PROSPECT EVALUATIONS, HANCOCK COUNTY, MAINE

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ROBERT S. YOUNG

Special Economic Studies Series No. 2
Maine Geological Survey
Robert G. Doyle
State Geologist

Department of Economic Development
Augusta, Maine

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ABSTRACT

A detailed study of base metal sulfide prospects in a large area in southern Hancock County was conducted by the Maine Geological Survey during the summer of 1961. The study (Operation "61"), using integrated geological-geophysical techniques was designed to study in depth 28 known and predicted sulfide prospects. Regional geochmical studies complemented the prospect studies.

The area under study extended from Castine and Pemaquid Townships on the west, along the coast in a 15 mile wide strip to Gouldsboro and Trenton on the east. Geologically the area is one of early Paleozoic sedimentation and volcanism, intruded by two or more discontinuous granite-granodiorite bodies. The relation of the ore deposits to these igneous masses is fully discussed. Mineralogically the sulfide deposits studied contained pyrite and pyrrhotite, chalcopyrite, galena (occasionally silver rich), sphalerite, argentite, arsenopyrite, bornite and millerite. Pyrite is the predominant sulfide host in the massive ore section. The deposits are found in all the sedimentary rock types present but occur most often in altered tuffaceous volcanics or quartz biotite schists.

Each prospect was mapped in detail and, when applicable, various ground geophysical instrument surveys were conducted over the prospect. EM instrumentation, both horizontal and vertical loop, a self-potential unit and a magnetometer were also employed on those prospects where their use was effective. An average 1000' N-S, E-W grid was established for each prospect survey. Station readings were at 100' intervals.

Results of the geophysical-geological studies for each prospect are published as profiles and grid maps. Local geochemical sample results and cultural features are also noted.

Regional geologic and a definitive analysis of fracture patterns are included and demonstrated by contour diagrams from equal area projections and polar coordinate diagrams. Regional north-east fracture patterns with imposed east-west tension cracks compose the predominant fracture directions except in the granite contact areas where the intrusive stresses control fracturing.

A brief summary of results, conclusions and recommendations is included.

INTRODUCTION

This report is the second of a series of special economic studies published by the Maine Geological Survey to develop detailed information on various areas in the State where a possible economic potential exists or is believed to exist. This Hancock County area was chosen because of its long history of mining and prospecting for base metal ores. The field work and subsequent report of this area is one part of a two-year program of exploration of the entire eastern Maine base metal-silver mineralogic province.

This western phase of the operation was known as Operation "61" and was planned and administered by Robert S. Young, Geophysical Contractor, Charlottesville, Virginia, under direction of Robert G. Doyle, State Geologist, Maine Department of Economic Development.

The purpose of Operation "61" is to provide the Maine Geological Survey with accurate, detailed and current information on the base metal sulfide potential of a large area in southern Hancock County, Maine (Plate 1). This information was gathered through an extensive, integrated geological-geophysical survey, one which was designed to evaluate the economic potential of the district as an entity through examination of individual deposits.

Operation "61", in its true perspective, should be considered as the initial phase of a comprehensive program to evaluate the base metal sulfide deposits of coastal Hancock and Washington Counties and a large area in central Maine. Operation "61" was formulated to determine the feasibility of prospecting for sulfide bodies in southern Hancock County with geophysical-geochemical aids to observable geology. The results of this survey will assist interested exploration and mining organizations in determining the extent and nature of additional work requirements; such additional work conceivably leading to the discovery and development of a mine.

The Survey was carried out in the prescribed manner, the technical aspects of which follow in this report. Because of the high "success ratio" of prospects examined and the then immediate interest in the area (Bangor Daily News, July 27, 1961), a release of preliminary information was advertised (August 1961) through the general mailing list of the Maine Geological Survey. The release, on September 6, 1961, consisted of a set of maps covering selected aspects of the geology and geophysical response of five prospects. Much of that data is reproduced in this report.

ACKNOWLEDGMENTS

The success of this survey was, in part, assured by the support and cooperation of many citizens residing in southern Hancock County. Not only were access rights readily granted, several prospects, not previously described in the literature, were brought to the attention of the field parties. It is a pleasure to acknowledge the cooperation of representatives of the several mining and exploration organizations working in the area during the summer. Of these, the management of Black Hawk Mining, Ltd., Montreal, P. Q., is especially thanked for access to grids, drilling and geophysical data in the Blue Hill district.

Representatives of the Maine Geological Survey, Robert G. Doyle and Webster F. Stickney, actively participated in work related to regional geological problems. Their friendly counsel and cooperation were most helpful. A section of this report is based on a more comprehensive analysis of the fracture patterns in the Blue Hill-Castine district by W. F. Stickney.

Special acknowledgment must be made to technical personnel constituting the survey party. Their performance was superior in all respects. Robert C. Barnes, University of Virginia, Charlottesville, Virginia, served as geologist and chief field assistant; Terrance H. Gray, Blue Hill, Maine, acted as instrument operator; Jerold I. Grindle, Blue Hill, Maine, and Stephen M. Maresca, Sedgwick, Maine, were field assistants.
PLATE 1. Map of Hancock County, Maine, showing the limits of the Area of Exploration.
LOCATION OF AREA

The exploration area consists of southern Hancock County, and its limits are shown on Plate 1. It is best described as the coastal strip lying between the longitude of Castine on the west and Gouldsboro on the east, extending inland in some places, to as much as ten miles. The total area covered by the geochemical survey was somewhat larger than that in which prospect evaluation took place.

As it is adjacent to the coast, much of the area is in the "summer resort" category. As such, road access is excellent; the major highways are U. S. Routes 1 and 1A and a network of excellent state highways covers the region between Route 1 and the coast. The largest town and best supply center is Ellsworth; principal villages are Blue Hill, Castine, Deer Isle, Franklin, and North Sullivan.

The entire exploration area is covered by modern 15' topographic maps, prepared by the U. S. Geological Survey, thus providing excellent geographic control for accurate prospect location. The areal base maps which accompany this report were compiled from the following 15' topographic maps: Orland, Ellsworth, Tunk Lake, Castine, Blue Hill, Deer Isle, Mount Desert, and Bar Harbor.

The choice of the area was based on geologic factors, derived from personal observation and published sources. Factors considered to be of prime importance were (1) the classic favorable environment of granitic intrusives and metasedimentary-metavolcanic hosts, (2) a relative multitude of prospects from which sulfide-bearing rocks had been extracted, and (3) the known presence of important concentrations of non-ferrous base metals.

It should be re-emphasized that the object of the survey was to evaluate the potential of the prospect area, as opposed to all individual prospects. Only with this aim was it possible to cover the large area outlined above; frequently, no attempt was made to delineate mineralized areas or geophysical anomalies, only to demonstrate that they exist.

