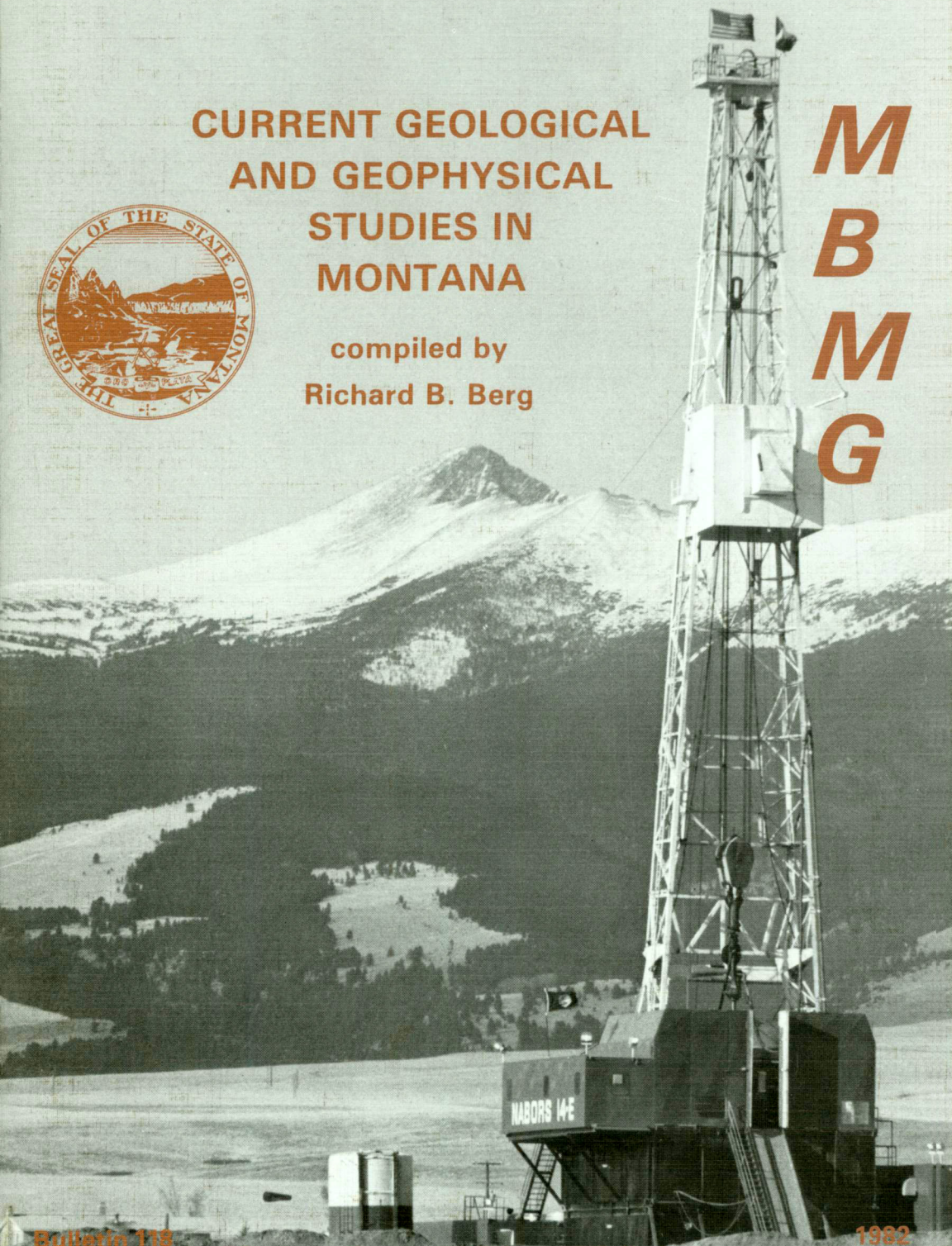
CURRENT GEOLOGICAL AND GEOPHYSICAL STUDIES IN MONTANA

compiled by
Richard B. Berg

MBMG



Bulletin 118

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Montana Bureau of Mines and Geology
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Sheets

About the cover . . .

Exploring the overthrust belt—Mount Powell (10,168') in the Flint Creek Range overlooks AMOCO's Johnson well no. 1. Test drilling is in SW¼ sec. 31, T. 7 N., R. 9 W., located 6 miles (10 km) southwest of Deer Lodge, Montana. (H. L. James photo.)

Preface

This annual list of current geological and geophysical studies would not be possible without the assistance of those who took the time to send us information on their research. We appreciate this cooperation and hope that you will find this list useful.

Most studies are listed under one heading only, but because of the difficulty of assigning some studies to a single catgegory, some are listed under more than one heading. The date following the entry is the expected date of completion. Many of the entries are numbered and plotted on the index maps. An asterisk [*] indicates that the area of study is plotted on the index map of southwestern Montana [**Sheet 2, back pocket**]. All other numbered entries are plotted on the index map of Montana [**Sheet 1, back pocket**].

Completed theses are not included in this compilation. For information on theses dealing with Montana geology, see Montana Bureau of Mines and Geology Special Publication 77 (1977). A revised edition of this index of theses is in preparation and will be available in late 1982. Northwest Geology, published annually by the Geology Department, University of Montana, is also an excellent source of information on theses dealing with the geology of Wyoming, Montana, Idaho, Oregon and Washington.

Many of the studies listed here are far from being completed. We suggest that anyone who wants more information on a specific project should correspond directly with the investigator.

Richard B. Berg
Economic Geologist
Montana Bureau of Mines and Geology

Butte
March 1, 1982

Areal Geology

1	Geologic maps of the Forsyth, Jordan and Miles City 2° quadrangles.	Robert N. Bergantino Montana Bureau of Mines and Geology
2	Geology of the eastern Garnet Range, Warm Springs Creek area, Powell County. Emphasis placed on structure, tectonics and igneous petrography. [September 1982]	Thomas J. Callmeyer Montana State University
3	Geologic mapping of the Circle, Richey and Forsyth 1° quadrangles. [1982]	Roger B. Colton USGS, Denver, Colorado
*4	A geological study of the Polaris 15-minute quadrangle, Beaverhead County. [Continuing]	Willard E. Cox Montana Tech
5	Hydrogeology and geothermal resources of the Little Bitterroot Valley, Montana. [June 1982]	Joseph J. Donovan, Montana Bureau of Mines and Geology
6	Geology of Glacier National Park. [1984]	Robert L. Earhart USGS, Denver, Colorado
*7	Precambrian geology and bedded iron deposits of the Ruby Range, southwestern Montana.	Harold L. James, USGS 1617 Washington St. Port Townsend, WA 98368
8	Geology of the Sandpoint 2° quadrangle (mainly in Washington and Idaho with a small area in Montana). [1982]	Fred K. Miller USGS, Menlo Park, California
*9	Geology of the Dillon 2° quadrangle. [1982]	Edward T. Ruppel USGS, Denver, Colorado
	Compilation of index maps for available geologic maps of Montana. Each index map is at a scale of 1:250,000 (1° x 2°) and shows outline of geologic maps within that 1° x 2° quadrangle. A bibliographic list of these maps is also being prepared as a part of this project, which will eventually cover the entire state.	Brenda Sholes and Robert Bergantino Montana Bureau of Mines and Geology
10	Geologic mapping and coal resources of the Baker-Wibaux 1:100,000 quadrangles, eastern Montana. [October 1982]	Mark A. Sholes, Susan Vuke, Michael Stickney, Robert Bergantino, Montana Bureau of Mines and Geology; Edith Wilde, Montana Tech.
11	Geology and mineral resources of the Italian Peak Wilderness study area. [1982]	Betty A. Skipp USGS, Denver, Colorado
*12	Geology of the Dubois 2° quadrangle, Idaho and Montana. [1984]	Betty A. Skipp USGS, Denver, Colorado
13	Compilation of geologic map of the Bozeman 2° quadrangle. [November 1982]	Don Smith Montana State University
14	Geology of the Butte 2° quadrangle. [1982]	Chester A. Wallace USGS, Denver, Colorado

