ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY OF THE
ROOSEVELT HOT SPRINGS KNOWN GEOTHERMAL RESOURCE AREA AND THE
ADJACENT MINERAL MOUNTAINS, MARCH 1978

D. Brooks McKinney

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MASTER

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EARTH SCIENCE LABORATORY
University of Utah Research Institute
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Division of Geothermal Energy

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INTRODUCTION.

This bibliography is a result of the need to present a unified account of the geologic and geothermal literature of the Roosevelt Hot Springs KGRA in Utah. References are compiled to March 31, 1978, and are complete to that date as far as is known.

Since ninety-nine references were found, it seemed worthwhile to append a brief annotation of the contents to provide researchers a starting point for further investigations in the Roosevelt area. Hopefully the annotations will limit the amount of necessary literature search to a minimum in a given type of research.

Additional studies by ESL in the Roosevelt area will assume this Bibliography to be inclusive and will list only pertinent publications and new material published after March 31, 1978.

ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY OF THE
ROOSEVELT HOT SPRINGS KNOWN GEOTHERMAL RESOURCE AREA AND THE
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D. Brooks McKinney

Armstrong, R. L., 1967, The Cordilleran miogeosyncline in Nevada and Utah: Utah Geol. Mineral Survey Bull. 78, 58 p.

A regional discussion of the EoCambrian through Triassic sediments of the Cordilleran miogeosyncline. Based on palinspastic restorations of the Cretaceous Sevier orogenic belt.

Armstrong, R. L., 1968, Sevier orogenic belt in Nevada and Utah: Geol. Soc. Amer. Bull., v. 79, p. 429-458.

A regional review and analysis of the Cretaceous Sevier thrust and fold belt which trends NE-SW through the Mineral Mountains.

Armstrong, R. L., 1970, Geochronology of Tertiary igneous rocks, eastern Basin and Range Province, western Utah, eastern Nevada, and vicinity, U.S.A.: Geochimica et Cosmochimica Acta, v. 34, p. 203-232.

A review and evaluation of dating techniques containing over 100 K/Ar dates on volcanic and intrusive rocks. Among these is a date of $9.2 \pm .3$ million years on biotite from the Mineral Mountains granite.

Ballantyne, J. M., and Parry, W. T., 1978, Hydrothermal alteration at the Roosevelt Hot Springs thermal area: petrographic characterization of the alteration to 2KM in depth: DOE/DGE Technical report 78-1701-a.1.1, contract EG-78-C-07-1701, 23 p.

A detailed study of the lithologies and alteration types in drill hole 14-2, a producing well within the Roosevelt KGRA.

Bamford, R. W., Bowman, J. R., Brown, F. H., Cook, K. L., Chapman, D. S., Hohmann, G. W., Nash, W. P., Parry, W. T., Ross, H. P., Sill, W. R., Smith, R. B., Ward, S. H., Whelan, J. A. and Wright, P. M., 1977. Geothermal Research, Roosevelt Hot Springs KGRA: DOE/DGE Quarterly Progress Report, August 1-October 31, 1977, contract EY-76-S-07-1601, 30 p.

A progress report on contractual obligations concerning DOE/DGE funded research. No geologic discussions.

Berge, C. W., Crosby, G. W., and Lenzer, R. C., 1975, Geothermal exploration of the Roosevelt K.G.R.A., Utah; in New concepts of exploration in the Rockies: Rocky Mtn. Section A. A. P. G. and S. E. P. M. 25th Ann. Mtg., Billings, Montana, no. 66, p. 52-53.

Bowman, J. R., Brown, F. H., Cook, K. L., Chapman, D. S., Nash, W. P., Parry, W. T., Sill, W. R., Smith, R. B., Ward, S. H., and Whelan, J. A., 1977, Geothermal Research, Roosevelt Hot Springs KGRA: Quarterly Progress Report, Feb. 1-April 30, 1977, ERDA contract EY-76-5-07-1601, 18 p.

A progress report on contractual obligations concerning ERDA funded research. No geologic discussions.