BRIEF HISTORY OF MINING AND EXPLORATION

It seems certain that deposits of sulfide minerals were known to exist in this region more than a century ago, and published references to such deposits are rather numerous after 1860. There are apparently a number of newspaper and magazine articles which bear on early prospecting efforts in coastal Hancock County, but one of the first efforts at a technical presentation was in 1878 by Kempton, dealing with the Sullivan "mining district." The principal period of development was from 1878 to 1883, the so-called "Copper Boom." The "Colby Atlas," published in 1881, shows quite accurately the metal prospects and mineral occurrences as they were known at that date. Details of the activity of this period, both mining and promotional, were reported in part in the Maine Mining Journal, published in Bangor, Maine, from January 1880 to September 1882. A summary of the mining efforts, in a historical setting, was prepared by Perkins in 1941. Mines from which production of ore was reported during the "boom" period were those in the Blue Hill district (principally the Douglas and Twin Lead), Deer Isle, Eggemoggin, Harborside (Cape Rosier), and the West Sullivan group. Since the 1880's, there has been no production from the district except from the Deer Isle mine in 1907 and the Douglas in 1918.

Residents of the area report sporadic exploration activity by both Canadian and American interests in the forty-three years since active mining ceased. These efforts were apparently intensified during periods of high base metal prices, as in the mid-1950's.

The U. S. Bureau of Mines contributed to the knowledge of the area by conducting investigatory drilling at the Tapley copper prospect, Brooksville twp., and the Douglas copper deposit, Blue Hill twp., and both drilling and ore beneficiation tests at the Cape Rosier zinc-copper-lead mine, Brooksville twp. The results of these tests are reported, respectively, in Reports of Investigation 4691, 4701 and 4344.

As might be expected, published references to the activities of private enterprise in the post-mining period are scanty. Levin and Sanford (1948, p. 1, 3) mention drilling at the Cape Rosier Mine by the St. Joseph Lead Co.; Hussey and Austin (1958, p. 11, 16) make note of recent exploration by the Penobscot Mining Corporation at the Cape Rosier property and diamond drilling by Texas Gulf Sulphur at the Douglas Mine property in 1957. Further reference to prospect drilling, four holes drilled by Texas Gulf Sulphur under Second Pond "several years ago," appeared in a lead article in the July 13, 1961 issue of the Weekly Packet, Blue Hill, Maine.

The Northern Miner, a trade journal published in Toronto, Ontario, contains numerous articles, in the period June 8, 1961-December 14, 1961, dealing with the exploration activity, both geophysical surveying and drilling, of Black Hawk Mining Ltd., Montreal, Quebec.

For those interested in the relation of specific companies to particular properties, a search of option and lease agreements recorded in the Registry of Deeds, Ellsworth, will prove enlightening.

REGIONAL GEOLOGY

Geologic maps are available which cover, with differing degrees of accuracy, all or parts of the southern Hancock County exploration area. Keith, in 1933, published a small scale geologic map of the State. Li (1942) compiled a geologic map depicting the geography of an 18-mile wide strip extending from South Brooksville to Lubec; the Castine and Cape Rosier-West Brookville areas are, thus, not included. The original geologic map by Smith, Bastin and Brown, in the U.S.G.S. Penobscot Bay Folio #149 (1907), has provided, through the years, a reliable foundation to which later, more detailed works were added. Forsyth (1953) modified the published formational boundaries in the Blue Hill-Sedgwick area and described the metamorphic facies in the Ellsworth schist, extending somewhat the previous work of Gillson and Williams (1929). Hussey and Austin (1958) contributed significantly by presenting the geology of various areas in southern Hancock County in which sulfide mineral prospects are particularly abundant: (1) Brookville-Castine, (2) Blue Hill, (3) Ellsworth-Surry, and (4) Sullivan-Hancock-Franklin. Wingard's (1961) unpublished maps and petrographic interpretations will form a standard reference for future workers in the western part of the sulfide district.

The detailed geologic relations of the area between East Sullivan and Gouldsboro are not yet clearly defined; the reconnaissance studies of Wing (1958) indicate gross relationships. University of Illinois Ph.D. quadrangle theses in the area, sponsored by the Maine Geological Survey, are in process of completion and will be completed in 1963.

At least one-half of the sulfide district is underlain by intrusive rocks, principally biotite granites but including gabbro, diorite and quartz monzonite. The six larger granite bodies in the Castine-Blue Hill area, some with striking circular outlines, have been described by Wingard (1961) thus: Oak Point, rapakivi type; Wallamanagus, Long Island and Sedgwick, gray-pink and medium-grained; South Penobscot and East Blue Hill, gray and coarse-grained. A rim of diorite separates the South Penobscot granite from the in-
truded host. In the western part of the district, diorites and granites intrude the pre-Middle Silurian Ellsworth schist and Penobscot formation and the Middle or Upper Silurian Castine volcanics. The Ellsworth schist as currently defined (Wingard 1961) is a much more complex stratigraphic unit than that described by Forsyth (1953). The lower Ellsworth is very heterogeneous, containing metamorphosed flow rocks and pyroclastics as well as clastic sediments. In the middle portion of the unit, metasediments, principally green schists, predominate. The upper Ellsworth is composed of schist, gneisses and greenstones. Contact effects, associated with granite intrusion, are marked in certain outcrop areas, and are usually manifest by the development of a mineral suite which includes biotite, cordierite, andalusite, and anthophyllite. The contact effects have been described by Smith, Bastin and Brown (1907), Lindgren (1925), Gillson and Williams (1929), Li (1942), Forsyth (1953), and Wingard (1961). In the interest of geophysical interpretations, it should be noted that graphite, other than as inclusions in metamorphic minerals, is not known to be present in the Ellsworth schist.

Because the unit does not appear to be present in the prospect area (except possibly Highland and Lymburner), the stratigraphy of the Penobscot formation will not be discussed here.

The younger Castine volcanics are restricted to the extreme western part of the area, found principally on the Castine and Cape Rosier peninsulas. In most cases, rock of Castine age are distinctly less metamorphosed than the older Ellsworth. This mapping unit is also heterogeneous, including flow rocks, pyroclastics and sediments. Agglomerates, white vitreous tufts and andesite flows are the most characteristic members.

The relationship of the large, circular granite complex between Franklin and Cherryfield, mentioned by Wing (1953), to the other large granite intrusives of the sulfide belt is not known, as is also the case of the contact between this intrusive and the host quartz-chlorite schist.