Areal geology (*continued*)

15 Correlation of a total field (proton precession) ground magnetic survey with detailed geologic mapping in order to develop a computer model for the geometry of the quartz monzonite Garnet stock. [June 1982]
Kurtis Wilkie
Iowa State University

Structural Geology/Tectonics

16 Investigation of the Bitterroot Valley in western Montana for evidence of recent tectonic activity. Methods include Landsat image and high altitude photo studies, land form analyses, and seismicity studies. [June 1982]
Peter E. Barkmann
University of Montana

17 Tectonic study of the Wolf Creek area utilizing Landsat photography. [June 1983]
Marcus Borengasser, University of Missouri, Columbia

*18 Determination of the age of the McCarthy Mountain structural salient; will include palynological and paleomagnetic sampling at key sites along exposed thrust traces near the Big Hole River. [July 1982]
David S. Brumbaugh
Northern Arizona University

19 A petrologic study of a mylonite zone that lies at the contact between high-grade gneisses and fine-grained schists at Sixmile Creek and Yankee Jim Canyon, Park County. [June 1982]
Robert L. Burnham
University of Montana

20 Stratigraphy, sedimentation and tectonic history of the Kishenehn and South Fork basins, northeastern Flathead County.
Kurt Constenius
Amoco Production Co.
Denver, Colorado

*21 The effects of preexisting structure on thrusting in the Bannack-Grayling area. [December 1982]
Jeffrey J. Coryell
Texas A and M University

22 Structural study of the southeast border zone, Bitterroot lobe, Idaho batholith, concentrating between Hamilton and Nez Perce Pass. [June 1983]
Lawrence Garmezy, Pennsylvania State University

*23 Structural relationships between the foreland province and the thrust and fold belt, southern Beaverhead County. [March 1982]
Phil M. Hammons
Texas A and M University

24 Structural geology and Precambrian stratigraphy of the Lemhi Pass region. [October 1982]
Peter M. Hansen, Pennsylvania State University

*25 Structural analysis of Missoula Group and mid-Cambrian units exposed along the eastern flank of the Anaconda-Pintlar Range. [October 1982]
Bruce Heise
University of Montana

26 Petrologic, geochemical and tectonic study of a section through the Bitterroot lobe (northern lobe) of the Idaho batholith. [Continuing]
Donald W. Hyndman
University of Montana

Structural geology/tectonics (*continued*)

	Neotectonic study of southern Montana east of 112°30′ longitude. [1982]	Willis Johns, Robert Bergantino, Montana Bureau of Mines and Geology
*27	Archean basement nappe tectonics in the Ruby Range, southwestern Montana; Precambrian structural history of the Ruby Range. [1983]	Lawrence Karasevich, Exxon Co., USA, P.O. Box 4279, Houston, TX 77001; John M. Garihan, Furman University
28	Mapping the radial dike pattern around the Big Timber intrusive complex and using that pattern to calculate paleo-stresses (both regional and local) at time of intrusion. [See Isotope Geology and Geochronology section for another aspect of the Crazy Mountains basin project.]	David R. Lageson Montana State University
29	Geology along the Beartooth highway, Gardiner Lake to Cooke City; a continuous strip map of Archean rocks and structures. [1983-1984]	Leonard H. Larsen University of Cincinnati
30	Geology and petrology of the Hell Roaring Lakes area, Beartooth Mountains. Large-scale mapping of Archean metasedimentary rocks; petrology, chemistry and structural analysis of polymetamorphic high-grade terrane. [1981-1982]	Leonard H. Larsen, University of Cincinnati; Lawrence C. Rowan, USGS, Reston, Virginia
	Geophysical and geological analysis of the Precambrian basement of Montana to determine its influence on Phanerozoic tectonics and Laramide magmatism. [May 1983]	David M. L'Heureux Purdue University
31	Study of the Cretaceous-Tertiary uplift history of the Sweetgrass arch which is interpreted to be a consequence of overthrust loading on an elastically rigid lithosphere.	John Lorenz, Division 4753 Sandia Laboratories Albuquerque, N.M. 87185
*32	Investigation of the history of activity of the Madison Range fault along its 1959 rupture, Madison County. [December 1982]	Elizabeth L. Mathieson Stanford University
33	Continuing research on the extent and characteristics of glacial phenomena and Quaternary tectonic features of the Yellowstone Valley south of Livingston, and the Madison Valley north of Raynolds Pass. [1984]	John Montagne Montana State University
*34	The deformation and transport direction of an allocthonous thrust sheet (associated with the Sapphire thrust plate) located in the southern Flint Creek Range of Montana. [September 1983]	Jeff Mow University of Michigan

Structural geology/tectonics (*continued*)

35	Geomorphic analysis of the Deep Creek fault trace in the upper Yellowstone Valley, Park County, with emphasis on examination of recent fault scarps. [August 1982]	Stephen F. Personius Montana State University
*36	Structural analysis of the Little Water syncline, Beaverhead County. [May 1983]	James Daniel Ponton Texas A and M University
37	Tectonics and recent seismicity near Flathead Lake, Montana. [1982]	Anthony Qamar University of Montana
	Study of thermal properties of rocks in Montana and of the relationship between fault displacement and formation of breccia and gouge. [1982]	Eugene C. Robertson USGS, Reston, Virginia
*38	Foreland deformation in Ruby, Highland, Tobacco Root, Madison and Gallatin ranges; ancestry of basement faulting; involvement of Archean in Laramide thrusting. [1983]	Christopher J. Schmidt, Western Michigan University; John M. Garihan, Furman University
*39	Structure of the Medicine Lodge thrust sheet, Beaverhead County.	Robert Scholten, Pennsylvania State University
*40	Geology and structure of the Horse Prairie basin and surrounding mountains, Beaverhead County.	Robert Scholten, Pennsylvania State University
*41	Study of Cenozoic tectonic patterns north of the Snake River Plain. [1982]	Betty A. Skipp USGS, Denver, Colorado
	Tectonic evolution of southwestern Montana, especially as reflected in the sedimentary record. [Continuing]	W. Thomas Straw, Western Michigan University
42	Structure and stratigraphy of the Smith-Weasel Creek area, Lewis and Clark County.	Page C. Twiss, David Zoe, Kurt Reinecke, Kansas State University
43	Cataclastic deformation associated with major thrust faults in western Montana. [July 1982]	Ann M. Vasko Montana State University
44	A study of Laramide and Recent tectonic activity along the Gardiner fault, northwest of Gardiner. [Spring 1982]	M. Arthur Williams Western Michigan University
*45	Structure and stratigraphy of the east-central Tendoy Range, Beaverhead County. [May 1983]	Nancy S. Williams, University of North Carolina, Chapel Hill
*46	Laramide and Late Cenozoic structural history and mechanics of basement faulting in the Jack Creek basin area, northern Madison Range. [Spring 1982]	Susan L. Wygant Western Michigan University
*47	Tectonic framework of the Pioneer Mountains. [1983]	E-an Zen USGS, Reston, Virginia

