ABSTRACTS OF RECENT GEOLOGICAL AND RELATED WORK ACCOMPLISHED OR IN PROGRESS

By

Graduate Students, University
of Arizona

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THESES COMPLETED

Ammon, Robert L.: M.S., 1959; The Recovery of Zinc from Solution Obtained by the Dissolution of Zinc from Sphalerite with Ammoniacal Solutions at Elevated Temperatures and Pressures.

The objective of the research described in this thesis was to determine the possibilities of recovering zinc from ammoniacal zinc solution produced by the dissolution of zinc from sphalerite at elevated temperatures and pressures.

A stock solution of ammoniacal zinc solution was prepared in a two-liter capacity autoclave with a charge of sphalerite concentrate, water, ammonia, and oxygen.

After reducing the copper, lead, and cadmium contents of the solution with granulated zinc, the purified solution was treated by distillation for the removal of the ammonia which resulted in the precipitation of 97.4 per cent of the zinc as basic zinc sulfate.

The calcination of the basic zinc sulfate at 1,200 degrees Centigrade produced a zinc oxide with a sulfur content of 0.02 per cent.

The reduction of the zinc oxide with hydrogen at temperatures of 700 and 900 Centigrade and the distillation and condensation of the zinc were successful although performed only on a qualitative basis.

The ammoniacal zinc solution was purified prior to electrolysis in two stages. The first stage comprised three cycles of zinc additions for the reduction of copper, lead and cadmium contents. The second stage consisted of the addition of ferrous sulfate, its oxidation to ferric state, and coprecipitation of iron, arsenic, and selenium.

The electrolysis after the first stage of purification resulted in a metallic zinc deposit with spongy, black scale and corrugations.

The electrolysis after the second stage of purification was successful in producing a bright, firm, and fine-grained deposit for a period of six hours after which a powdery metallic zinc deposit was observed.

In the preparation of the stock ammoniacal zinc solution, its purification with three cycles of zinc additions and the precipitation of basic zinc sulfate, experimental work on the recovery of ammonia was undertaken. The results showed that 93.3 per cent of the ammonia could be recovered for reuse.

Bryner, Leonid: Ph.D., 1959; Geology of the South Comobabi Mountains and Ko Vaya Hills, Pima County, Arizona

The South Comobabi Mountains and Ko Vaya Hills are in the Papago Indian Reservation in southern Arizona, about midway between the towns of Tucson and Ajo. The South Comobabi Mountains form on a map a crescentic pattern which is concave to the north and has a span of about eight miles. The Ko Vaya Hills are immediately west of the mountains and occupy about ten square miles in a total mapped area of eighty square miles. The investigation of this area

consisted mainly of geologic mapping and microscopic examination of thin sections.

The Jaeger diorite complex with metamorphic inclusions, located in the soutern part of the range, comprises the oldest group of rocks in the mapped area. This complex is intruded by the Ko Vaya quartz monzonite, which forms the basement on which were deposited as much as 10,000 feet of lava flows that are predominantly andesitic but also include latites. The flows are overlain by up to 7,000 feet of clastic sediments of continental, fluvistile origin, which are inferred to be Lower Cretaceous from their similarity to the Recreation red beds in the Tucson Mountains. A sequence of persilicic igneous rocks represented by granophyres, porphyries, microbroccias, pebble dikes, and breccias were first intruded through Cretaceous time. All the rocks so far mentioned are overlain unconformably by fanglomerates and other rocks of Tertiary or Quaternary age.

The Chief structural features are a northwesterly dipping monocline in the northcentral part of the area mapped, and a dike-like form for most persilicic intrusions, which is probably due to intrusion along faults or fissures.

The area mapped comprises the larger part of the Cobabi Mining District, where small deposits of silver, gold, copper, and lead have been mined intermittently.

The geology of the area investigated has some marked resemblances to the geology of the Ajo area and of the Coyote and Tucson Mountains.

Donald, Peter G.: M.S., 1959; Geology of the Fresnal Peak Area, Baboquivari Mountains, Arizona

The Fresnal Peak area is located on the eastern slope of the Baboquivari Mountains approximately 50 miles southwest of Tucson.