One of the most striking aspects of this geologic setting is the spatial relationship between sulfide deposits and granitic intrusions. This fact has been pointed out by almost every author who has discussed the geologic attributes of southern Hancock County, but bears repetition. The restriction of sulfide deposits to the contact zone is spectacular at Sullivan and Blue Hill, but is a general characteristic throughout the area. However, it should be emphasized that, at a few places, notably the Campbell and Franklin prospects, the granite is mineralized. The work performed by Li (1942) led to a set of conclusions which seem to be valid, at least when applied on a regional scale. Li (1942, p. 43) states:

"The relative abundance of some ore minerals in some mines and their total absence in others is dependent upon the distance of the mine from the granite. Pyrite is the most persistent ore mineral and is found in all of the mines discussed. It is particularly abundant, however, in the Blue Hill district, where chalcopyrite, pyrite, and pyrrhotite are the three chief ore minerals. Magnetite also occurs here.

The location of the district surrounded by two granite masses accounts for this high-temperature mineralization.

Ore specimens from the mines along Frenchman Bay, where granite occurs on one side only, show galena as a minor accessory. Chalcopyrite and pyrite remain the chief ore minerals. In mines very near the contact, such as the Franklin Extension Mine, pyrrhotite and arsenopyrite are abundant ... where mines in the Silurian rocks are located at a considerable distance from the granite, sphalerite and galena are the chief ore minerals.

The zonal distribution is thus evident. Copper ores occur in the areas near and surrounded by granite. Zinc and lead deposits occur farther from the granite."

Another approach to the gross problem of sulfide mineralization is that of ultimate control of deposition; that is, foliation vs. fracture, replacement vs. open-space deposition, and pre-v. post-metamorphism. As in the study of nearly all ore districts, this was one of the principal problems facing early workers. Emmons (1910, p. 15), after his studies felt competent to classify the sulfide deposits under the headings of:

A. Deposits older than regional metamorphism,
B. Deposits associated with granite intrusions.

The later work of Li (1942, p. 19) tends to negate the Emmons' classification thus, "those deposits considered by Emmons as of pre-metamorphic origin were actually formed by fluids expelled from the granite."

In an attempt to contribute to the resolution of attending problems, W. F. Stickney, of the Maine Geological Survey, completed a foliation-fracture pattern analysis of the Castine-Blue Hill area as an adjunct to the geophysical program (Maine Geol. Survey, Open File Rept., 1961). The fundamental object of this research was to establish and evaluate relationships between these physical components: (a) foliation in layered rocks, (b) fractures (open and healed), (c) lineation or foliation in intrusive masses, (d) trends of known or inferred mineralized zones, or blind geophysical anomalies.

Methods: The aim of this investigation was to cover the area under investigation with a uniform spread of observations as near as one mile apart as possible. The desired distribution of data was rather readily maintained in the areas underlain by schists and volcanics; however, a good distribution of outcrops was difficult to obtain over the granites. The Sedgwick granite and the interior portion of the East Blue Hill granite are particularly well covered with glacial debris.

Attitudes for foliations and lineations were recorded for each outcrop station. These elements included joints, fractures, foliation, glacial striations, and bedding. A few observations were mapped on oriented feldspar laths, which were occasionally observed in the coarser portions of the granites.

Joints and fractures are well developed in the tuffs and flow rocks of the Castine volcanics; their brittle nature and resistance to subaerial erosion make them excellent recorders of tectonism. Therefore, they became the source of many joint and fracture observations; some outcrops have as many as eight joint systems. Fractures sealed with quartz and similarly healed joints were segregated from the non-sealed joints for analysis, as it may be possible that this gangue quartz, whether "dry" or mineralized, is related to the period of sulfide mineralization over the entire area.

Foliation readings were mainly taken from the Ellsworth schist east of the Sedgwick granite, although a number were mapped from a smaller area of exposure of this schist west of the granite. The volcanics also contain lithologies from which foliations were mapped.

Data presentation: Two methods of plotting the data were used in an attempt to show concentrations of attitudes in the various structural elements observed. All features excepting bedding and lineation of feldspars were plotted on polar coordinate paper in an initial attempt to establish any strike trends which may exist. This procedure is also advisable because many of the data lacked dip angles, which could not be discerned from a large number of ground-level outcrops. For obvious reasons, this was the only method used to plot glacial striations.
As it is desirable to indicate both strike and dip of planar features, three dimensional plots were made for foliation and joints. Few observations were obtained on healed fractures that such an analysis for these features would not be valid. Both foliation and joint plots were made on the Wulff stereographic projection net and the Schmidt equal area net. Only the percentage contour diagrams on the Schmidt net are included in this report.

So few observations were noted on bedding and trends of feldspar laths in the granites they were not plotted; an analysis of their significance is not feasible at this time. In both methods of analysis structures occurring in the plutonic rocks were treated as a group, as were those occurring in the host rocks. It was felt that this procedure might give some idea of the relative ages of the major joint systems occurring in these two rock types. Further, it was thought that tectonic forces causing foliation in the volcanics and metasediments may be reflected as a joint system in the plutonic rocks.

Foliation data: These data appear both as polar coordinate (Plate 2A) and equal-area projections (Plate 3). From the contours of plots on the equal-area net, it is apparent that the dominant foliation trend is northeast, generally with varying dips to the southeast, but with a few steep northwest dips. Strong, isolated highs in the northeast and southwest quadrants, particularly the 6-7% area in the northeast quadrant, indicate a definite foliation trend to the northwest with shallow dips to both northeast and southwest.

The rose diagram of foliation strikes also shows the dominance of northeast trends, with peaks in the ranges N. 15-25°E., N. 30-35°E., and N. 60-70°E. The two northwest peaks, at N. 15-20°W. and N. 65-75°W., stand out over a background of few or no readings.

In the Ellsworth schist bedding is usually obliterated, but where discernible, bedding essentially parallels foliation. It seems evident that regional metamorphism is responsible for the northeast trends of foliation and bedding; variations from this are due to physical injection of the granitic plutons.

Joint-fracture data in host rocks: The strikes of both joints and sealed fractures are plotted on the polar coordinate Plate 4. Three major and one minor trends are evident, roughly east-west, N. 45-60°E., N. 65-75°E., and N. 5-10°E. The strong east-west system may be a set of tension joints owing their origin to a northeast-southwest couple effect, so well shown by drag folding in the Ellsworth schists.

Separation of the gangue-sealed fractures from the joints (Plate 2B), shows that these fractures are the reason for the two highs in the northeast quadrant of Plate 4. This indicates that there may have been two periods of post-metamorphism fracturing, one of which was followed by introduction of silica-bearing solutions. Rocks as old and as well-deformed as the Ellsworth and Castine have undoubtedly undergone several stages of compression and shearing.

A contour diagram (Plate 5) of plots on equal-area projection of 234 joints (no fractures included) shows the dominant east-west strike and steep, north or south dips (45% highs around the north and south poles). Other than these high areas, the contours show a relatively even distribution of poles. It can be concluded that all joints in the host rocks are steeply dipping, regardless of strike.