Stratigraphy, Sedimentary Petrology and Paleontology

	Stratigraphy and sedimentation of the Revett Formation (Belt Supergroup) in western Montana and northern Idaho.	David G. Alleman University of Montana
	Correlation of unusually thick Miocene deposits in Jackson Hole, Wyoming, with isolated exposures in west-central Montana. [1983]	Anthony D. Barnosky University of Washington
48	Stratigraphy and sedimentology of the transition between the Judith River and Bearpaw formations on the Fort Belknap Indian Reservation, north-central Montana. [July 1982]	Roger E. Braun Montana State University
	Chronostratigraphy of mid-Cretaceous hydrocarbon source rocks, western interior. [1984]	William A. Cobban USGS, Denver, Colorado
	[See Structural Geology/Tectonics.]	Kurt Constenius
*49	Review of carbonate-bearing intervals associated with the Precambrian Y LaHood clastic wedge along the south margin of the Belt basin, from the Highland Mountains to the Bridger Range. [June 1983]	Walt Coppinger Trinity University
	Sedimentology of the Kootenai Formation, southwestern Montana. [May 1983]	Peter G. DeCelles Indiana University
	Tertiary geology and uranium occurrences of the Powder River basin. [1983]	Norman Denson USGS, Denver, Colorado
	Study of western interior Cretaceous uranium basins. Includes work on the Cloverly, Eagle and Fox Hills formations. [1984]	Harry W. Dodge, Jr. USGS, Denver, Colorado
50	Plant remains, detailed stratigraphy and sedimentology of the Middle Eocene Sepulcher Formation in northwestern Yellowstone National Park and vicinity (Gallatin petrified forests) are being studied to provide a better paleoenvironmental reconstruction. [1982?]	Lanny H. Fisk Michigan State University
	Environments of coal deposition in the U.S. western interior coal basins. [1982]	Romeo M. Flores USGS, Denver, Colorado
51	Facies relationships and provenance of the Swift Formation (Jurassic), southwestern Montana. [January 1982]	Norman A. Fox Montana State University
	Study of Mississippian continental margins of the conterminous United States. [Results in press; SEPM Special Publication.]	Raymond C. Gutschick, University of Notre Dame, and Charles A. Sandberg USGS, Denver, Colorado

Statigraphy, sedimentary petrology and paleontology (*continued*)

*52	Sedimentary processes and tectonic implications of the Beaverhead Formation (Upper Cretaceous-Paleocene). Work will be concentrated in the vicinity of Red Conglomerate Peaks and Antone Peak. [September 1983]	J. Christopher Haley Johns Hopkins University
53	Regional stratigraphy of the Upper Jurassic and Lower Cretaceous in southern Alberta and north-central Montana. [April 1982]	Brad J. Hayes University of Alberta
	Disseminated sulfides, diagenesis and sedimentary facies within the Revett Formation of northeastern Idaho and northwestern Montana. [June 1982]	Stephen D. Herndon University of Montana
54	Paleocene floras and stratigraphy of the northern Big Horn basin of Montana and Wyoming. [1985]	Leo J. Hickey, Division of Paleobotany, Smithsonian Institution, Washington, D.C. 20560; and Erling Dorf, Princeton University
55	Floral change across the Cretaceous/Tertiary boundary in the Hell Creek and Tullock formations of McCone and Garfield counties.	Leo J. Hickey, Division of Paleobotany, Smithsonian Institution, Washington, D.C. 20560; William E. Clemens and Edwin Stanley
56	Geochronology and stratigraphy of the Cretaceous-Tertiary boundary sediments of the Hell Creek-Fort Union transition sediments in the Hell Creek area.	J. F. Lerbekmo University of Alberta
	Study of petroleum source rock characteristics and depositional setting of Upper Mississippian and Lower Pennsylvanian beds in Utah, Idaho, Wyoming and Montana. [1985]	Edwin K. Maughan USGS, Denver, Colorado
57	Fossil plants of the Early Cretaceous Kootenai Formation near Great Falls. Includes analysis of the structure and affinities of the individual plant species and their paleoecological relationships.	Charles N. Miller, Jr. and Constantine A. LaPasha, Department of Botany, University of Montana
*58	Petrology of the Bozeman Group, Madison County [Summer 1983]	Stewart Monroe Central Michigan University
	Biostratigraphy and depositional environments of Tertiary nonmarine basins, Rocky Mountain foreland. Includes work in the Powder River basin. [1984]	Douglas J. Nichols USGS, Denver, Colorado
	Study of metalliferous and petroliferous kerogen-rich marine Paleozoic shales in the Great Basin and Rocky Mountains. Includes work in Montana. [1985]	Forrest G. Poole USGS, Denver, Colorado

Stratigraphy, sedimentary petrology and paleontology (*continued*)

	Depositional history and petroleum geology of the Minnelusa Formation. [1985]	R. T. Ryder USGS, Denver, Colorado
	Stratigraphic framework and facies analysis of the Mississippian system, western North America. [1984]	William J. Sando, USGS and U.S. National Museum, Washington, D.C.
59	Sedimentology and stratigraphy of the lower Belt in the Helena embayment (includes the Neihart Quartzite, Chamberlain Shale and Newland Formation) [1983-1984]	Juergen Schieber University of Orgeon
	Stratigraphic analysis and modeling of Tertiary basins of western Montana. [1985]	Gary B. Schneider USGS, Denver, Colorado
60	Origin of petrified wood associated with coal in southeastern Montana. [Spring 1983]	Mark Sholes, Montana Bureau of Mines and Geology
61	Coal resources and sedimentologic controls on coal distribution in the Ashland area, southeastern Montana. [April 1982]	Mark Sholes Montana Bureau of Mines and Geology
*62	Mineral resources of the Madison-Gallatin Wilderness. Includes stratigraphic and sedimentologic studies of Upper Cretaceous section. [1983]	Frank S. Simons USGS, Denver, Colorado
	Depositional environment of the Mount Shields Formation (Missoula Group), western Montana. [June 1982]	Susan M. Slover University of Montana
	Study of Madison Group stratigraphy and sedimentology in central and south-central Montana. [Continuing]	Don Smith Montana State University
63	Stratigraphy and sedimentary petrology of the Madison Group, Beartooth Mountains, Montana. [June 1984]	Don Smith Montana State University
64	Sedimentologic, paleontologic, and stratigraphic investigation of the Big Snowy Group, Bridger Range and adjacent areas. [June 1984]	Don Smith Montana State University
	Tectonic influences on Cretaceous sediment-dispersal patterns in southwestern Montana. [1982]	Lee J. Suttner and Peter DeCelles, Indiana University—Bloomington
65	Stratigraphy, sedimentation, geochemistry and clay mineralogy of sediments in Flathead Lake. [Summer 1982]	Gray Thompson University of Montana
	Clay mineralogy, vertebrate paleontology, stratigraphy, sedimentation, paleoclimatology and uranium deposits in Tertiary basins of western Montana. [Summer 1982]	Gray Thompson University of Montana