Bowman, J. R., Brown, F. H., Cook, K. L., Chapman, D. S., Nash, W. P., Parry, W. T., Sill, W. R., Smith, R. B., Ward, S. H., and Whelan, J. A., 1977, Geothermal Research, Roosevelt Hot Springs KGRA: Quarterly progress report May 1-July 31, 1977, ERDA contract EY-76-5-07-1601, 31 p.

A progress report on contractual obligations concerning ERDA funded research. No geologic discussions.

Brown, F. H., 1977, Attempt at paleomagnetic dating of opal, Roosevelt Hot Springs KGRA: ERDA Technical Report, v. 77-1, contract EY-76-S-07-1601, 13 p.

A paleomagnetic study of oriented core from the Roosevelt Hot Springs opal mound. The study suggests a maximum age of 350,000 years for silica deposition and a rate of deposition of 1-2m per 10000 years.

Brown, F. H., 1977, Obsidian hydration rinds: geothermal research, Roosevelt Hot Springs KGRA: Quarterly Progress Report to ERDA, contract EY-76-S-07-1601, 11 p.

Brumbaugh, W. D., and Cook, K. L., 1977, Gravity survey of the Cove Fort-Sulphurdale KGRA and the North Mineral Mountains area, Millard and Beaver Counties, Utah: ERDA Technical Report, 77-4, contract EY-76-S-07-1601, 131 p.

This study surveyed the northern end of the Mineral Mountains from approximately 38°31' latitude northward, and did not include the Roosevelt KGRA. In the northern Mineral Mountains the study identified Basin and Range faulting, and suggested the presence of thrust and strike slip faulting.

Bryant, N. L., and Parry, W. T., 1977, Hydrothermal alteration at Roosevelt Hot Springs KGRA-DDH 1976-1: ERDA Technical Report, v. 77-5, contract EY-76-S-07-1601, 87 p.

A detailed study of the alteration in a 200 foot drill core from the Roosevelt KGRA. The study identifies three major alteration zones, proposes a dynamic model of the alteration system, and calculates the heat flow contribution of the alteration.

Bullock, K. C., 1976, Fluorite occurrences in Utah: Utah Geol. and Mineral Survey Bull. 110, 89 p.

This compilation gives brief descriptions of fluorite-bearing prospects in skarns of the Mineral Mountains granite.

Butler, B. S., Loughlin, G. F., Heikes, V. C., and others, 1920, The ore deposits of Utah: U.S. Geol. Survey Prof. Paper 111, 672 p.

This is one of the earliest references on the Mineral Mountains geology. It contains a sketchy discussion of the general geology and a description of mining prospects.

Condie, K. C., 1960, Petrogenesis of the Mineral Range pluton, southwestern Utah: Univ. Utah, unpub. M.S. thesis, 92 p.

A review of Mineral Range geology based on the work of Earl (1957) and Liese (1957) with revisions and additional mapping by the author. Condie suggests that the Mineral Mountains granite may have been formed by granitization of older metamorphic rocks.

Cook, K. L., and P. M. Mudgett, 1966, Regional gravity of the Mineral, San Francisco, Beaver, and northern Wah Wah Mountains region, in Beaver and Millard Counties, Utah: Utah Academy of Science Proceedings, v. 43, part 2, p. 62.

Cook, K. L., Montgomery, J. R., Smith, J. R., and Gray, E. F., 1975, Simple Bouguer gravity anomaly map of Utah: Utah Geol. and Mineral Survey Map 37.

Cordova, R. M., and Mower, R. W., 1976, Fracturing and subsidence of land surface caused by the withdrawal of ground water in the Milford area, Utah: Jour. Research, U.S. Geol. Survey, v. 4, no. 5, p. 505-510.

This study notes two types of subsidence in the Milford area, west of the Mineral Mountains: near-surface subsidence due to lowering of the potentiometric surface and deep-seated subsidence due to reduction in artesian pressure. Both types are attributed to pumping from domestic and agricultural wells.

Crawford, A. L., and Buranek, A. M., 1945, Tungsten deposits of the Mineral Range, Beaver County, Utah: Dept. Mining and Metallurgical Research (University of Utah State Eng. Exp. Station) Bull. 25, 48 p.