Joint-fracture data in plutonic rocks: These data are illustrated in the same manner as those concerning the host rocks. Plate 6A represents polar coordinate plots for all joints and gangue-sealed fractures; fractures are plotted separately, but in the same manner, on Plate 6B. Plate 7 is a contour diagram constructed from points plotted on an equal area projection net. Both types of presentation illustrate that a good percentage of the joints trend to the northeast; the 6-7% high areas on the contour diagram show that the dips are vertical or steep to both northwest and southeast. A polar coordinate plot of fractures is presented (Plate 6B) for comparative purposes; the small sample population precludes drawing conclusions from these data.

Glacial striae data: To assist those interested in "boulder-train prospecting," as well as contributing to the knowledge of Pleistocene ice movement, the trends of glacial striae were recorded as a matter of form. A total of 43 outcrops with clearly discernible striae were mapped: the results are plotted in polar coordinate form on Plate 6C. A very prominent peak at N. 10-25°W., represents the dominant areal direction of ice movement. A minor peak at N. 30-35°W, is due either to an earlier period of glaciation or to ice plasticity. The phenomenon of an outcrop showing two clearly defined sets of striae, separated by as much as 15°, is not unusual in this area.

Summary of data: Insofar as foliation is concerned, Stickney postulates that the strong preponderance of northeast trends is the result of pre-intrusion, regional metamorphism, and that consistent departures from this probably result from the physical emplacement of granitic plutons.

Analysis of joints plus fractures in the host rocks shows a predominance of east-west and northeast trends with steep dips. Sealed fractures, considered alone, show a strong N. 60-70°E. trend which correlates with a prominent joint direction in the plutonics. The healed fractures usually transgress foliation. Stickney suggests that these joints may be tension effects related to a northeast-southwest couple, the presence of which is indicated by drag folding in the Ellsworth schists.

The plots of joints-fractures in the intrusive rocks show trend patterns which are much less definite than those in the host rocks. The major point of departure between the two sets of plots is the striking absence of a dominant east-west joint set in the granite plutons. Weak northeast and northwest trends correlate, perhaps fortuitously, with trends in the host rocks. Three-dimension plots (stereographic and equal-area) show that steep dips (>45°) predominate, but that strike trends are not positive. Stickney (1961) postu
A. Polar coordinate diagram of 137 foliation strike observations on the Ellsworth schist and Castine volcanics. One quarter inch equals one observation.

B. Polar coordinate diagram of 60 quartz-sealed fractures occurring in the Ellsworth schist and Castine volcanics. One half inch equals one fracture.

Percentage contour diagram prepared from an equal-area projection plot of 119 foliation observations on the Ellsworth schist and Castine volcanics.
Plate 4

Polar coordinate diagram of joints and sealed fractures in the Ellsworth schist and Castine volcanics. One sixth inch equals approximately one joint or fracture.

Plate 5

Percentage contour diagram prepared from an equal-area projection of 234 joints in the Ellsworth schist and Castine volcanics.
A. Polar coordinate diagram of strike of joints and sealed fractures in plutonic rocks. One quarter inch equals one joint or fracture.

B. Polar coordinate diagram of 33 quartz-sealed fractures occurring in plutonic rocks. One half inch equals one observation.

C. Polar coordinate diagram of 43 glacial striae in southwestern Hancock County, Maine. One quarter inch equals one striation.

Percentage contour diagram prepared from an equal-area projection of 173 joints in the plutonic rocks.
lates that the northeast trend is due to shearing effects of regional metamorphism, the same tectonics which produced the foliation and drape in the metavolcanic rocks. Further, the east-west trend is related specifically to a northeast-southwest couple. However, it appears that the principal joints in the schist and volcanics predate, or formed as a result of the granite intrusions, and that the joints within the granite plutons are nearly random and probably represent a cooling phenomenon.

Comparison of fracture analysis to mineralized zones: As a follow-up to the preceding fracture analysis by Stuckney, the observed or inferred mineralized trends from seventeen prospects were plotted (Fig. 1) and compared to the previously described foliation-joint-fracture plots. Despite the small sample population, comparisons of the various plots show a close correlation between mineralized trends and foliation. Even more striking is the total absence of mineral trends in the predominant east-west joint direction. The close adherence to foliation direction suggests (a) selective replacement along foliation, (b) emplacement along structures formed by the same forces responsible for foliation, or (c) fracturing of selective units which parallel foliation. Likely, all three possible controls were locally effective.

EXPLORATION PROGRAM

The principal object of the Survey-sponsored exploration program was to establish the feasibility of prospecting for sulfides in southern Hancock County with modern, but standard, geophysical equipment. Secondary objects were (1) accurate location of sulfide occurrences, (2) geochemical reconnaissance, (3) examination of selected prospects, both geologically and geophysically, and (4) selection of areas which might be recommended for further investigation.

It must be emphasized that no attempt was made nor intent implied to place a relative "value" on a prospect. Geophysical and geological data were collected and are presented as facts. Whether or not a known prospect constitutes a geophysical or geochemical anomaly is not necessarily a measure of the economic potential of that prospect. Hence, recommendations for additional surveying are based on one or more physical or chemical attribute of the prospect which can be measured through some method described in this report.

Geophysical Surveys

The exploration area, because of outcropping sulfide occurrences, has been the subject of intensive prospecting efforts for at least a century. The probability of locating large sulfide bodies through direct observation, either sulfides or gossan, is considered to be very slight. However, bedrock outcrops are relatively few in this area; the majority of the surface is glacial debris. Therefore, only a small proportion of the potentially mineral-bearing ground has been adequately prospected. The principle of using geophysical instruments to detect sulfide occurrences under cover is well known, having been successfully applied in a number of places. The fundamental question to be resolved in this program, despite its apparent simplicity, had many ramifications; it is not only a problem of whether sulfides occur, but also one of their composition, form of occurrence, depth, thickness, degree of oxidation, magnetism, and conductivity. Which geophysical instruments are best suited to detection of sulfides under given conditions is best determined by empirical observation.

The instruments chosen for basic survey work were magnetometer, self-potential unit and two types of electromagnetic units. It is beyond the scope of this report to discuss the principles on which each method is based; standard texts are available which adequately cover these principles (Eve and Keys, Dobrin, Jakosky). However, as an aid to data interpretation, a brief discussion of selected technical aspects of each method is included.

All geophysical data were taken on survey grid stations, established on Brunton compass-and-chain control. As seen on individual prospect maps, grids varied greatly in size; however, they were usually no smaller than 600' x 800' (three traverse lines 800' long, separated by 300') with stations at 50-foot intervals on both base line and traverses. The size of the final grid was usually a function of the degree to which existing geological conditions (mineralized zones?) reacted to geophysical instrumentation.