Granites of undetermined age crop out in the eastern and southwestern portions of the area. The eastern granite exposure contains numerous pegmatite-aplite segregations and fracture injections. Continental type sediments, deposited during late Cretaceous-early Tertiary times, lie marginal to igneous bodies and dip at low angle to the west. Granite-sedimentary rock contacts are marked by shear or fault zones striking N10-40 W and dipping to the southwest.

Structural features are dominated by a tension joint pattern striking N 50-80 W and N 05-25 E. Fractures dip at a high angle to the southwest and east. These are commonly followed by acid and basic dikes of Tertiary age.

Narrow zones of mineralization are observed at several points within the Fresnal Peak area. These are characterized by high temperature replacement, extreme selectivity, and lack of continuity. A late magmatic genesis is suggested.

Faick, John N.: Ph.D., 1959; Stratigraphy, Structure and Composition of cement Materials in North Central California

A geologic investigation for materials from which to manufacture cement was made in north central California. Parts of the Sierra Nevada and Great Valley provinces are included in the area investigated. The area is underlain by sedimentary and igneous rocks ranging in age from Silurian to Recent. Paleozoic shales, sandstones, limestone, and associated igneous rocks were metamorphosed, tightly folded, uplifted and eroded at the close of the Paleozoic. These were again submerged in the Mesozoic when a nearly similar sequence of rocks was formed. The rocks of these two eras are grouped together as the "Bedrock series" although they are separated by a profound unconformity. Uplift during the Sierra Nevada orogeny and subsequent erosion caused great amounts of material to be removed from the Sierra Nevada and deposited as clastic sediments in the Great Valley province during the Cretaceous and Cenozoic. Many deposits of calcareous materials are present in formations of Carboniferous and Triassic age. In Plumas County two large deposits of Triassic age were mapped, drilled, and sampled. The deposit near Genesee is the type locality for the Hosselkus limestone. This large, relatively pure deposit is deformed, having

been overturned, folded, and faulted. Near Virgilia is a deposit of argilaceous limestone having a composition similar to natural cement rock. Argilaceous materials suitable for cement admixture occur in some of the Carboniferous formations and in post-Jurassic rocks along the east side of the Sacramento Valley. Some Upper Cenozoic rhyolitic ruffs occurring in the area have pozzolanic properties.

Gray, Robert S.: M.S., 1959; Cenozoic Geology of Hindu Canyon, Mohave County, Arizona

Cenozoic fluviatile and lacustrine(?) sedimentary deposits in Hindu Canyon and Lost Man's Canyon near Peach Springs, Arizona, are of interest for their possible bearing on the history of the Colorado River in the southwestern part of the Colorado Plateau. The sediments blanket the Paleozoic bedrock in the lower parts of the canyon, and occur as isolated outcrops along the walls.

Hindu Canyon and Lost Man's Canyon represent a segment of a former drainage system that has been disrupted: possibly, it may represent an early course of the Colorado River.

In this paper the Hindu Canyon formation and the Buck and Doe conglomerate are defined as formations in the Hindu Canyon area.

Certain conclusions may be drawn as to the geological history of the canyon. It was formed during Cenozoic time, possibly after the first movement on the Hurricane fault, and then filled with Cenozoic deposits. A combination of climatic changes and/or damming by structural movements could have caused deposition of these sediments. Re-excavation of the canyon by destructive forces has eroded the deposits. Present outcrops are only remnants of deposits that formerly filled the canyon.

Imsailer, James B.: M.S., 1959; Structural Geology of the Safford Peak Area, Tucson Mountains, Pima County Arizona

The structures of the Safford Peak area of the Tucson Mountains are dominantly east-west. One east-west right-lateral strike-slip fault was mapped in addition to east-west high-angle normal and reverse faults. Another prominent structural direction is nearly north-south. Both major directions are believed to be the result of older zones of structural weakness, but presently existing faults are believed to have occurred contemporaneously with regional tilting in the Late Tertiary. Tertiary intrusives, for the most part, follow the major directions of faulting. Field relationships have demanded changes in the names and definitions of certain formations.

Kyburz, Edward P.: M.S., 1959; The effecienty of Scraper Buckets in Mining Practice

This thesis describes an experimental investigation of the relationships between scraper operating and design variables and of the effect of these relationships on mine scraper effeciency.