A report on tungsten prospects occurring in skarns along the western contact of the Mineral Mountains granite. The report contains a brief generalized discussion of the range's geology.

Crawford, A. L., and Buranek, A. M., 1942, Tremolite deposits of the Mineral Range, Millard County, Utah: Utah State Dept. of Publicity and Indus. Development in cooperation with the Mining and Metallurgical Research Dept., Univ. Utah, Circular #2.

A description of fibrous tremolite deposits from a skarn adjacent to the Mineral Mountains granite, northern Mineral Mountains. Approximate location is S.2 T25S R9W.

Crebs, T. J., 1976, Regional gravity survey of the central Mineral Mountains, Utah, including detailed gravity and ground magnetic surveys of the Roosevelt Hot Springs area: Univ. Utah, unpub. M.S. thesis.

Crebs, T. J., and Cook, K. L., 1976, Gravity and ground magnetic surveys of the Central Mineral Mountains, Utah: NSF Final Report, Grant GI 43741, v. 6, 129 p.

A detailed study covering the Roosevelt Hot Springs KGRA and adjacent areas. The study suggests the presence of an E-W fault in Negro Mag Wash with the southern side downthrown approximately 70 m; it estimates vertical displacements on the Dome fault at 50 m and 580 m displacement along the Basin and Range fault on the west side of the Mineral Mountains. The study also estimates that the area's metamorphic rocks are up to 250 m thick and suggests that they overlay the Mineral Mountains granite near the hot springs.

Crebs, T. J., Cook, K. L., Thangsuphanich, Ittichai, Brumbaugh, W. D., and Ward, S. H., 1976, Gravity and magnetic surveys of the Mineral Mountains area, Utah, including Roosevelt Hot Springs KGRA: Soc. of Exploration Geophysicists Annual International Meeting Abstracts, no. 46, p. 89-90.

Crosby, G. W., 1972, Dual origin of Basin and Range faults in Plateau-Basin and Range transition zone, central Utah: Utah Geol. Assoc., Publ. 2.

Crosby, G. W., 1973, Regional structure in southwestern Utah, in Geology of the Milford area: Utah Geol. Assoc., Publ. 3, p. 27-33.

A brief generalized introduction to the regional structural trends of southwestern Utah. These trends include the Sevier orogenic belt, regional changes in the orientations of Basin and Range faults, the Basin and Range/Colorado Plateau transition, an E-W trending igneous zone, and the intermountain seismic belt.

Dedolph, R. E., and Parry, W. T., 1976, A thermodynamic model of the hydrolysis of microcline in acid sulfate solutions: ERDA Technical Report, v. 76-2, contract EY-76-S-07-1601, 63 p.

This study develops a theoretical model of the hydrolysis of microcline by hydrothermal solutions. Solution compositions and temperatures from the Roosevelt geothermal system are used to arrive at theoretical reaction paths and alteration mineral zonation.

Durham, J., 1977, Environmental Analysis, prepared for six 3,000 $\pm$ m (10,000 $\pm$ ft.) deep, geothermal exploratory test wells in the Roosevelt Hot Springs Unit, Beaver County, Utah: E.A. #59, U.S. Geol. Survey Conservation Division, Menlo Park, Cal., p. 7-9,13.

Earl, F. N., 1957, Geology of the central Mineral Range, Beaver County, Utah: Univ. Utah, unpub. Ph.D. thesis, 112 p.

A geologic study of the Central and southern Mineral Range. Within the KGRA, Earl mapped preCambrian metamorphic rocks intruded by Tertiary granites. His mapping extends southward where Paleozoic sediments are exposed. Mining prospects in the southern portion of the range are briefly described.

Evans, S. H. Jr., and Nash, W. P., 1975, Low-temperature rhyolite from the Roosevelt geothermal area, Utah (abs.): Geol. Soc. Amer. Ann. Mtg. Programs with Abstracts, v. 7, no. 7, p. 1070.

Evans, S. H., Jr., 1977, Geologic map of the central and northern Mineral Mountains, Utah: Dept. of Geology and geophysics, Univ. Utah, ERDA contract EY-76-S-07-1601.