It must be pointed out that prospects were evaluated geologically and mineralogically prior to establishing a grid, and, as a general rule, "vein quartz" deposits were not explored geophysically. The character of metal distribution in quartz veins is such that they rarely respond to geophysical methods.

Magnetic surveys: Magnetic surveys were accomplished with a Schmidt-balance, vertical force magnetometer. Field readings were taken at 25-foot or 50-foot intervals along both grid traverses and base line. In reduction, all readings were corrected for diurnal and day-to-day variations. On the various prospect maps, magnetic values have been contoured at intervals designed to best delineate local magnetic features. Variations in vertical intensity are shown with reference to an arbitrary datum, one which is not necessarily the same from prospect to prospect.

Self-potential surveys: The S-P maps show variations in natural earth currents resulting from the spontaneous polarization of a subsurface sulfide or graphitic body. In many cases, this effect is well developed where associated with oxidizing complex sulfide deposits.

In the field, S-P data were taken on 25-foot stations on the traverses and 50-foot stations on the base line. The survey method is best described as the "base line" or "center reel" procedure; all readings were taken from the base line station on each traverse and all traverses were related through readings taken along the base line.

Because anomalous S-P values occupy a wide range, being dependent on many factors, the contour interval may vary from map to map. In each case, the contour interval was selected to best display local polarization effects. Individual S-P anomalies can be evaluated only in terms of existing local factors, including (1) nature and composition of the sulfide body, (2) depth of overburden, (3) amount and character of ground water, and (4) degree of oxidation of sulfides.

Vertical-loop electromagnetic survey: This geophysical method employs a fixed position, generator-powered transmitter, operating at 1000 cps, with the loop in vertical orientation. The portable receiver loop, with amplifier and clinometer, was read at 50-foot stations along the grid traverses at transmitter to receiver separations of 300 to 1000 feet. VLEM data are presented in terms of "dip-angles," which are angular departures from horizontal of the resultant of the primary-secondary fields at receiver stations. "Cross-over" points (point of change from West to East or North to South dips) represent the effective electrical axis.

On all prospect maps showing VLEM data, the position of each transmitter location (set-up) is shown, and the various profiles run from that set-up are designated. This procedure allows better interpretation of the conductor characteristics through analysis of the transmitter-receiver "coupling."
Horizontal-loop electromagnetic survey: In this EM method both the portable transmitter and receiver loops were operated in horizontal attitude. The unit is battery-powered, operates on a frequency of about 900 cps, and the two coils are directly coupled. In the field, the unit is run with a coil separation of 200 feet. Through direct coupling the primary field is compensated, and data recorded are arbitrary percentage values of the in-phase and out-of-phase elements of the vertical component of the secondary field (Sz). In-phase values of minus ten percent, with proportional accompanying out-of-phase deflections, are considered significant. The profiles on accompanying prospect maps are plots of field data taken on 50-foot stations; no correction has been made for possible instrument drift or topographic effects. However, elevation differences between the transmitter and receiver loops are usually expressed by in-phase deflections without accompanying out-of-phase changes (see Hinckley and Douglas-Owen HEM maps).

Geochemical Survey

Introduction: The entire exploration area was covered in reconnaissance by a geochemical survey, one which involved testing water samples for heavy metal (HM) content. The location of individual samples and their respective heavy metal values are shown on accompanying base maps (Plates 8-11). Several areas are recommended for additional evaluation.

Hawkes' (1957) outstanding contribution to the field of geochemical prospecting presents the general philosophy and historical background of the method. Further, the advantages and disadvantages of various individual methods are discussed in considerable detail; they need not be repeated here.

As is true for any exploration program, geophysical or geochemical, many factors had to be evaluated prior to the final choice of a specific method or technique. The principal factors bearing on this particular program were: (a) size of the overall area, (b) size and composition of the mineralized bodies which might be expected, and (c) time and funds available to complete the project. Water sample analysis was a method which met the specifications for an acceptable tool. The ultimate choice of this method was based on the observation that nearly all of the known mineral deposits in the exploration area contained some proportion of zinc, silver, or copper, or perhaps all three elements. Empirical observations by numerous investigators demonstrate that zinc and silver are highly mobile in acid waters rich in sulfate (mineralized environment) and that copper is moderately mobile under the same conditions. The distribution of copper in surface water is definitely restricted by the chemical aspects of the carrier; however, identical factors are not nearly as restrictive in the case of zinc, allowing a much wider distribution from the source area. The basis for water-sample geochemistry is contained in Hawkes' statement (1957, p. 283) that "the elements that can move readily in ground water and soil moisture are in general the elements of high mobility, such as zinc and cobalt. The dispersion patterns caused by them can, of course, be mapped directly by sampling and analysis of the water itself."

Inspection of topographic maps covering the exploration area shows that, under normal climatic conditions, the area is drained by numerous small streams such that a judiciously chosen water sample would test a relatively small drainage area with low contamination probability. In all cases, samples were taken upstream from roads, trails, houses or other cultural elements. Where above-background values were recorded, at least three samples were run; the samples separated by at least several tens of feet. Where a choice was practicable, samples were taken from brooks, cold seeps, or, best of all, springs. The danger

Index map of the southern Hancock County exploration area showing the coverage of each of four geochemical sample location maps.

KEY TO COLOR CODE OF GEOCHEMICAL SAMPLES

Values in ppm, total reacting heavy metals cast in terms of zinc equivalents.

- 0.020ppm (threshold) and below
- 0.020ppm - 0.040ppm
- 0.040ppm - 0.060ppm
- 0.060ppm
PLATE 8. Geochemical Sample Location Map, Section 1.
PLATE 9. Geochemical Sample Location Map, Section 2.
PLATE II. Geochemical Sample Location Map, Section 4.
of artificial contamination in these cases is minimized, as is the effect of dilution by non-metal-bearing waters.

To eliminate, as much as possible, the effects of short-term variations in stream composition due to weather changes, no water samples were taken (for record) for 72 hours after a significant rain. As a further check on weather-caused variations, and chemical reagents as well, two base sample stations (both anomalous in HM content) were established and periodically checked. However, no effort was made to evaluate “delayed” reactions, such as the release of copper or zinc through the decay of leaves. As all of the water samples were taken over a short-time span, the effect of delayed, leaf-decay heavy metal input is considered a constant. Further, no estimate can be made of the day-to-day effects of metal-fixing plants and bacteria in surface water, but, lacking evidence to the contrary, such effects are considered negligible.