The initial phase of the project concerns itself with the selection of a standard of effeciency that is reliable and applicable for laboratory experimentation and the objectives to be sought from the study. The effecienty standard selected was the ratio of the average rock scraped per pass to bucket weight.

A scaled model scraper hoist, scraper table, and hoe, box, and crescent type buckets are used to determine relationships of particle size classification, bucket weight, bucket type, rope speed and moisture. Two mine-run samples of quartzite and copper sulfide ore were used for test purposes. The preparation of the test samples was controlled by maximum particle sizes of 1/4, 1/2, 1, and 2 inches. Series of tests with the hoe, box, and crescent scrapers were run on these samples. Bucker weights were varied by 200 gram increments, rope speed by 50 fm increments, and moisture contents of 0, 5, 10, and 15 per cent were used. The results of experimental test data are presented in graphs and tables.

Analyses of the test data collected and of previous test work are presented with respect to a selected group of important operating and design variables.

LeMone, David Vondenburg: M.S., 1959; The Devonian Stratigraphy of Cochise, Pima, Santa Cruze Counties, Arizona and Hidalgo County, New Mexico

The Devonian rocks of the southwest consist of essentially five basic facies and formations. They are: the euxinic black shale Percha formation, the marginal geosynclinal facies of the Cerros de Murcielagos sequence and the Muddy Peak limestone, the coarse clastic Swisshelm formation, the embayment or near shore Northeastern Arizona and Southwestern Colorado sequence, and the stable shelf Martin formation. Numerous other formations have been described in the literature, but represent only minor lithologic variations and paleontological subdivisions.

Late Devonian seas advanced across Arizona from the southwest in the Caborca region of Northern Sonora, Mexico and from the northwest from the area of the Cordilleran Geosyncline. A positive area existed in East Central and Northern and Central Western New Mexico. Evidence of arching with closure towards the southwest along the trend of "Mazatzal land" is shown in the post-Devonian Mississippian erosion surface. The existence of positive movements in this arch is not established for Devonian sediments. Mazatzal land existed probably only as a few offshore islands in Devonian time in Central Arizona.

Loring, W. B.: Ph. D., 1959; Geology and Ore Deposits of the Northern Part of the Big Indian District, San Juan County, Utah

The Big Indian uranium district lies in northern San Juan County, in southeastern Utah, 33 miles southeast of Moab. The northern part of the district includes the North Alice, Far West, Radon and Cord mines. The district is on the Colorado Plateau.

A thick evaporite sequence was deposited in the Paradox basin during Pennsylvanian time. During the late Pennsylvanian, and through Permian time, red sands and shales from the Uncompahgre highland alternated with limestone, forming the "Rico" and Cutler formations. Post-Culter doming, about a salt plug, resulted in a 3^{o} unconformity with overlying Triassic Chinle sand and shale beds. Above the Chinle, the Wingate formation is composed of eolian sand; it is the main surface rock in the district. The Jurassic is comprised of a thick sand section, - Kayenta, Navajo and Entrada, overlain by the Morrison formation, which consists of alternating sand and shale in the lower part and shale in the upper part. The youngest rocks in the district are Cretaceous, - Burro Canyon-Dakota sandstone, and Mancos shale. Most of the uranium is found near the base of the Chinle formation; there is some production from the Morrison Salt Wash member in outlying parts of the district, such as in the Rattlesnake mine, to the north.

Most of the structures are post-Mancos, - probably Laramide. An anticline trending northwest, was localized by the earlier dome. Upward forces resulted in the Lisbon Valley fault along the axis of the anticline, with uplifting of the southwest, foot-wall block. This block was subdivided by a series of radial and concentric fractures, - faults and joints, centering on a point near the Lisbon Valley fault. In the hanging-wall block at this point, there is a copper deposit in the Dakota-Burro Canyon sandstone.

Uranium ore deposits were formed during the early Tertiary. In the foot-wall block, acid, reducing fluids moved out and up, along the fractures, removing calcite cement and bleaching the hematite; affecting in patticular sandstone and arkose immediately above and below the Cutler-Chinle contact. Ore-bearing solutions followed the bleaching ones; pyrite, in sparse amounts, was deposited first, then pitchblende and calcite. The pitchblende occurs scattered through the calcite cement, and coating and replacing quartz grains; the calcite is colored pink from disseminated hematite. The bleaching may have been effected by a sulphur acid; and the ore emplacement by a carbonate solution, with a ferrous precipitant.