Statigraphy, sedimentary petrology and paleontology (*continued*)

	[See Structural Geology/Tectonics.]	Page C. Twiss, David Zoe and Kurt Reinecke
	Biostratigraphy and organic metamorphism, Upper Paleozoic and Triassic rocks, overthrust belt, western United States. [1984]	Bruce R. Wardlaw USGS, Denver, Colorado
	Mississippian crinoids of central and western Montana. [Continuing]	G. D. Webster Washington State University
66	Sedimentology of the Altyn Formation (Precambrian) of Glacier National Park. Emphasis is on shallowing-upward cycles, stromatolites, microbiotas and evaporitic carbonates. (Summer 1982]	Brian White Smith College
67	Stratigraphy and petrography of the Fox Hills Formation in the Baker and Wibaux 1:100,000 quadrangles, eastern Montana. [December 1982]	Edith Wilde Montana Tech
	Carbonate geology and petrology of the Madison Group (relating outcrops in Little Belt and Big Snowy mountains to subsurface oil fields in eastern Montana.	James Lee Wilson University of Michigan-Ann Arbor
	Stratigraphy, and sedimentology of the Ravalli, middle Belt carbonate, Missoula Group rocks, northwestern Montana.	Don Winston University of Montana

Geochemistry, Mineralogy and Petrology

68	Geology and resources of thorium. Includes work on the Rainy Creek complex and the alkaline complex east of Hamilton. [1985]	Theodore J. Armbrustmacher USGS, Denver, Colorado
*69	Geochemical exploration of Dillon 2° quadrangle (CUSMAP). Includes studies of plutons in the Anaconda Range and the relationship between the petrogenesis of batholithic rocks and mineral deposits. [1982]	Byron R. Berger USGS, Denver, Colorado
*70	Geochemical study of the mass transfer associated with the formation of talc deposits. [September 1984]	John B. Brady Smith College
	Geochemistry and economic geology of hydrothermal vein carbonate—fluorspar deposits, western Montana. [Continuing]	D. G. Brookins University of New Mexico
	[See Structural Geology/Tectonics.]	Robert L. Burnham

Geochemistry, mineralogy and petrology (*continued*)

71	Geochemical and petrologic analysis of xenoliths from the Late Cretaceous Lodgepole intrusive (near Nye, Montana), including Stillwater Complex cumulate-textured, Paleozoic sedimentary and Precambrian metasedimentary xenoliths. Comparisons will be made between the Stillwater-type xenoliths and the exposed Stillwater Complex outcrop five miles to the south. [May 1983]	R. A. Borzdowski and G. C. Ulmer, Temple University; D. P. Gold, Pennsylvania State University
72	Geology, petrography, and petrogenesis of volcanic rocks in the Union Peak-Mt. Baldy area, central Garnet Range. [May 1982]	Bruce A. Carter University of Montana
73	Volcanic and related intrusive rocks of the Gallatin Range. [Continuing]	Robert A. Chadwick Montana State University
74	Evolution of the volcanic field in the Yellowstone Plateau-Island Park area of Wyoming, Idaho and Montana. [1985]	Robert L. Christiansen USGS, Menlo Park, California
	Study of clinker produced by burning of coal beds in Montana and Wyoming; will include radiometric dating.	Donald A. Coates USGS, Denver, Colorado
*75	Petrology of "Laramide" plutons in the North Doherty igneous complex.	William S. Cordua University of Wisconsin—River Falls
*76	Petrology of pre-Beltian rocks in the Tobacco Root Mountains and their relationships to pre-Beltian rocks in the Gravelly and other adjacent ranges.	William S. Cordua University of Wisconsin—River Falls
77	Sulfide mineralogy of the Stillwater Complex. [1982]	Gerald K. Czamanski USGS, Menlo Park, California
78	Petrology and geochemistry of the Great Falls coal field, Cascade and Judith Basin counties.	John Daniel and Jane Mathews, Montana Bureau of Mines and Geology
79	Vitrinite reflectance of oil shale in the Heath Formation, Fergus County.	John Daniel, Montana Bureau of Mines and Geology
80	Petrography of Mammoth coal seam, Bull Mountain basin, Musselshell County.	John Daniel, Montana Bureau of Mines and Geology; Gary Cole, Sohio
	Investigation of the anion geochemistry of the Rosebud coal seam. [June 1982]	Frank Diebold and Margaret Ikeda, Montana Tech
	Investigation of the minor metal geochemistry of the Rosebud coal seam. [September 1982]	Frank Diebold, Douglas Drew and Tim Snelling, Montana Tech

Geochemistry, mineralogy and petrology (*continued*)

*81	Chemical modeling of The Anaconda Company Butte operations waste-water treatment system and effluent and natural drainage system. [April 1982]	Frank Diebold, Montana Tech; Dennis Jenke, Montana State University
	Evaluation of flyash as a tailings-pond amendment to neutralize sulfide tailings, fix metals and reduce seepage losses. [December 1981]	Joseph J. Donovan, John L. Sonderegger, Montana Bureau of Mines and Geology
82	Reconnaissance study of orbicular granites in the Beartooth Mountains. [1983]	George W. Fisher Johns Hopkins University
83	Geochemical constraints on the origin of Proterozoic anorthosites, western United States (includes Bitterroot anorthosite, Montana). [1982]	Steven A. Goldberg University of Oregon
84	Geology of the Slough Creek Tuff and the Ash Mountain area, Park County. [Continuing]	James T. Gutmann Wesleyan University
*85	Structural relations of metabasites in the northwest and southern Tobacco Root Mountains, Madison County. [1982]	Thomas B. Hanley Columbus College
*86	Mineral chemistry of some garnet pyribolite metabasites from the Tobacco Root Mountains, Madison County. [1983?]	Thomas B. Hanley, Columbus College; Peter Dahl, Kent State University
	Continuing study of kimberlitic rocks in Montana	B. Carter Hearn USGS, Reston, Virginia
87	Study of variations in the bulk composition within the basal norite of the Stillwater Complex. [1983]	Rosalind T. Helz USGS, Reston, Virginia
	[See Stratigraphy, Sedimentary Petrology and Paleontology.]	Stephen D. Herndon
	Geochemistry of clinker produced by the burning of coal beds. Includes dating clinker by the fission-track method. [1984]	James R. Herring USGS, Denver, Colorado
*88	Study of the mineralogy of amphibolites and metamorphic facies of rocks in the Tobacco Root Mountains and adjoining areas. Also microprobe analyses of pyroxene-garnet pairs and areal synthesis of facies in the region. [1982 or 1983]	David F. Hess Western Illinois University
	[See Structural Geology/Tectonics.]	Donald W. Hyndman
89	Nutrient budget in sediments of Flathead Lake, Montana.	Jaswant Singh Jiwan University of Montana
90	Field relations, petrology and mineralization of the Linster Peak dome, Fergus County. This study examines the calc-alkaline and alkaline magmatic activity in the eastern Judith Mountains. [June 1982]	Gail Kirchner University of Montana

