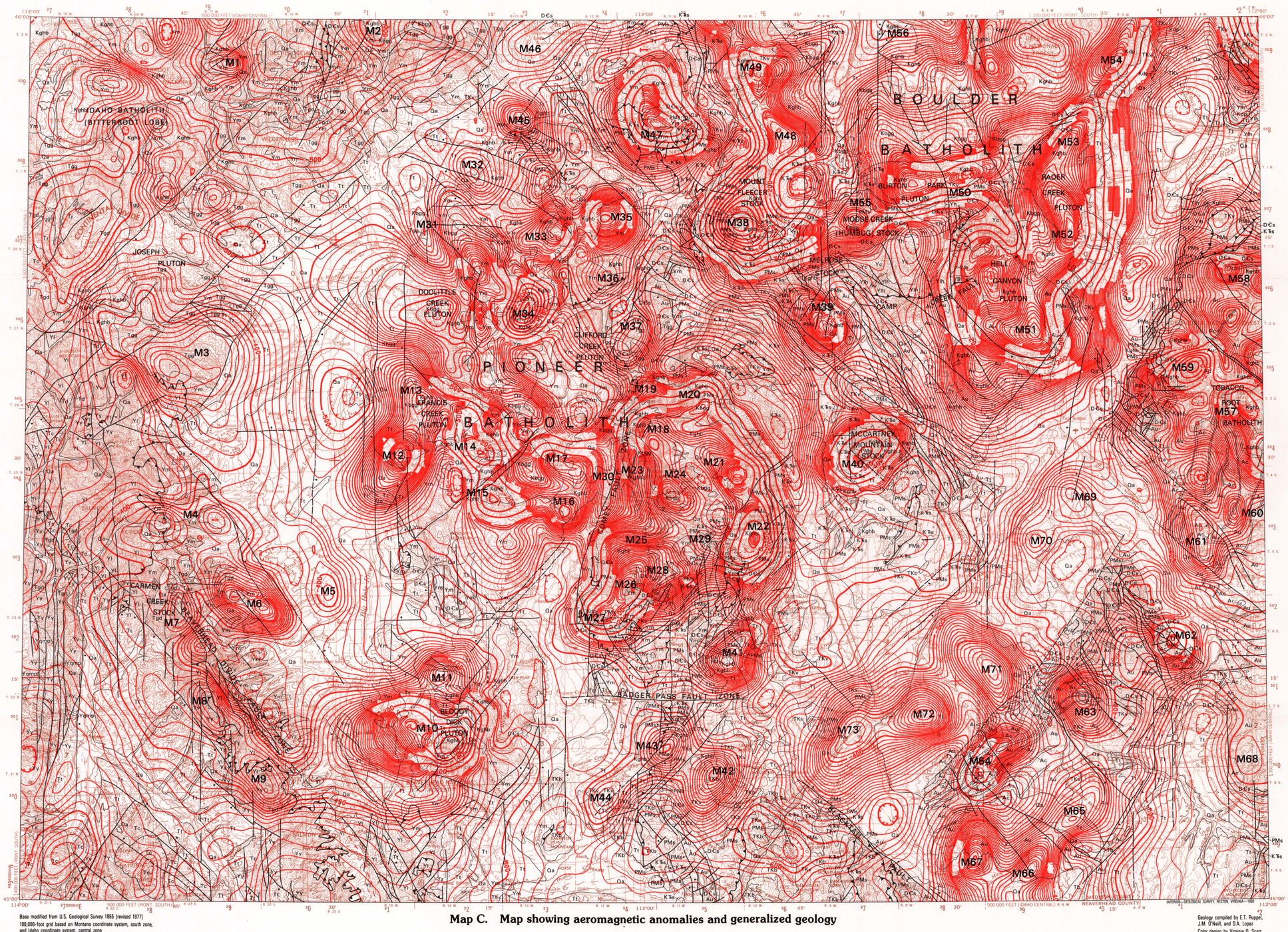
High-angle fault—Dashed where approximately located or inferred, dotted where concealed; bar and ball on downthrown side; arrows show direction of strike-slip movement