Most of the ore is in Chinle sand laid down by braided streams, which flowed westerly from the Uncompahgre highland, and is found where these sands overlie the paleo-outcrop of a Cutler arkose bed. Where the Cutler sand is missing, ore may occur in Chinle siltstone, or in the top part of the Cutler.

Shirley, Joseph F.: M.S., 1959; A Study of the Frothing Properties of of Certain Potential Flotation Reagents

The scientific approach to the problem of determining the potential value of new frothing reagents was selected rather than the routine method of testing such reagents.

After a thorough review of the literature on foaming and frothing it was decided to construct equipment which was designed by S. C. Sun for use in determining quantitiaively the ability of a reagent to produce foram. Two well established frothing reagents were used as standards, namely methyl iso-butyl carbinol and methyl amyl alcohol. The results of the experimental work with the foramometer equipment were used to reject certain reagents and select the remaining reagents for further experimental work on frothing, solely on the basis of the ability of each reagent to produce more or less foam than the standards. Seven reagents were rejected and three, namely, ethyl amyl carbinol, hexylene glycol polymer, and methyl iso-butyl carbinol polymer were selected for further experimental work.

Before proceeding with the experimental work on frothing the three selected reagents were tested with respect to variables which might affect the foraming property. These variables were the concentration of the potential frother, the rate of aeration and the affect of the pH. In general, there was a linear increase in the volume of foam produced as the concentration of potential frothers was increased. The methyl iso-butyl polymer, however, was not appreciably affected with increase of its concentration. As the rate of aeration was increased the volume of foan imcreased. An increase in the pH value of the solution did not appreciably affect the volume of resulting foam when calcium hydroxide was used.

Even though the production of sufficient foam is an essential property for a satisfactory frothing agent, it does not follow that the production of foam by itself is the only property. In order to determine if the potential agents had other essential properties of a satisfactory frother, further experimental work was done in a flotation machine employing two selected Arizona copper ores. The results of such experimental work were judged on the basis of metallurgical results produced, namely the extraction of copper and the grade of the concentrate.

As a result of the experimental work on one of these ores, it was determined that all three of the reagents compared favorably with the standard methyl isobutyl carbinol. However, compared with another widely used standard, Dow froth 250, only hexylene glycol polymer compared favorably.

As a result of the experimental work on the other ore, which was a more difficult one to treat, the methyl iso-butyl carbinol polymer proved extremely successful compared to methyl iso-butyl carbinol, which is presently being used in the commercial treatment of the ore. The other two potential reagents produced results, which compared favorably with the methyl iso-butyl carbinol.

Studebaker, Irving: M.S., 1959; Structure and Stratigraphy of the Helmet Peak area, Pima County, Arizona

The Helmet Peak area is located twenty-two miles south-southwest of Tucson in Pima County, Arizona.

A sequence of Permian and Cretaceous (?) rocks crops out in and adjacent to Helmet Peak. The Cretaceous (?) rocks may be in part either older or younger than Cretaceous but the limestone and siltstone member, in the center part of the section, is no older than Cretaceous.

Cretaceous(?) rocks, consisting of arkose, sandstone, siltstone, and limestone, approximately 5,000 feet thick, form a broad syncline which plunges steeply to the southeast.

Permian sediments, consisting of limestones, dolomites, and quartzites, form a sharp anticline which plunges 70 degrees to the southeast. The Permian sediments occur in what appears to be a Klippe that rests on top Cretaceous(?) sediments.

Faulting, which is later than the folding of the Cretaceous(?) beds, has offset portions of these beds approximately 2,500 feet. Granites and andesites were intruded along fault zones after the Cretaceous(?) beds were folded.

Walker, Giles E.: M.S., 1959: Intrusive relations of the Batholith of Southern California, near Bonsall, California

Intrusive structures observed within the Batholith of Southern California near Bonsall, California are elongated approximately parallel to the northwest or Pacific Coast tectonic belt. Linear and platy flow structures preserved in these Cretaceous intrusions likewise parallel this direction and are steeply dipping to vertical movements with domal structures formed in the granodiorite. The basement complex into which the Cretaceous intrusions have been emplaced are Triassic and Jurassic metamorphics.