Evans, S. H., Jr., and Nash, W. P. 1978, Quaternary rhyolite from the Mineral Mountains, Utah, U.S.A.: DOE/DGE, Final Report, v. 77-10, contract EY-76-S-07-1601, 59 p.

A petrologic study of the Quaternary rhyolite flows and domes of the Mineral Mountains. The study concludes that all the quaternary rhyolites could have been derived from the same evolving magma, but that there is no genetic relationship between the Quaternary rhyolites and Tertiary rhyolites also exposed in the Mineral Mountains.

Everett, F. D., 1961, Tungsten deposits of Utah: U.S. Bureau of Mines Inf. Circ. 8014, 44 p.

A very brief generalized description of the skarn tungsten mineralization associated with the eastern contact of the Mineral Mountains granite. Report includes a prospect location map and one chemical analysis of the mineralization.

Geothermex, Inc., 1977, Geothermal potential of the lands leased by Geothermal Power Corporation in the Northern Mineral Mountains, Beaver and Millard Counties, Utah: report for Geothermal Power Corp., 43 p.

A consulting report on geothermal potential in the vicinity of the Roosevelt KGRA. Includes a brief discussion of the geology.

Gilbert, G. K., 1890, Lake Bonneville: U.S. Geol. Survey Monograph 1, 438 p.

This classic monograph identifies and describes Escalante Bay, an arm of Lake Bonneville that occupied the valley on the Mineral Mountains west flank.

Godwin, L. H., Haigler, L. B., Rioux, R. L., White, D. E., Muffler, L. J. P., and Wayland, R. G., 1971, Classification of public land valuable for geothermal steam and associated geothermal resources: U.S. Geol. Survey, Circular 647, 18 p.

Greider, B., 1976, Geothermal energy Cordilleran hingeline - west in Symposium on Geology of the Cordilleran Hingeline, Hill, J. G., ed.: Denver Rocky Mtn. Assoc. Geologist, p. 351-362.

Heylum, E. B., 1966, Geothermal power potential in Utah: Utah Geol. and Mineral Survey Special Studies 14.

Hintze, L. F., 1963, Geologic map of southwestern Utah: Utah Geol. and Mineral Survey (1:250,000 scale)

Hintze, L. F., 1960, Preliminary geology map of the Richfield, Utah 2° quadrangle: Brigham Young University.

Hobbs, S. W., 1945, Tungsten deposits in Beaver County, Utah: U.S. Geol. Survey Bull. 945-D., p. 81-111.

Descriptions of tungsten prospects in the eastern Mineral Mountains. The deposits are in skarns developed adjacent to the Mineral Mountains granite.

Kerr, P. F., 1946, Tungsten mineralization in the U.S.: Geol. Soc. of Amer., Mem. 15, 241 p.

Keller, G. R., Smith, R. B., and Braile, L. W., 1975, Crustal structure along the Great Basin - Colorado Plateau transition from seismic refraction studies: Jour. Geophys. Res., v. 80, no. 8, p. 1093-1098.

A seismic study of the Basin and Range-Colorado Plateau transition which indicates a mantle upwarp of low-velocity material centered on the Wasatch front and approximately coincident with the intermountain seismic belt.

Koenig, J. B., Anderson, D. R., and Hutterer, G. W., 1975, Exploration and development of geothermal resources in the United States, 1968-1975: Proceedings, Second U.N. Symposium on the Development and Use of Geothermal Resources, no. 1., p. 139-142.

A review article which briefly mentions Roosevelt Hot Springs as an area of active exploration and good geothermal potential.

Lee, W. T., 1908, Water resources of Beaver Valley, Utah: U.S. Geol. Survey, Water-Supply Paper 217, 56 p.

One of the earliest references on the Mineral Mountains and vicinity. The report contains a brief description of the general geology, and chemical, temperature and flow data on the Roosevelt Hot Springs.

Liese, H. C., 1957, Geology of the northern Mineral Range, Millard and Beaver Counties, Utah: Univ. Utah, unpub. M.S. thesis, 88 p.