Method of analysis: The method of water sample analysis utilized in this survey was essentially that described by Wark (1955, pp. 111-114), which has considerable merit over that used by Huff (1948) and Blois (1956). The field reagents were 0.001% diphenylthiocarbazone (“dithizone”) in chloroform and a combined buffer-indicator-complexing solution. The dry dithizone (in 100 mg units) and certified reagent chloroform were purchased from a commercial supply house; the buffer solution was prepared and certified by a private laboratory. Field solutions of dithizone were prepared as required from a stock solution (100 mg dithizone dissolved in 100 ml chloroform). Chloroform, despite its volatility, was very satisfactory because of: (1) its stability when properly handled, (2) its purity as available from commercial sources, and (3) the rate at which dithizone dissolves in it. Wark (1955, p. 114) states, “Dithizone in chloroform is relatively stable and the dilute solution may last for a week under field conditions.” However, as a precautionary measure, heeding the problems encountered by other workers, dilute field solutions were discarded five hours after preparation. As a result of this precaution, it is believed that none of the reported anomalous values can be attributed to oxidized dithizone.

Individual water samples ranged between 25 ml and 200 ml; the standard sample size was 100 ml. The sample container described by Wark has many desirable attributes, foremost among which is the decreased possibility of physical contamination. The only undesirable feature is the limitation to a small sample (100 ml). In this particular area, 100 ml samples will not allow precise definition of “background level.” Discussion of the problem with other workers led to the design of a larger sample container. A pyrex Erlenmeyer flask of desired volume (500 ml or 100 ml) is chosen and the standard cap is fitted with a piece of pyrex tubing, such that when the flask is stoppered the tubing projects straight downward. The tubing, which is glass-welded to the stopper, is calibrated in 1 ml increments and serves as an internal volumetric flask.

One other word of precaution should be added, because of the relative difficulty with which some metal dithizonates “come down” (copper and nickel), it is recommended that the sample be agitated at least an additional two minutes after the apparent endpoint has been reached.

In summary, this method of sample collection and analysis (1) is simple to perform, (2) requires inexpensive equipment and reagents, (3) requires only a few minutes per analysis, (4) has a high degree of reproducibility, (5) has been proved valid in various geochemical situations, but is undoubtedly most useful in locating sphalerite-bearing deposits.

Survey results: During this reconnaissance geochemical survey, water samples were collected and analyzed from 215 separate localities representing swamps, lakes, springs, brooks, and streams. Nearly all of these localities are shown on accompanying maps (Plates 8-11). Analysis of survey results established areal background as 0.020 ppm (threshold) or less; heavy metal values being presented as parts-per-million, with all of the reacting metals cast as zinc equivalents (see Fig. 2, Wark, 1955, p. 113). The percentage breakdown of number of samples vs. heavy metal content is as follows:

<table>
<thead>
<tr>
<th>Classification</th>
<th>Percent</th>
<th>HM content, ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background</td>
<td>80.9%</td>
<td>&lt;0.020</td>
</tr>
<tr>
<td>Low</td>
<td>15.8%</td>
<td>0.020 - 0.040</td>
</tr>
<tr>
<td>Moderate</td>
<td>1.4%</td>
<td>0.040 - 0.060</td>
</tr>
<tr>
<td>High</td>
<td>1.9%</td>
<td>&gt;0.060</td>
</tr>
</tbody>
</table>

Despite efforts to secure samples free of contamination, a small number of the recorded anomalous values probably represent culture.

Many of the slightly above-threshold values recorded can be evaluated only in the light of additional work. However, several of the anomaly areas may be singled out for special attention.

West Castine Area; Plate 8: although it is unlikely that the anomalous content of heavy metals detected in samples from these three sites represents a mutual source, the proximity of one to another is suspicious. All of the samples were in the “Low Value” category (<0.030 ppm), but they were reproducible. Further investigation of the Bog Brook drainage area is indicated.

Highland Prospect Area; Plate 8: local water sample values have been cited elsewhere in this report (Plate 24). Because of the known existence of base metal sulfides and the abundance of springs and seeps in the headwater area of Smelt Brook, detailed geochemical prospecting in this restricted basin may prove valuable.

Campbell Prospect Area; Plate 8: prospecting efforts (pits, trenches, etc.) here have been so slight that they cannot be considered a contributor of contamination. Because of the widespread heavy cover in this area, sampling of all springs, bogs, and seeps is a logical prospecting approach.

Cape Rosier Area; Plate 9: this small area contains a relatively high percentage of anomalous values; however, four of these are only very slightly above threshold. The samples at elevation 102 one-half mile northwest of Cape Rosier P. O. and on Blake Point may have been contaminated. However, the two samples between Cape Rosier P. O. and the head of Weir Cove appear valid, as does the anomalous sample closest to Cape Rosier. The heavy metal content in these three water samples (0.035-0.040 ppm) approaches the “Moderate Value” level.

Second Pond Area; Plate 9: the values recorded in this drainage area classically represent massive contamination and natural anomalies. The miles over which the water has a greater than normal metal content attests to the number of mineralized zones, the amount of contamination, and the inherent mobility of zinc in surface water. Except in areas of very limited size, it appears impossible to separate natural contributions (such as the zone under Second Pond) from sources of contamination (tailings and open workings).

West Franklin Area; Plate 10: the one high value recorded here is undoubtedly a contribution from the local Franklin-Franklin Extension zone.

Alder Brook, Franklin Twp.; Plate 11: the anomalous value probably results from road construction at a point between the two sample sites.
INDIVIDUAL PROSPECTS

In the following prospect descriptions, names which have applied in the past are retained (appearing in quotations); if the prospect has not been previously described, or if the designation is of dubious validity, the name of the principal current landowner is used. As an aid to location and access, the known landowners are listed for each prospect. No attempt has been made to verify ownership claims or reported property lines, and it is possible that landowners other than those listed are involved.

In those cases wherein the State of Maine is listed as an owner, part or all of the grid area or prospect lies under a great pond or involves tidal lands. A full explanation of the legal aspects of this situation may be found in the Maine Mining Law for State-Owned Lands — Chapter 135, Public Laws of 1959. In these particular cases, mineral rights held by the State are open to staking.

INDEX NO. 1: "EMERSON" - "NORTH CASTINE" PROSPECT

Location: Castine Twp.

Ownership: August C. Flamman
North Castine, Maine

Frank L. Wiswall
North Castine, Maine

Mervin A. Wood
West Castine, Maine

Geology: The only known outcrops on this prospect are found at the extreme north end of the grid, along the Bagaduce River (Plate 19). In this area two lithologies, both characterizing the Castine formation, are found. The most prominent outcrop (1N + 0) is composed of agglomerate, rounded to sub-rounded fragments of white vitreous tuff in a matrix of foliated gray tuff (foliation: N.50°E.; 75° NW-vertical) (Plate 18A). The fragments, ranging in size between 1.4" and 10", are elongate parallel to the foliation. All of the outcrops in this particular area show the effects of glacial erosion; the glacial striae strike N.13°W. (Plate 18B).