The regional fracture pattern present is the result of northwest wrench-faulting with compressive stresses oriented about N24E. Such compression has resulted in the formation of consistent and extensive jointing along the longitudinal, diagonal and tension directions.

Primarily, emplacement of the intrusions has been controlled by the longitudinal or west-northwest direction. However, minor control and emplacement has also been effected along the north-northeast or tension direction.

Emplacement of the intrusions has been accomplished by magmatic stoping and forceful injection. Stoping, which is most prominent in relation to the earlier intrusions, is evidenced by the abundantly distributed inclusions in the tonalites, plus an intruding magma of low viscosity and density. Forceful injection evidenced particularly in connection with the granodiorite is substantiated by commensurate flow, transition and fracture structures.

The origin of the magma as seen from relations in the area is a strictly magmatic one. Evidences in support of this are chilled contacts, prevalence of sharp, continuous contacts throughout the area between the different rock units and truncation of structures.

Wargo, Joseph G.: Ph.D., 1959; The Geology of the Schoolhouse Mountain Quadrangle, Grant County, New Mexico

The schoolhouse Mountain quadrangle is bounded by Lat. 32°45' 32°52' 30" N; Long. 103°30'--108°37'30" W, and is located in northern Grant County, New Mexico, approximately 20 miles west of Silver City.

Volcanic pyroclastics and flows crop out in the northern part of the area. These rocks have been divided into nine formations containing 34 members. The lowermost units are andesites. The andesites are overlain by a thick series of pyroclastics and flows of rhyolitic composition. The rhyolites are overlain by a thin basalt flow. Precambrian granite and amphibolite overlain by Cretaceous sediments crop out in the southern part of the quadrangle.

Two major faults are found in the area; the north-south trending Schoolhouse fault and the east-west trending Wild Horse fault. A broad complex arch trending in a north-northwest direction crosses the quadrangle.

A study of: (1) magnetic susceptibilities, (2) chemical compositions and (3) refractive index of fused rock reveals a means of distinguishing between

some of the volcanic units that appear identical to the field. Closely spaced sampling and adequate geologic control are important to a successful application of these three correlation methods.

Woolhiser, David Arthur: M.S., 1959; Hydrologic Characteristics of a Semiarid Watershed

A three-year study has been made of the hydrologic characteristics of the Atterbury Reservoir Watershed, a semiarid watershed of eighteen square miles, located near Tucson, Arizona. The watershed is drained by two major ephemeral streams, Davis-Monthan Wash and Main Wash. A critical-depth flume was designed and was constructed in Davis-Monthan Wash to measure rates and volumes of stream flow. Runoff from the remainder of the watershed was measured volumetrically in three reservoirs equipped with water stage recorders.

Rainfall was measured in twenty-seven standard and three weighing-recording rain gages which were installed in 1955. This rain gage network was probably of sufficient density to delineate the rainfall patterns produced by convectional thunderstorms.

An intensity-duration-frequency-area relationship was developed from an analysis of three years of rainfall data from the watershed. It was found that the occurrence of a storm center over any location on the Atterbury Reservoir was governed by chance, and that the statistical distribution of storm center depths is closely described by a log-normal distribution. An excellent correlation was also found between the logarithms of the area enclosed by an isohyet, and the logarithm of the difference between the storm center depth and the isohyetal depth. A fair linear correlation was found between the duration of ninety per cent of storm center depth and the storm center depth.

The average runoff for 1956, 1957, and 1958 was 0.28 inches. The runoff showed little annual variation, although the average rainfall varied from 7.30 inches in 1956 to 13.61 inches in 1957. The surface runoff had excellent chemical characteristics.

It was found that upland vegetation had a negligible effect on moisture penetration into the soil. Infiltration rates were controlled by the surface layer of soil.

THESIS WORK IN PROGRESS

Clay, Donald W.: Late Cenozoic Stratigraphy in The Dry Mountain area, Graham County, Arizona.

The problem consists of correlation of all stratigraphic units exposed in the Dry Mountain area. Particular emphasis is placed on textural relations as a means of determing the direction of source areas.

Cunningham, John E.: Geology of the North Tumacacori foothills.

As a result of granite intrusion into the sedimentary rocks in the foothills at the northern end of the Tumacacori Mountains, there has been extensive alterration of the country rock, and ore mineralization. Investigation will be carried out to discover any patterns of alteration and/or mineralization, and to determine the origin of the numerous quartz-carbonate dikes in the area.