A geologic study of the northern Mineral Mountains, north of the Roosevelt KGRA. Liese mapped a sequence of Cambrian sediments cut by Cretaceous (?) thrust faulting. These rocks were also intruded by two phases of Tertiary plutonic rocks.

Lipman, P. W., Rowley, P. D., Mehnert, H. H., Evans, S. H., Nash, W. P., and Brown, F. H., 1978, Pleistocene rhyolite of the Mineral Mountains, Utah - geothermal and archeological significance: Jour. Research U.S. Geol. Surv., v. 6, no. 1., p. 133-147.

A geologic study of young rhyolite domes and flows of the Mineral Range. These rhyolites yield K/Ar dates of 0.5 to 0.8 m.y. These young dates lead the authors to suggest this rhyolitic event as the heat source for the Roosevelt Hot Springs KGRA.

Lipman, P. W., Rowley, P. D., and Pallister, J. S., 1975, Pleistocene rhyolite of the Mineral Range, Utah--geothermal and archaeological significance: Geol. Soc. Amer. Ann. Mtg. Abstracts with Programs, v. 7, no. 7, p. 1173.

Matlick, J. S., and Smith, J. L., 1976, Summary of 1975 geothermal drilling, western United States: Geothermal Energy, v. 4, no. 6, p. 28-31.

Industry review article containing a brief account of Phillips Petroleum's activity in the Roosevelt KGRA.

Maxey, G. B., 1946, Geology of part of the Pavant Range, Millard County, Utah: Am. Jour. Sci., v. 244, p. 324-356.

Geology of the southernmost Pavant Range, adjacent to the Mineral Mountains. Contains a description of the thrust faulting of early Paleozoic rocks over Mesozoic and Permian rocks.

Mehnert, H. H., Rowley, P. D., and Lipman, P. W., 1978, K-Ar ages and geothermal implications of young rhyolites in West-Central Utah: Isochron/West, no. 21, p. 3-7.

K/Ar dates on young rhyolites adjacent to Utah KGRAs. The study includes six dates on Mineral Mountains rhyolites ranging from 0.51 to 0.79 m.y. The authors suggest that these youthful dates may indicate that the rhyolites are the heat source of the Roosevelt KGRA.

Micro Geophysics, 1977, Refraction shooting near Roosevelt Hot Springs: Data: DOE/DGE Final Report, v. 77-4, contract EY-76-S-07-1601, 56 p.

Milligan, J. H., Marsell, R. E., and Bagley, J. M., 1966, Mineralized springs in Utah and their effect on manageable water supplies: Utah State Univ., Logan, Utah Water Research Lab. Rept. W623-6.

Flow at Roosevelt had stopped as of this study so the springs are mentioned but not discussed in detail.

Mower, R. W., and Cordova, R. M., 1974, Water Resources of the Milford area, Utah, with emphasis on ground water; State of Utah Dept. of Natural Resources, Tech. Pub. no. 43, 106 p.

Mundorff, J. C., 1970, Major thermal springs of Utah: Utah Geol. and Mineral Survey Water Resources Bull. 13, 60 p.

This paper is a compilation of Utah hot springs. A brief section is devoted to the Roosevelt Hot Springs.

Nash, W. P., 1976, Petrology of Quaternary volcanics of the Roosevelt KGRA, and adjoining area, Utah: Univ. Utah Publications Board Rept. 261 549/OST, 102 p.

A petrologic study of the young rhyolites of the Mineral Range. Magmatic temperature is estimated at 700°C with water fugacities ranging from 350 to 3450 bars. The magma chamber is estimated to have been at a depth of approximately 1.6 km.

Nash, W. P., and Smith, R. P., 1977, Pleistocene volcanic ash deposits in Utah: Utah Geology, v. 4, no. 1, p. 35-42.

A discussion of major and trace element analyses of glasses from Pleistocene ash deposits. Includes three samples from the Mineral Mountains.

Olson, T. L., and Smith, R. B., 1976, Earthquake surveys of the Roosevelt Hot Springs and Cove Fort areas, Utah: Univ. Utah, unpub. Report., N.S.F. contract G.I. 43741, v. 4.