Geochemistry, mineralogy and petrology (*continued*)

91	Geology, petrology and geochemistry of the Elkhorn Peak area—A contribution to the discussion of the nature of the Boulder batholith. [March 1983]	Eirik J. Krogstad Western Washington University
92	Magma immiscibility of shonkinite-syenite system in the Box Elder laccolith, Bearpaw Mountains, north-central Montana.	Paul W. Kuhn University of Montana
93	Petrologic, geochemical, and isotopic studies of the Stillwater Complex. In particular, detailed geochemical studies of the PGE-enriched J-M Reef are being used to set better limits on the formation of PGE mineral deposits in mafic layered intrusions. Examination of trace-element data from the ultramafic zone of the complex has provided a better understanding of the processes producing cumulate rocks. [August 1982]	David D. Lambert and E. C. Simmons, Colorado School of Mines
94	Continued geologic mapping of igneous bodies of Crazy Mountains; Coffin Butte and Little Elk dome in the northern part are targeted. [1982-1983]	Leonard H. Larsen University of Cincinnati
*95	Mapping, geochemical sampling and fission track age-dating of numerous Tertiary volcanic deposits in Sage and Blacktail creeks, Beaverhead and Madison counties. [June 1983]	Kim L. Marcus Western Washington University
	Relationship between geothermometers and reservoir and spring temperatures for hydrothermal systems in Montana. [1982]	Manuel Nathenson USGS, Menlo Park, California
96	Leopard rock protolith of ellipsoidal amphibolite, North Snowy block, Beartooth Mountains, Montana. [1982]	John C. Palmquist Lawrence University
97	Petrology of three hypabyssal alkalic bodies of Eocene age located on the Fort Belknap Indian Reservation. [April 1982]	Robert P. Pfouts University of Montana
*98	Mapping, petrology and geochemistry of volcanic rocks in the Gravelly Range, Madison County. [Continuing]	Paul Pushkar, Wright State University; Jim Gutmann, Wesleyan University
99	Study includes detailed modal and chemical variations of silicate minerals in select stratigraphic sections through the Stillwater Complex. The ultimate goal is to determine the petrogenesis of the intrusion or at least the major processes involved in its crystallization history. [Continuing]	L. D. Raedeke and I. S. McCallum University of Washington
100	Geology and petrogenesis of the Archean rocks in the Little Rocky Mountains. [June 1982]	Judy Reese University of Montana

Geochemistry, mineralogy and petrology (*continued*)

101	Petrographic and economic evaluation of a syenite porphyry on the Fort Belknap Indian Reservation, Little Rocky Mountains. [June 1982]	Janet S. Roemmel University of Montana
	Geochemistry of the Tippicanoe sequence of the western craton. [1982]	Leonard G. Schultz USGS, Denver, Colorado
102	Sr isotope systematics, major elements and trace-element chemistry of granitic rocks, inclusions and country rocks from the northeast border zone of the Idaho batholith. [Spring 1982]	Robert D. Shuster University of Kansas
	Compilation of information on Late Cenozoic volcanic centers will include a map of west-central Montana. [1982]	Robert L. Smith USGS, Reston, Virginia
	Isolation and structural determination of organo-metal complexes in plants and their relationship to soil geochemistry.	Donald Stierle Montana Tech
	[See Stratigraphy, Sedimentary Petrology and Paleontology.]	Gray Thompson
*103	The origin and evolution of the Tobacco Root batholith, a zoned granitic pluton in Madison County.	Charles J. Vitaliano Indiana University—Bloomington
	Study of ultramafic inclusions in basalts will include a study of feldspathic peridotite-gabbro xenoliths in Montana. [1983]	Howard G. Wilshire USGS, Menlo Park, California
104	The mineralogy of the Black Pine mine, Granite County. [August 1982]	Lester G. Zeihen Montana Tech

Isotope Geology and Geochronology

*105	Geochronologic studies include work on rocks from the Pioneer Mountains. [1985]	Joseph G. Arth USGS, Reston, Virginia
	[See Structural Geology/Tectonics.]	David S. Brumbaugh
	[See Geochemistry, Mineralogy and Petrology.]	Donald A. Coates
106	Studies include the installation of equipment at Yellowstone National Park to monitor helium concentrations in fumaroles. [1985]	Irving Friedman USGS, Denver, Colorado
	[See Structural Geology.]	Lawrence Garmezy, Pennsylvania State University
	[See Geochemistry, Mineralogy and Petrology.]	James R. Herring

Isotope geology and geochronology (*continued*)

107	Radiometric dating of deformed dikes around the Big Timber intrusive complex to determine times of thrusting in the central Montana salient of the fold and thrust belt. [See Structural Geology/Tectonics section for another aspect of the Crazy Mountains basin project.]	David R. Lageson Montana State University
	[See Stratigraphy, Sedimentary Petrology and Paleontology.]	J. F. Lerbekmo
	[See Geochemistry, Mineralogy and Petrology.]	Kim L. Marcus
	Existing data in Radiometric Age Data Bank for Montana will be revised and updated.	Richard F. Marvin USGS, Denver, Colorado
	Chemical and isotopic evidence of the origins of natural gases. [1985]	Dudley D. Rice USGS, Denver, Colorado
108	Studies of stable isotopes include work on sulfur isotopes and recharge systems in the geothermal areas of Yellowstone National Park. [1985]	Robert O. Rye USGS, Denver, Colorado
	[See Geochemistry, Mineralogy and Petrology.]	Robert D. Shuster University of Kansas

Geophysics

	[See Structural Geology/Tectonics.]	Peter E. Barkmann
109	Gravity study of the Kishenehn basin, northeastern Flathead County.	Kurt Constenius, Amoco Production Co., Denver, Colorado
	Proterozoic and Phanerozoic paleomagnetic studies include work in the overthrust terrane of the Belt basin. [1985]	Donald P. Elston USGS, Flagstaff, Arizona
110	Geophysical studies of the Butte 2° quadrangle (CUSMAP). Will include gravity and magnetic surveys. [1983]	William F. Hanna USGS, Reston, Virginia
111	Development of a model of crustal structure in the region roughly defined by the Cut Bank, Kalispell and Sandpoint quadrangles, northwestern Montana and northern Idaho. [June 1982]	David William Harris University of Montana
112	Electrical studies include work in the Mt. Henry-Ten Lakes Wilderness area. [1985]	Donald B. Hoover USGS, Denver, Colorado
*113	Geophysical studies of the Dillon 2° quadrangle (CUSMAP). Will include complete gravity coverage of this quadrangle. [1983]	Harold E. Kaufmann USGS, Denver, Colorado
	Aeromagnetic and gravity surveys in conjunction with evaluation of the mineral resources of wilderness areas and CUSMAP work. [1984]	M. Dean Kleinkopf USGS, Denver, Colorado

Geophysics (*continued*)