Most of the dump rock around both shafts is homogenous, devitrified, light gray tuff, varying in structure from massive to well-foliated. The large fragments may contain several thin, coarser grained intercalations. These specimens indicate that the foliation, in all cases, probably parallels bedding.

Outcrops along the shore around 0 + 1E are all massive, white, vitreous tuff, which may contain up to several percent of pyrite as disseminated cubic crystals. Foliation is essentially absent in this rock type (bedding: N.41°E.; 79° SE), in sharp contrast to the highly foliate tuff agglomerate at 1N + 0. One small outcrop is mineralized with thin stringers of sphalerite and exsulfide (iron oxides).

Sulfide-bearing dump rocks, presumably from local workings, are scattered around the North Castine shaft area. The sulfides identified in hand specimens are pyrite, sphalerite, galena, and chalcopyrite. Pyrite is dominant, occurring as crystalline and fine...
PLATE 12. Prospect Location Map, Section 1.
PLATE 13. Prospect Location Map, Section 2.
PLATE 14. Prospect Location Map, Section 3.
PLATE 15. Prospect Location Map, Section 4.
PLATE 16. Prospect Location Map, Section 5.
grained aggregates. The massive pyrite tends to be low in values; high-grade zones are usually fracture fillings in vitreous tuff ("hornstone"). In general, the sulfides occur as (1) massive aggregates, (2) disseminated grains in both vitreous ("hornstone") and devitrified tuff, and (3) small fractures.

An assay run on a composite grab sample from the dump at IN + 0 yielded the following metal content:

<table>
<thead>
<tr>
<th>Metal</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>0.130 oz./ton</td>
</tr>
<tr>
<td>Silver</td>
<td>4.6 oz./ton</td>
</tr>
<tr>
<td>Lead</td>
<td>6.4%</td>
</tr>
<tr>
<td>Copper</td>
<td>0.163%</td>
</tr>
<tr>
<td>Zinc</td>
<td>10.5%</td>
</tr>
</tbody>
</table>

Jointing is well-developed in both lithologies; following is a tabulation of the joint surfaces measured:

<table>
<thead>
<tr>
<th>Strike</th>
<th>Dip</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.62°W.</td>
<td>60°SW</td>
</tr>
<tr>
<td>N.33°W.</td>
<td>70°NE</td>
</tr>
<tr>
<td>N.82°W.</td>
<td>41°SW</td>
</tr>
<tr>
<td>N.18°W.</td>
<td>vertical</td>
</tr>
<tr>
<td>N.05°E.</td>
<td>47°SE</td>
</tr>
<tr>
<td>N.12°E</td>
<td>63°SE</td>
</tr>
<tr>
<td>N.50°E.</td>
<td>vertical</td>
</tr>
<tr>
<td>N.70°E.</td>
<td>vertical</td>
</tr>
<tr>
<td>E-W</td>
<td>vertical</td>
</tr>
</tbody>
</table>

Geophysics: Considered individually, the various geophysical surveys show positive results, but not spectacular anomalies. It is through excellent correlation that the geophysical data become impressive. The self-potential survey (Plate 20) revealed only one area of significant spontaneous polarization, that beginning on traverse 9W and extending southwestward through traverse 15W. The zone of greatest magnetic (Plate 21) activity is somewhat displaced from the S-P axis, but does occupy the same general area, between traverses 9W and 15W. Both electromagnetic surveys (VLEM and HEM) indicate zones of conductivity which nearly duplicate the S-P axis. The width of the zone of negative HEM deflection suggests that the conducting zone will be measured in tens of feet (Plate 23). The symmetry of both HEM and VLEM profiles (Plate 22) reveals a steep (near-vertical) dip for the conductor.

Wingard (1961, p. 41) states that "East of Negro Island a series of black, graphite slates and quartzites occurs but soon disappears beneath cover. The same rock types on the south shore of Hatch Cove also disappear beneath cover." Despite the fact that both cited localities are in the general area of the prospect, it appears doubtful that the geophysical anomalies are "stratigraphic," that is, related directly to graphite-bearing units. Waste rock removed from underground workings directly on strike contain no obvious graphite. The characteristics of the conducting zone (irregularity, apparently relatively
low specific conductivity, termination) are more suggestive of a conductive complex sulfide body than a uniform stratigraphic unit. Further geophysical evaluation to the southwest will assist in determining the anomaly cause.

INDEX NO. 2: “HIGHLAND” PROSPECT

Location: Penobscot Twp.

Ownership: Frank R. Devereux
North Castine, Maine

Eugene N. Lymburner
Brooksville, Maine

Geology: The general area of the Highland Prospect has been mapped as being underlain by Castine volcanics (Wingard, 1961). In the approximately sixty-two acres covered by the Highland grid no naturally outcropping rocks were located. Bedrock is exposed for examination in the pit at grid coordinates 3\(^2\)S + 0. A large amount of dump rock is available for inspection at the Highland shaft at grid coordinates 0 + 0 (Plate 24).

The dump rock at the main shaft (0 + 0) is almost entirely rusty, chlorite schist heavily impregnated with pyrite. The pyrite occurs as leaves or pods strung out parallel to foliation. Cubic pyrite crystals are present, but not abundant. Small amounts of chalcopyrite were detected in dump specimens.

The geologic situation at the pit (3\(^2\)S + 0) is apparently somewhat different. Specimens of the chlorite schist previously described are also present in the dump rock at this pit, carrying, in general, less pyrite and displaying a more massive form. However, the greater proportion of the dump rock is of a lithology not seen at the main shaft. This rock, which is exposed in the pit walls, is dark gray with a slight green tint, medium-grained and has a fairly even fabric. From hand-specimen examination the rock appears to be made up almost entirely of bladed and radiating ferromagnesian minerals (amphibole?). In addition to the silicates, sulfides and magnetite are present. Of paramount importance is the fact that the sulfides in this rock type are mainly pyrrhotite and chalcopyrite. Both sulfides occur as disseminated grains, finely crystalline aggregates and thin, short stringers. Very small amounts of secondary bornite are present. Several dump rock specimens contain thin (\(\frac{1}{2}\)" - \(\frac{1}{4}\)"), white quartz veins, which are usually mineralized.

A composite assay of both mineralized schist and "altered" rock gave a copper content of 0.504\%/\(\text{Cu}\), gold, silver, lead, and zinc were not present in detectable amounts.

On the basis of rock type and magnetic data, it is proposed that the area around 3\(^2\)S + 0 was a center of hydrothermal mineralization; chalcopyrite, pyrrhotite and magnetite were deposited and the introduction of water and silica resulted in the widespread development of amphibole (from chlorite) and limited silicification.