This study found little earthquake activity and no correlation with the hot springs in the Roosevelt KGRA.

Olson, T. L., Sill, W. R., and Smith, R. B., 1975, Integrated geophysics, Roosevelt Hot Springs. Society of Exploration Geophysicists Annual International Meeting Abstracts, no. 45, p. 28.

Park, G. M., 1968, Some geochemical and geochronologic studies of the beryllium deposits in western Utah: Univ. Utah, unpub. M.S. thesis, 104 p.

A comparison study of Utah beryllium occurrences including the Miller Mine on the eastern flank of the Mineral Mountains. The study includes chemical analyses of the beryllium mineralization and a K/Ar date of 15.5 m.y. $\pm$ 1.5 for the mineralization.

Parry, W. T., Benson, N., and Miller, C. D., 1976, Geochemistry and hydrothermal alteration at selected Utah hot springs, v. 3: National Technical Information Service Report 264-415/1, 141 p.

Parry, W. T., Nash, W. P., Bowman, J. R., Ward, S. H., Whelan, J. A., Bryant, N. L., Dedolph, R. E., Evans, S. H., Bowers, D., 1977, Part I - Geology and Geochemistry of the Roosevelt Hot Springs - A Summary, DOE/DGE Final Rept. v. 77-2, contract EY-76-S-07-1601, 12 p.

Parry, W. T., Nash, W. P., and Ward, S. H., 1977, Part III - Roosevelt Hot Springs area field trip: DOE/DGE Final Rept. v. 77-2, contract EY-76-S-07-1601, 11 p.

Petersen, C. A., 1973, Roosevelt and Thermo Hot Springs, Beaver County, Utah: Utah Geol. Assoc. Pub. 3, p. 73-74.

A very brief summary of the geology of the Roosevelt KGRA.

Petersen, C. A., 1974, Summary of stratigraphy in the Mineral Range, Beaver and Millard Counties, Utah: Utah Geology, v. 1, p. 45-54.

A brief summary of the stratigraphy of the Mineral Mountains which correlates units mapped by Liese (1957) and Earll (1957) with better known stratigraphies in adjacent areas.

Petersen, C. A., 1975, Geology and geothermal potential of the Roosevelt Hot Springs area, Beaver County, Utah: Univ. Utah, unpub. M.S. thesis, 50 p.

A detailed description of the geology of the Roosevelt Hot Springs and adjacent area. The study includes data on the hot spring deposits, chemistry of the springwaters, and faulting in the alluvium adjacent to the hot springs.

Petersen, C. A., 1975, Geology of the Roosevelt Hot Springs Area, Beaver County, Utah: Utah Geology, v. 2, no. 2, p. 109-116.

A discussion of the Roosevelt KGRA geology; includes a geologic map.

Peterson, D. L., 1972, Complete Bouguer gravity anomaly map of parts of Beaver, Iron and Millard Counties, southwestern Utah: U.S. Geol. Survey Open-File Report (scale 1:250,000).

Petrack, W. E., 1976, Test electromagnetic soundings, Roosevelt Hot Springs KGRA: NTIS Report TR-74-1, 21 p.

Phillips Petroleum Company, 1974, Shallow temperature gradient test holes, National Resource Lands, Roosevelt Hot Springs area: unpub. release by U.S. Dept. of Interior, Bur. Land Management.

Phillips Petroleum Company, undated, Geothermal operations, Roosevelt K.G.R.A.: unpub. information release.

Rowley, P. D., Lipman P. W., Mehnert, H. H., Lindsey, D. A., and Anderson, J.J., 1978, Blue Ribbon lineament, an east-trending structural zone within the Pioche mineral belt of southwestern Utah and eastern Nevada: Jour. Research U.S. Geol. Survey, v. 6, no. 2, p. 175-192.

This study identifies a structural lineament within the east-west Pioche Mineral Belt. This belt is a major structural feature which passes through the Mineral Mountains. The article includes a review and discussion of the geologic and geophysical evidence of this belt and others within Utah and Nevada.

Sainsbury, C. L., 1962, Helvite near Beaver, Utah: Am. Mineral., v. 47 p. 395-397.