Dickinson, Robert G.: Insoluble residue zones and correlations of the El Paso limestone in southwestern New Mexico and southeastern Arizona.

Subdivisions of the type section of the El Paso limestone are to be established using diagnostic insoluble residues. Correlations of these subdivisions will be made with zones of similar character in surface exposures of the El Paso limestone in southwestern New Mexico and southeastern Arizona.

Evensen, Charles G.: Studies of the Shinarump formation of northern Arizona and adjoining regions.

The Triassic Shinarump formation crops out in a number of localities in northern Arizona and adjoining areas of Utah, Nevada, and New Mexico. A pronounced erosion surface occurs between it and the underlying beds, which are generally the Triassic Moenkopi formation, whereas its upper contact is generally gradational into the overlying Triassic Chinle formation. The Shinarump is a relatively thin continental conglomeratic sandstone and contains the most important uranium deposits in Arizona. Problems which may be solved by intensive study include (1) source areas of the sediments; (2) means of deposition; (3) origin and character of sedimentary structures and cementing material; (4) evidence within the unit as to the history of the surrounding region; and (5) origin and controls of uranium-vanadium-copper deposits occurring within the formation .

Fair, Charles L.: Geology of the Fresnal Canyon area, Baboquivari Mountains, Pima County, Arizona.

A Cretaceous and/or Tertiary sedimentary and volcanic sequence is exposed in fault contact with igneous and metamorphic rocks. Determinations to be made are the age, thickness and attitude of this sequence, and its structural relationship to the bounding igneous and metamorphic rocks.

Local metamorphism and mineralization will be mapped and its relationship to structural conditions and lithology will be sought.

Gardner, Murray C.: A structural study of the Pusch Ridge-Ventana (Rock) Canyon area, Santa Catalina Mountains, Arizona.

Reconnaissance work and detailed mapping of small areas along the southern edge of the Santa Catalina Mountains indicates the presence of small folds with gentle south limbs, broad crenulated crests, plunging axes and steep to overturned north limbs. Drag folds on the southern limbs of the small folds indicate that upper beds slipped north relative to lower beds. These "type" folds, together with the appearance of the southern Catalina Mountain slopes, indicate that the main mountain mass in this area is a great fold of the same structure, with gneisses, schists, and granitic bodies related to the dynamics of folding. Relation of minor and major structures to the development of the Santa Catalina Mountains is the problem under consideration.

Gray, Irving B.: Nature and origin of the Moenkopi-Shinarump hiatus in northeastern Arizona.

The thin Shinarump conglomerate overlies the finer-grained Moenkopi formation as a blanket deposit across many thousands of square miles in the Four Corners

region of the Colorado Plateau. The contact between these two distinct lithologies represents a widespread surface of erosion. Several theories have been offered to explain the nature and origin of this surface, but all fail to satisfactorily relate it to (1) the processes involved in its development, (2) its final shape, and (3) the origin of the overlying conglomerate. The problem is to properly relate all the observable field relationships to a logical sequence of geological events.

Kerns, John R.: Geology of the Aqua Verde Hills, Pima County, Arizona.
The problem consists of a detailed study of stratigraphy and structure of the area and preparation of a map showing bedrock geology and structure.

Laughlin, Alexander William: Petrology of the Molino Basin area of the Santa Catalina Mountains, Arizona.
A dark colored gneissose rock crops out in the Molino Basin area of the Santa Catalina Mountains, Arizona. The origin of this rock and its relationship to the adjacent augen-gneiss are uncertain. Both igneous and sedimentary origins have been suggested for the rock. During this study it is hoped that the original source material for the gneiss may be determined.

Livingston, Donald E.: Structural and economic geology of the Beaver Lake Mountains, Beaver County, Utah.
To map the structure, mineralization, alteration and areal geology of the Beaver Lake Range, Utah.

Lootens, Douglas J.: Structure and Petrography of the east side of the Sierrita Mountains, Pima County, Arizona.
The problems in the Sierrita Mountains include (1) determination of the character of the various igneous rocks, (2) mapping and interpretation of the structural elements, (3) determination of the age relations and, if possible, the absolute age of the rocks and, (4) a reconstruction of the structural history of the region. In addition, an attempt will be made to relate mineralization to specific structural events.