	Geophysical studies of the overthrust belt, northern Rocky Mountains. [1985]	M. Dean Kleinkopf USGS, Denver, Colorado
114	Gravity surveys in Glacier National Park and adjoining areas. [1985]	D. M. Kulik USGS
	Contemporary tectonics and seismicity of southwestern Montana. [Continuing]	David R. Lageson, Montana State University; Michael Stickney, Montana Bureau of Mines and Geology
	[See Structural Geology/Tectonics.]	David M. L'Heureux
	[See Structural Geology/Tectonics.]	Elizabeth L. Mathieson
115	Study of long-term (1965-1968 and 1973-1980) seismicity patterns in Yellowstone National Park. [1982]	Andrew M. Pitt USGS, Menlo Park, California
	[See Structural Geology/Tectonics.]	Anthony Qamar
116	Seismic stratigraphy of recent sediments in Flathead Lake. [1982]	Anthony Qamar University of Montana
	Historical seismicity and earthquake hazards in Montana. [1982]	Anthony Qamar, University of Montana; Michael Stickney, Montana Bureau of Mines and Geology
	[See Structural Geology/Tectonics.]	Eugene C. Robertson
117	Remote sensing studies in the Wallace, Butte and Dillon 1° quadrangles (CUSMAP). [1982]	Lawrence C. Rowan USGS, Reston, Virginia
	Crustal strain studies include resurveying of geodolite network near Hebgen Lake, Montana. [1985]	James C. Savage USGS, Menlo Park, California
	Determination of epicenters and magnitudes for western Montana earthquakes. [Continuing]	Michael Stickney, Montana Bureau of Mines and Geology
	[See Areal Geology.]	Kurtis Wilkie

Economic Geology

118	Geochemical exploration in the Butte 2° quadrangle (CUSMAP). [1982]	John C. Antweiler USGS, Denver, Colorado
	Geology of barite deposits in Montana. [1984]	Richard B. Berg, Montana Bureau of Mines and Geology
	[See Geochemistry, Mineralogy and Petrology.]	Byron R. Berger
	[See Geochemistry, Mineralogy and Petrology.]	John B. Brady
	[See Geochemistry, Mineralogy and Petrology.]	D. G. Brookins
	Studies in remote sensing applied to mineral exploration. Includes Montana sites. [Continuing]	Frank C. Canney USGS, Denver, Colorado

Economic geology (*continued*)

*119 Geology and ore deposits of selected mines in the Virginia City district. [December 1982]	Marshall Cole Montana State University
Determination of the regional geochemical differences that may be related to the deposition, redistribution or concentration of ore metals in the Spokane Formation. [1982]	Jon J. Connor USGS, Denver, Colorado
*120 A study of the mechanisms and rates involved in the surficial weathering of a protore assemblage in the Butte district.	Aric B. Cunningham, University of California, Berkeley
[See Geochemistry, Mineralogy and Petrology.]	Gerald K. Czamanski
121 Geostatistical analysis of the internal structure and spatial distribution of ore deposits in early magmatic environments. Study will be on the Stillwater Complex. [1982]	Lawrence J. Drew USGS, Reston, Virginia
122 Mineral resources of the Anaconda-Pintlar Wilderness. [1983]	James E. Elliott USGS, Denver, Colorado
123 Mineral resources of the Butte 2° quadrangle (CUSMAP). [1983]	James E. Elliott USGS, Denver, Colorado
Titanium resources of the United States. Includes work on the titanium in porphyry metal deposits of the western U.S. [1985]	Eric R. Force USGS, Reston, Virginia
Study of selected talc deposits in southwestern Montana.	Steve Groening Montana Tech
[See Stratigraphy, Sedimentary Petrology and Paleontology.]	Stephen D. Herndon
*124 Mineralogy, alteration and ore genesis of veins surrounding the Cable stock west of Anaconda, Deer Lodge County. Includes the Pyrenees, Southern Cross, Cable and Gold Coin mines. [May 1982]	Margaret A. Holmes Montana Tech
[See Areal Geology.]	Harold L. James
*125 Geochemical soil sampling of area from Butte to Rochester district including west flank of the Highland Mountains. [1982]	Willis Johns Montana Bureau of Mines and Geology
126 Geologic reconnaissance and soil sampling, Chief Cliff district, Lake County. [1982]	Willis Johns, Montana Bureau of Mines and Geology
*127 Geology and ore deposits of the Red Pine mine and vicinity, Sheridan mining district, Madison County. [June 1983]	Teresa M. Kinley Montana State University
[See Geochemistry, Mineralogy and Petrology.]	Gail Kirchner

Economic geology (*continued*)

128 Geology of chromium. Includes study of small bodies of chromite-rich ultramafic rocks northwest and southeast of the Stillwater Complex. [1985]	Bruce R. Lipin USGS, Reston, Virginia
129 Metallic mineral deposits, Lewis and Clark County. [1982]	Henry McClernan, Montana Bureau of Mines and Geology
*130 Metallogenic map of the Dillon 2° quadrangle. [1982]	Henry McClernan, Montana Bureau of Mines and Geology
*131 Geochemical exploration, Tobacco Root Mountains. [1983]	Henry McClernan, Montana Bureau of Mines and Geology
*132 Geochemical exploration, Rochester district, Highland Mountains. [1983]	Henry McClernan and Don C. Lawson, Montana Bureau of Mines and Geology
133 Investigation of occurrences of platinum-group metals in stratiform basic and ultramafic rocks. Includes work in the Stillwater Complex of Montana. [1985]	Norman J. Page USGS, Menlo Park, California
*134 Study of mineral deposits in the Dillon 2° quadrangle includes fluid inclusion studies of core from Cannivan Gulch and work on the German Gulch, Whitehall and Blue Wing mining districts. [1984]	Robert C. Pearson USGS, Denver, Colorado
[See Stratigraphy, Sedimentary Petrology and Paleontology.]	Forrest G. Poole
*135 Description of main stage and pre-main stage structural patterns, alteration zoning and metal zoning of the Butte deposit. Interpretation of zoning in relation to chemistry of metal transport and hydrothermal metasomatism. [1984]	Mark Reed University of Oregon
[See Geochemistry, Mineralogy and Petrology.]	Janet S. Roemmel
[See Geophysics.]	Lawrence C. Rowan
An assessment of uranium mineralization potential in west-central Montana. [Fall 1983]	Arnold Silverman University of Montana
[See Stratigraphy, Sedimentary Petrology and Paleontology.]	Frank S. Simons
[See Areal Geology.]	Betty A. Skipp
136 Mineral resources of the Mt. Henry Wilderness. [1983]	R. E. Van Loenen USGS
137 Mineral resources of the Ten Lakes Wilderness. [1983]	James W. Whipple, USGS Spokane, Washington

Economic geology (*continued*)

*138	Ore deposits, Virginia City area, southwestern Montana.	Kenneth L. Wier USGS
	[See Geochemistry, Mineralogy and Petrology.]	Lester G. Zeihen Montana Tech