A brief description of beryllium mineralization at the Miller Mine on the Mineral Range's east flank.

Shuey, R. T., 1974, Aeromagnetic map of Utah: Utah Geol. and Mineral Survey Map.

Sill, W. R., and Bodell, J., 1977, Thermal gradients and heat flow at Roosevelt Hot Springs: ERDA Technical Report: v. 77-3, contract EY-76-S-07-1601, 46 p.

Heat flow and thermal gradients from 39 drill holes were found to outline an anomalously warm zone along faults controlling the near-surface flow of the Roosevelt Hot Springs. This anomaly correlates with low resistivity zones and is attributed to the circulation of thermal waters.

Sill, W. R., Ward, S. H., Tripp, A., Parry, W. T., and Swift, C. M., Jr., 1976, Electrical and geochemical models of the near surface zone at Roosevelt Hot Springs KGRA, Utah: Society of Exploration Geophysicists Annual International Meeting Abstracts, no. 46, p. 95-96.

Smith, G. E., 1977, Roosevelt Hot Springs geothermal find: Geothermal Energy, v. 5, no. 1, p. 14-16.

Smith, R. B., 1976, Micro-earthquakes in the Black Rock Desert to Mineral Mountains area: Univ. Utah, Dept. Geology and Geophysics, unpub. map.

Smith, R. B., and Sbar, M., 1974, Contemporary tectonics and seismicity of the Western States with emphasis on the intermountain seismic belt: Geol. Soc. Amer. Bull. v. 85, p. 1205-1218.

This study defines a belt of seismicity that follows the Wasatch front in northern Utah but broadens and turns southwestward in the Tushar mountains, eventually passing through Cedar City and into Nevada. This belt is interpreted as a subplate boundary.

Sontag, R. J., 1965, Regional gravity surveys of parts of Beaver, Millard, Piute and Sevier Counties, Utah: Univ. Utah, unpub. M.S. thesis, 30 p.

The area of this study includes the extreme eastern margin of the Mineral Mountains.

Stewart, J. H., and Poole, F. G., 1974, Lower Paleozoic and uppermost Precambrian Cordilleran miogeosyncline, Great Basin, western United States; in Dickinson, W. R., ed., Tectonics and Sedimentation: Soc. Econ. Paleontologists and Mineralogists Spec. Pub. 22, p. 28-57.

Swanberg, C. A., 1974, The application of the Na-K-Ca geothermometer to thermal areas of Utah and the Imperial Valley, California: Geothermics, v. 3, no. 2, p. 53-59.

This study computed an average temperature of 289°C for the Roosevelt geothermal system. This was the highest temperature obtained in Utah and it compares favorably with the temperatures of developed geothermal fields in California and Mexico.

Thangsuphanich, I., 1976, Regional gravity survey of the southern Mineral Mountains, Beaver County, Utah: Univ. Utah, unpub. M.S. thesis.

Thurston, W. R., Staatz, M. H., Cox, D. C., and others, 1954, Fluorspar deposits of Utah: U.S. Geol. Survey Bull. 1005, 53 p.

This compilation mentions several fluorite-bearing prospects in skarn zones on the east side of the Mineral Range.

Tripp, A., Ward, S. H., Sill, W. R., Swift, C. M., Jr., and Petrick, W. R., 1976, Electromagnetic and Schlumberger resistivity soundings in the Roosevelt KGRA, Utah: Society of Exploration Geophysicists Annual International Meeting Abstracts, no. 46, p. 89-90.

TRW Systems Group, 1975, A study of geothermal prospects in the western United States: Final Report, Redondo Beach, California, 147 p.

University of Utah, 1975, Residual magnetic intensity, Mineral Mountains area, Millard and Beaver Counties, Utah: Univ. Utah, unpub. map (scale: 1:24,000).

Ward, S. H., 1977, Final Report, Volume 77-0: ERDA, contract EY-76-S-07-1601, 7 p.

Report outlining completion of contractual obligations for ERDA funded study of Roosevelt KGRA. No geologic discussions.

Ward, S. H., 1977, Geothermal exploration architecture: ERDA Technical Report: v. 77-2, contract EY-76-S-07-1601, 19 p.