Marlowe, James I.: Late Cenozoic geology of the Lower Safford Basin on the San Carlos Apache Reservation, Arizona.
Plio-Pleistocene sediments deposited in that portion of the Safford Valley contained within the San Carlos Indian Reservation are well exposed by erosion and offer the possibility of study and reconstruction of the depositional history of the area; a study of the stratigraphy and associated structural features may lead to conclusions relating to the broad structural and sedimentary environment of this and similar intermontane basins.

Mathias, William F., Jr.: Heavy minerals of some Arizona tuffs.
A series of tuff beds occur in the Safford Valley area of Arizona. The correlation of these tuffs, and the beds in which they occur, is uncertain. By means of a detailed study of these tuffs, it will be determined if there are any distinguishing variations by which they may be recognized, thus creating a possible means of correlation for the area.

As a supplement, there will be an attempt to locate the mineral chevkinite within the tuff from which radioactive age determinations might be made.

Moore, Robert Atwell: Cretaceous stratigraphy of the southeast flank of the Empire Mountains, Pima County, Arizona.
Rocks of Cretaceous age lie unconformably on Upper Permian limestones on the eastern and southeastern flanks of the Empire Mountains. It has been supposed that this section of marine and nonmarine rocks is equivalent to the Lower Cretaceous Bisbee group. The presense of vertebrate and invertebrate fossil fragments in the section indicate, however, that these rocks may be equivalent in part to the Upper Cretaceous Sonoita group exposed in the Santa Rita Mountains. The section appears to be complete and undisturbed by faults or isoclinal folds. Detailed study of this section will furnish a standard for correlation of other, more highly faulted Cretaceous rocks in the general area, and will also furnish information on the age relationships and paleogeography of Cretaceous rocks of southeastern Arizona.

Pashley, Emil F., Jr.: Geology of the Casa Grande Mountains.
The Casa Grande Mountains are composed of complexly folded metamorphic rocks intruded by igneous dikes which seem to have a structural control that is unrelated to the structure of the metamorphic rocks. The trend of the mountain mass itself seems to continue to the northwest where it is represented by a ridge which is buried by alluvium. A large number of driller's logs in this region are available and may show a relationship between the mountain mass and the nature of the alluvium.

Platt, Wallace S.: Land-surface subsidence in the Tucson area.
The appearance of foundation failure of structures as indicated by cracks and actual displacement along the cracks has stimulated the interest of a few individuals. Preliminary investigation indicates that the observed structural failures are not random in their orientation and frequency but rather follow a pattern of concentric form.

Sabels, Bruno E.: Geochronology of the San Francisco Plateau volcanic field and adjacent areas in northern Arizona.
Lavas of felsic, intermediate and basaltic composition form conspicuous piles and extensive blankets in Northern Arizona. The age and cause of the volcanic events is to be investigated, and the sequence of activity to be reconstructed.

Samii, Cyrus: Geology of the Flat Rock oil field, Upton County, Texas.
The Flat Rock Oil Field was discovered in Upton County, Texas in 1951 and has been continuously producing since then. The geology and engineering of the field will be studied.

Thacpaw, Saw Clarence: Geology of the Ruby Star Ranch area, Twin Buttes mining district, Pima County, Arizona.
The Twin Buttes mining district, of which the Ruby Star Ranch is a part, is one of the major copper-producing areas in the State. Although the region has been extensively studied many geologic problems remain to be solved. It is anticipated that a study of the rock types, mineralization, and structures in the Ruby Star Ranch area will contribure new geologic data for the district.

Warnack, George F.: Gossan of Cerro de Pasco district, Peru.
The Cerro de Pasco ore bodies are overlain by an iron oxide gossan which in places carries commercial values of silver and lead. Although the gossan material has been mined at various times, the detailed mineralogy has been studied only sporadically. Thus, the exact mineralogy of the gossan material is unknown. This thesis will be an attempt to establish the mineralogy of the gossan and its association with the underlying sulfide types as to the mineralogy and environment of the deposits.

Whitacre, Halford E., II: Geology of the Madera Canyon area.
The problem of this thesis will be to construct a geologic map, to identify the different rock types, and to interpret the general geology of the Madera Canyon area.