Energy

	[See Geochemistry, Mineralogy and Petrology.]	Theodore J. Armbrustmacher
139	Geology and geothermal resources of the Jackson Hot Springs area, Big Hole Valley. [June 1982]	Geoffrey A. Black Montana State University
	Anomalous vitrinite reflectance in outcrops over known oil fields in Montana, Wyoming and Oklahoma will be evaluated as a tool for exploration. [1985]	Neely H. Bostick USGS, Denver, Colorado
140	Geology and coal resources of the Ismay-Plevna area, Fallon County, eastern Montana. (To be released as an open-file report.)	Ed Burks USGS, Billings, Montana
	Geochemistry of sedimentary organic matter, crude oil and natural gas. Will include a report on the hydrocarbon generation and oil and gas potential of the northern Montana disturbed belt. [Continuing]	Jerry L. Clayton USGS, Denver, Colorado
	[See Geochemistry, Mineralogy and Petrology.]	Donald A. Coates
141	Coal geology of the Bull Mountain coal field. [1982]	Carol W. Connor USGS, Denver, Colorado
142	Coal geology of the Birney 1° quadrangle. [1983]	William C. Culbertson USGS, Denver, Colorado
	[See Stratigraphy, Sedimentary Petrology and Paleontology.]	Harry W. Dodge, Jr.
143	Geological, geophysical and hydrogeological investigations at Bozeman Hot Springs. [October 1982]	Joseph J. Donovan and Michael Stickney, Montana Bureau of Mines and Geology
	Evaluation and development of biogeochemical prospecting techniques for petroleum utilizing plant macro species. Includes work in Montana. [1985]	Terrence J. Donovan USGS, Flagstaff, Arizona
	[See Geochemistry, Mineralogy and Petrology.]	John Daniel
	[See Geochemistry, Mineralogy and Petrology.]	Frank Diebold, Douglas Drew and Tim Snelling
	[See Geochemistry, Mineralogy and Petrology.]	Frank Diebold and Margaret Ikeda

Energy (*continued*)

	Investigation of the effect of ground-water chemistry upon the uptake of uranium by Great Basin big sagebrush and black greasewood. [July 1982]	Frank Diebold and Steve McGrath, Montana Tech
	[See Stratigraphy, Sedimentary Petrology and Paleontology.]	Romeo M. Flores
	Tertiary oil basins of the western United States. [1983]	Thomas D. Fouch USGS, Denver, Colorado
144	Coal resources of the Blackfoot Indian Reservation. [Continuing]	William J. Mapel USGS, Denver, Colorado
	NCRDS (National Coal Resources Data System). This is a program of the USGS with the cooperation of state agencies to establish a national computerized coal data base.	Jane Mathews Montana Bureau of Mines and Geology
	[See Stratigraphy, Sedimentary Petrology and Paleontology.]	Edwin K. Maughan
145	Coal geology of the Broadus 1° quadrangle. [1984]	Marguerite McLellan USGS, Denver, Colorado
	Gas-bearing strata of mid-Cretaceous age in western Wyoming and adjacent areas. [1985]	E. A. Merewether USGS, Denver, Colorado
	A computer program that locates epicenters of microseisms in burning coal mines will be applied to sites in the Powder River basin. [Continuing]	Carter H. Miller USGS, Denver, Colorado
146	Interpretation of the subsurface geology and evaluation of the hydrocarbon potential of the Blackfoot Indian Reservation. [1983]	Melville R. Mudge USGS, Denver, Colorado
	[See Geochemistry, Mineralogy and Petrology.]	Manuel Nathenson
147	Reservoir studies of the Madison Group, disturbed belt, Montana. [1985]	K. M. Nichols USGS, Denver, Colorado
	Oil and gas in overthrust terrains, Montana. [1984]	William J. Perry, Jr. USGS, Reston, Virginia
	Geologic appraisal of petroleum provinces. Includes work on the Williston and Powder River basins. [Continuing]	James A. Peterson USGS, Missoula, Montana
	[See Stratigraphy, Sedimentary Petrology and Paleontology.]	Forrest G. Poole
	Geology and oil and gas resource potential of the U.S. western overthrust belt. [1985]	Richard B. Powers USGS, Denver, Colorado
	Remote sensing for uranium exploration in the Powder River basin. [1985]	Gary L. Raines USGS, Denver, Colorado

Energy (*continued*)

	[See Isotope Geology and Geochronology.]	Dudley D. Rice USGS, Denver, Colorado
148	Characterization of natural-gas resources in low-permeability reservoirs of the northern Great Plains. (Includes work at the Bowdoin dome of Montana.) [1982]	Dudley D. Rice USGS, Denver, Colorado
149	Coal resources of the northeast part of the Crow Indian Reservation. [1982]	L. N. Robinson USGS
	Regional correlation of coal-bearing rocks in the Rocky Mountains. [Continuing]	Henry W. Roehler USGS, Denver, Colorado
	[See Stratigraphy, Sedimentary Petrology and Paleontology.]	R. T. Ryder
	A stratigraphic, tectonic and petroleum source-rock analysis of the Devonian and Mississippian of two related petroleum provinces—the developing overthrust belt and the related eastern Great Basin frontier province. [1985]	Charles A. Sandberg USGS, Denver, Colorado
	Resource assessment in EMRIA program. Provides geologic guidance and analysis of coal resource and coal quality assessments from samples provided by the drilling program of the Bureau of Land Management. [Continuing]	Gary B. Schneider USGS, Denver, Colorado
150	Petroleum reservoir rocks of the western United States. Will include field work in the Madison Group exposed in the disturbed belt. [1983]	Peter A. Scholle USGS, Denver, Colorado
	[See Stratigraphy, Sedimentary Petrology and Paleontology.]	Mark A. Sholes
	[See Areal Geology.]	Mark A. Sholes, Susan Vuke, Michael Stickney, Robert Bergantino, Edith Wilde
	Chemical analysis and geologic evaluation of coal from western interior coal basins of the United States. [1982]	F. O. Simon USGS
*151	Geothermal aquifer resource evaluation in the Deer Lodge and Madison valleys, and in the Bozeman Hot Springs area.	J. L. Sonderegger and J. J. Donovan, Montana Bureau of Mines and Geology
	[See Stratigraphy, Sedimentary Petrology and Paleontology.]	Gray Thompson
152	Study of oil shale in the Heath Formation of central Montana.	Susan Vuke, Montana Bureau of Mines and Geology