A cost-effectiveness analysis of geothermal exploration programs in the Basin and Range. Focuses on the general Roosevelt KGRA region.

Ward, S. H., Bodell, J. M., Brumbaugh, W. D., Carter, J. A., Cook, K. L., Crebs, T. J., Olsen, T. L., Parry, W. T., Sill, W. R., Smith, R. B., Thangsuphanich, I., and Tripp, A. C., 1977, Part II - Geophysics of the Roosevelt Hot Springs Thermal Area, Utah: DOE/DGE Final Rept., v. 77-2, contract EY-76-S-07-1601, 17 p.

A brief summary of geophysical investigations at the Roosevelt KGRA carried out by researchers from the University of Utah.

Ward, S. H., and Crebs, T., 1975, Report on preliminary resistivity survey, Roosevelt Hot Springs K.G.R.A.: Univ. Utah, unpub. Report, N.S.F. contract G.I. 43741.

Ward, S. H., Rijo, L., and Petrick, R. W., 1975, Electromagnetic soundings in the geothermal environment (abstr.): United Nations Symposium on the Development and Use of Geothermal Resources, Abs., no. 2, unpaginated.

Ward, S. H., and Sill, W. R., 1976, Dipole-dipole resistivity surveys, Roosevelt Hot Springs KGRA, v. 2: National Technical Information Service, Report 264-897/0, 52 p.

Waring, G. A., (revised by R. R. Blankenship and R. Bental) 1965, Thermal springs of the United States and other countries of the world - a summary: U.S. Geol. Survey Prof. Paper 492, p. 17, 43.

This compilation briefly mentions the Roosevelt Hot Springs.

Whelan, J. A., 1970, Radioactive and isotopic age determinations of Utah rocks: Utah Geol. Mineral Survey Bull. 81.

A review of age dates from the Mineral Mountains granite made prior to 1970. Cites a 242 m.y. lead/alpha date on zircon by Odekirk in Liese (1957), a 15.5 ± 1.5 m.y. K/Ar date from biotite/muscovite obtained by Geochron Labs for Park (1967), and unpublished 10 ± 10 m.y. lead/alpha date on zircons by T. W. Stern of the U.S.G.S. Whelan considers the K/Ar date to be preferred.

Whelan, J. A., 1976, Geology of the Mineral Mountains: National Science Foundation Final Report, Grant GI-43741.

Whelan, J. A., 1977, Thermal gradient and heat flow drilling: National Science Foundation, Final Report v. 5, Grant GI-43741, 48 p.

A discussion of costs and logistics for 1975 drilling directed by University of Utah researchers. No geologic discussion of results.

Whelan, J. A., Nash, W. P., Parry, W. T., and Petersen, C. A., 1975, Design of exploration systems with application to Roosevelt KGRA, Utah (abst.): United Nations symposium on the Development and Use of Geothermal Resources, Abstracts, no. 2, unpaginated.

White, D. E., and Williams, D. L., 1975, Assessment of geothermal resources of the United States, 1975: U.S. Geol. Survey Circular 726.

This report briefly mentions Roosevelt Hot Springs including them in two of its major classifications of geothermal systems: "hydrothermal convection systems" and "igneous related geothermal systems."

Woodward, L. A., 1968, Lower Cambrian and Upper Precambrian strata of Beaver Mountains, Utah: A.A.P.G. Bull., v. 52, p. 1279-1290.

This paper describes Precambrian rocks from the Beaver Mountains, west of the Mineral Mountains. The Prospect Mountain Quartzite, which this paper describes in detail, extends into the Mineral Mountains.

Woodward, L. A., 1970, Tectonic implications of structures of Beaver and northern San Francisco Mountains, Utah: Geol. Soc. Amer. Bull., v. 81, p. 1577-1584.

A review of evidence for eastward thrusting during the Sevier orogeny in southwestern Utah.

Zietz, I., Shuey, R. T., and Kirby, J. R., Jr., 1974, Aeromagnetic map of Utah: U.S. Geol. Surv. Geophys. Inv. Map GP-907.

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