Reverse fault—Dashed where approximately located or inferred; sawteeth on upthrown side; generally high angle, but flattens locally

Thrust fault—Dashed where approximately located or inferred; sawteeth on upper plate; generally low angle, but folded to steeper angles in places

Shear zone—Shown within unit Kghb southeast of Butte

Boundary of caldera

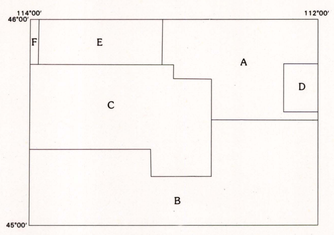


Map C. Map showing aeromagnetic anomalies and generalized geology

EXPLANATION

–210– **Magnetic anomaly contour**—Contour interval 10 nT; hachures indicate lower values. Contours simulate anomalies at an altitude of 3.2 km (10,500 ft) above mean sea level. Anomaly map was produced by merging diverse data sets shown on index map

M74 **Aeromagnetic anomaly referenced in text**



INDEX SHOWING SOURCES OF MERGED TOTAL-INTENSITY AEROMAGNETIC DATA.

A. Johnson and others (1965): Flight elevation 10,500 ft (3.2 km) barometric; flight-line spacing 2 mi (3.2 km); flight direction east-west; no reference field removed; contour intervals 20 and 100 nT.

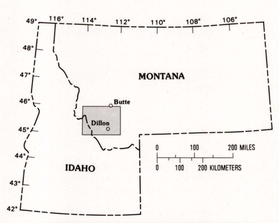
B. U.S. Geological Survey (1975): Flight elevation 12,000 ft (3.6 km) barometric; flight-line spacing 2 mi (3.2 km); flight direction east-west; updated IGRF 75 removed; contour interval 10 nT.

C. U.S. Geological Survey 1979): Flight elevation 9,000 ft (2.7 km) barometric; flight-line spacing 0.5 mi (0.8 km); flight direction east-west; updated IGRF 75 removed; contour intervals 10, 20, and 100 nT.

D. U.S. Geological Survey (1981a): Flight elevation 1,000 ft (0.3 km) above ground; flight-line spacing 0.5 mi (0.8 km); flight direction east-west; updated IGRF removed; contour interval 20 nT.

E. U.S. Geological Survey (1981b): Flight elevation 1,000 ft (0.3 km) above ground; flight-line spacing 0.5 mi (0.8 km); flight direction east-west; updated IGRF 75 removed; contour interval 20 nT.

F. Zietz and others (1980): Flight elevation 15,000 ft (4.5 km) barometric; flight-line spacing 5 mi (8 km); flight direction east-west; main magnetic field of the Earth (Fabiano and Peddie, 1969) removed.



INDEX MAP SHOWING LOCATION OF THE DILLON 1° × 2° QUADRANGLE

Base modified from U.S. Geological Survey 1955 (revised 1977)
100,000-foot grid based on Montana coordinate system, south zone, and Idaho coordinate system, central zone
10,000-meter Universal Transverse Mercator grid ticks, zone 12

SCALE 1:250 000

5 0 5 10 15 20 25 MILES

5 0 5 10 15 20 25 KILOMETERS

CONTOUR INTERVAL 200 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geology compiled by E.T. Ruppel, J.M. O'Neill, and D.A. Lopez
Color design by Virginia D. Scott
Graphic design by William E. Sowers
Cartography by Joe Romero
Manuscript approved for publication July 2, 1992

MAPS SHOWING GRAVITY AND AEROMAGNETIC ANOMALIES IN THE DILLON 1° × 2° QUADRANGLE, IDAHO AND MONTANA

By
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Edward T. Ruppel, Montana Bureau of Mines and Geology

1993