Hydrogeology

153	Ground-water resource map of the Forsyth, Jordan and Miles City 1° x 2° quadrangles (part of Montana Altas Project).	Robert N. Bergantino Montana Bureau of Mines and Geology
	Bibliography and index map of ground-water studies in Montana and adjacent areas.	Faith Daniel, Montana Bureau of Mines and Geology
154	Geochemical study of mine spoil hydrology in Decker and Big Sky mines. Predictive models to simulate solute transport are being developed. [September 1982]	Robert Davis USGS, Helena, Montana
	[See Energy.]	Frank Diebold and Steve McGrath
	[See Areal Geology.]	Joseph J. Donovan
155	Hydrogeology and preliminary reclamation design of acid mine drainage, Stockett-Sand Coulee coal field, Cascade County.	Joseph J. Donovan and John L. Sonderegger, Montana Bureau of Mines and Geology
156	Hydrologic baseline study of Stillwater Complex and adjacent areas. [September 1983]	Richard Feltis USGS, Billings, Montana
	Structure contour maps of Madison aquifer on 1° x 2° sheets. [September 1983]	Richard Feltis USGS, Billings, Montana
157	Analysis of water resources and water allocation in the Tongue River basin including the impact of energy development on water resources. [Continuing]	David H. Hickcox Ohio Wesleyan University
	Study of the effect of mine wastes on water resources of the upper Missouri River basin, Montana (Beaverhead and Madison and parts of Silver Bow and Deer Lodge counties). [1982]	Willis Johns and others Montana Bureau of Mines and Geology
158	Five-year base line water-quality study of Lake Creek, Lincoln County, downstream from the Troy Project silver-copper mill site. [1984]	Don C. Lawson, John L. Sonderegger, Montana Bureau of Mines and Geology
159	Stillwater Complex base line surface-water quality study in Stillwater and Sweet Grass counties.	Don C. Lawson, John L. Sonderegger, Montana Bureau of Mines and Geology
	Detailed hydrologic studies of selected high-priority coal lease tracts. Studies define ground-water systems, document water-quality conditions, and evaluate potential impacts of mining. [September 1985]	Neal McClymonds and Michael Cannon USGS, Helena, Montana
160	Reconnaissance hydrologic study of ground- and surface-water systems in the upper Big Hole basin. Will define ground-water availability, surface-water characteristics, and water-quality conditions. [September, 1983]	Julianne Levings USGS, Helena, Montana

Hydrogeology (*continued*)

	Statewide hydrogeological data system—collection, analysis, compilation, storage and retrieval. [Continuing]	Marvin R. Miller, Wayne A. Van Voast, Tom W. Patton, Robert N. Bergantino, Judeykay Schofield, Roger Noble, Fred A. Schmidt, Art Middelstadt, Montana Bureau of Mines and Geology
161	Ground-water monitoring near waste-water treatment facilities in Glacier National Park. [September 1985]	Joe A. Moreland USGS, Helena, Montana
	Occurrence and characteristics of ground water in the Great Plains region, Montana. [June 1982]	Roger A. Noble, Robert N. Bergantino, Tom Patton, Brenda C. Sholes and Faith Daniel, Montana Bureau of Mines and Geology
	Occurrence and characteristics of ground water in the Rocky Mountains region, Montana.	Roger A. Noble, Robert N. Bergantino, Tom Patton, Brenda C. Sholes and Faith Daniel, Montana Bureau of Mines and Geology
162	Evaluation of the ground water contribution to Muddy Creek from the Greenfield Bench irrigation district.	Roger A. Noble, Thomas J. Osborne, Fred A. Schmidt Montana Bureau of Mines and Geology
163	Availability of ground water for irrigation use in the Turner-Hogeland area.	Tom W. Patton, Fred A. Schmidt, Art Middelstadt, Montana Bureau of Mines and Geology
	Statewide basic-data collection program.	Fred A. Schmidt, Art Middelstadt, Montana Bureau of Mines and Geology
164	Ground-water monitoring (both water level and quality) in the Poplar River area.	Fred A. Schmidt, Art Middelstadt, Montana Bureau of Mines and Geology
	[See Energy.]	J. L. Sonderegger and Joseph J. Donovan
165	Shallow ground water related to potential coal mining in the Bull Mountain area, central Montana. [1982]	Keith S. Thompson, Wayne A. Van Voast, Montana Bureau of Mines and Geology, Billings
166	Mining-related hydrologic evaluations near the Big Sky mine, southeastern Montana. [Continuing]	Wayne A. Van Voast, Montana Bureau of Mines and Geology, Billings

Hydrogeology (*continued*)

Investigation of soluble salts in coal overburden and the qualities of ground waters in spoils. [1982]	Wayne A. Van Voast, Keith S. Thompson, Montana Bureau of Mines and Geology, Billings

Geomorphology and Glacial Geology

*167 Glacial geology of the Bear Gulch valley, Tobacco Root Mountains. [May 1983]	Robert D. Hall, Indiana University/Purdue University
Quaternary geologic map of the United States. [1983]	Robert D. Hall, Indiana University/Purdue University
*168 Glacial geology of the South Willow Creek valley, Tobacco Root Mountains. [May 1983]	Robert D. Hall, Robert Martin, Bonnie Moore, Guy Swinford, Indiana University/Purdue University
169 Geomorphic history of the northern Bighorn basin.	Marvin Kauffman, Franklin and Marshall College; Dale F. Ritter, Southern Illinois University
*170 Alpine to sub-alpine drainage-head geomorphic features in the Taylor-Hilgard Mountains; water purification and retardation as affected by moraines, avalanche tongues, rock glaciers, landslides and talus. [1984]	John Montagne Montana State University
171 Mapping and interpretation of pediment surfaces present between the Pryor Mountains and the Big Horn River north of the Montana-Wyoming border. [Spring or Summer 1982]	Gerald E. Nelson University of Kansas
[See Structural Geology/Tectonics.]	Stephen F. Personius

Environmental and Engineering Geology and Environmental Geochemistry

Weathering effects on the geotechnical properties of coal-bearing rocks. [1984]	Alan F. Chleborad USGS, Golden, Colorado
*172 A study of the Bear Creek-Johnson ranch landslide area, Deer Lodge County, Montana. (SW¼ sec. 25 and SE¼ sec. 26, T. 2 N., R. 12 W., about 8.3 miles northwest of Wise River). [1985?]	Willard E. Cox Montana Tech
173 Measurement of coarse bedload transport using the natural magnetism of cobbles as a tracer. The study is on Squaw Creek, Gallatin County. [June 1985]	Stephan G. Custer Montana State University

Environmental and engineering geology and environmental geochemistry (*continued*)

	[See Geochemistry, Mineralogy and Petrology.]	Frank Diebold and Dennis Jenke
	[See Hydrogeology.]	Joseph J. Donovan and John L. Sonderegger
	Availability of elements in soils from areas of strip mining in Utah, New Mexico and Montana. [1982]	Larry P. Gough USGS, Denver, Colorado
	Geochemical composition sources and transport of natural and polluted atmospheric dusts. [1983]	Todd K. Hinkley USGS, Denver, Colorado
	[See Geochemistry, Mineralogy and Petrology.]	Jaswant Singh Jiwan
174	Engineering geology of the Crow Agency and Lodge Grass 7½′ quadrangles. [1984]	Stephen P. Kanizay USGS, Denver, Colorado
175	Engineering geology of the Birney 1° quadrangle. [1984]	Robert M. Lindvall USGS, Denver, Colorado
	Study includes indentification of the elements that are released to both ground and surface water and examination of the availability of elements to plants from spoil-pile material and the changes in spoil-pile material through time. [1982]	James M. McNeal USGS, Denver, Colorado
*176	Quaternary dating and neotectonics. Includes obsidian hydration dating of pre-1959 faulting and ages of scarps in the Hebgen, Montana, earthquake area. [Continuing]	Kenneth L. Pierce USGS, Denver, Colorado
	[See Geophysics.]	Anthony Qamar and Michael Stickney

Back Pocket

Sheet 1—Index map of Montana.

Sheet 2—Index map of southwestern Montana.

Production Information

Camera-ready copy prepared on EditWriter 7500 by MBMG.

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