Geochemical Survey (Plate 24): Examination of the Highland culture map will show that the grid area is particularly well-suited for water analysis study. Springs and seep-areas, both with significant discharge rate, are fairly abundant in the central and southwestern parts of the grid. Water samples from all springs and brooks were tested for total heavy metals (HM). The regional "water background" is approximately 0.015 ppm HM. The highest value recorded on the Highland grid is 0.090 ppm HM (this also represents the highest "uncontaminated" water value recorded during the entire geochemical survey). Water from two springs, both about 100 feet west of the base line between traverses 3S and 6S, contained 0.090 ppm HM. Values for water samples taken at other places on the grid (except that at 12S + 1W) reveal a relatively rapid drop-off in HM content which continues at such a rate that less than one-half mile downstream the water no longer contains detectable heavy metals in anomalous amounts. The value of 0.085 ppm recorded at 12S + 1W indicates that the HM source must be quite nearby.

The rapid drop-off in total HM content downstream from the spring source emphasizes the fact that the predominant HM is not highly mobile in aqueous solution. This fact, coupled with the color of the metal dithizonate extracted from stream sediment samples, strongly suggests that copper is the principal heavy metal ion in the water samples.

It should be noted that the HM content of the water standing (stagnant) in the pit (3\(^2\)S + 0) is lower than that of the high-discharge springs. It is obvious, then, that the HM content of the springs and seeps is not controlled by existing workings, but by a source whose base metal contribution is more massive.

Geophysical Surveys: There is little question of the fact that the data obtained through geophysical surveys on the Highland grid are more impressive than any other prospect reported on herein. Agreement between techniques is good, but not complete. For this reason, and because the EM data are fairly complex, data from each survey method are discussed individually:

Horizontal-loop EM (Plate 25): All grid lines were traversed with horizontal-loop EM equipment. Readings were taken on fifty-foot stations. As few as two and as many as four conductors were mapped on each traverse line. In-phase values over most of the zones were in the moderate range (25%/35%); however, a few were very high (50%). The ratio of out-of-phase to in-phase values (at the point of maximum in-phase deflection) generally lies in the range 1:5-1:8, with extremes of 1:3 and 1:16. It may be of importance to note that the symmetry of in-phase profiles rarely carries from line to line; the striking exception is the correlation between traverses 9S and 12S.

Comparison of spatial distribution of anomalous values and old workings shows poor correlation; the nearest conductor is some one hundred feet from the southern pit. Comparison between geochemical samples and conducting zones emphasizes the importance of the small, eastern conductor and the large, central conductor.

On the basis of symmetry of in-phase profiles, the conducting zones appear to be nearly vertical in attitude, or dipping steeply to the southeast.

Vertical-loop EM (Plate 26): This survey contributed significantly to the overall picture by establishing the continuity of each of the three conducting zones and extending the known length of the eastern conductor. The symmetry of dip-angle profiles corroborates dip data drawn from HEM profiles, that is, the conductors are near-vertical or dip steeply to the southeast. On the VLEM map, dip angles greater than 45° are plotted as 45°.

Through extended length, the presence of nearby outcropping sulfides, and positive geochemical data, the eastern conductor assumes greater importance.

Magnetometer Survey (Plate 27): Contoured at 100 gamma intervals, one small area on the Highland grid is obviously anomalous. In the area around the southern pit (3\(^2\)S + 0) there is a dipolar magnetic anomaly with vertical-intensity relief of more than 2600 gammas. Part of the magnetic zone coincides with the easternmost EM axis.
The southern end of the central EM axis is generally marked by a broad, low-value magnetic zone.

The high-value magnetic zone correlates well with the geochemical anomaly.

Self-potential Survey (Plate 28): Electromagnetic conductors, because they most frequently are near-surface sulfide accumulations or graphitic zones, usually correlate well with anomalous spontaneous polarization. In this aspect, the S-P data are both positive and puzzling. The eastern conductor and the magnetic anomaly are well-marked by a persistent S-P anomaly along the center of which potential values approach one-half volt. The central conductor coincides in part with a rather ill-defined conductor and parts of the central conductor are not expressed at the surface by a significant variation in natural potential. There is no apparent reason for the absence of S-P confirmation of the western and central conductors, especially in those areas where the conducting material must be very near the surface (central conductor, 9S and 12S). It is possible that (a) the western conductor is a water-filled shear zone, or that (b) the conductor is overlain by a thick, relatively impermeable overburden. The electrical characteristics of the zone indicate that (a) is highly unlikely; without additional information it is not possible to evaluate (b).

Regardless of the problems of interpretation of geophysical data which currently exist, the Highland grid should be extended in all dimensions and a comprehensive geochemical and geophysical survey carried out. At this stage, positive geochemical-geophysical data and evidence indicating local hydrothermal mineralization suggest that this specific area is one of the most likely in the entire region.

INDEX NO. 3: LYMURNER PROSPECT

Location: Penobscot Twp.

Ownership: Eugene N. Lymurner
Brooksville, Maine

Edgar L. Torrey
North Sedgwick, Maine

Geology (Plate 29): The prospect pit on the Lymurner grid is approximately 2,000 feet east of the Highland shaft. According to Wingard (1961), this grid, like the Highland, is underlain by Castine volcanics. The only bedrock outcrop known to occur within the grid limits is that in the small pit at coordinates 4N + 0.6E. Examination of the weathered outcrop and dump specimens indicates that the country rock is a quartz-mica (sericite) schist with varying amounts of iron sulfide (all pyrite?) and magnetite. A selective assay of a composite grab-sample from the dump revealed the following metallic components:

<table>
<thead>
<tr>
<th>Metal</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>trace</td>
</tr>
<tr>
<td>Silver</td>
<td>0.02 oz./ton</td>
</tr>
<tr>
<td>Lead</td>
<td>none</td>
</tr>
<tr>
<td>Copper</td>
<td>0.100%</td>
</tr>
<tr>
<td>Zinc</td>
<td>trace</td>
</tr>
</tbody>
</table>

Geochemical Survey (Plate 29): The Lymurner grid is devoid of water except for a seep area on the south of traverse “O.” Water samples from the seep were analyzed for HM content several times over a 30-day period. In all instances the HM content consistently 0.079 to 0.080 ppm (4x5 background). As the closest drainage divide is only a thousand feet distant, it is assumed that the extremely high HM content is a very local contribution. It is also assumed that a large proportion of the dissolved heavy metals is copper.

Geophysical Survey: Important geophysical anomalies were mapped by all geophysical methods applied. However, as was the case at the Highland Prospect, there is not complete agreement in the spatial relations of the various anomalies. The horizontal-loop EM equipment mapped a conducting zone on all five traverse lines (Plate 30). Over this northeast-trending zone the total in-phase relief approached 60%, (traverse “0”) and the ratio of total out-of-phase deflection to total in-phase deflection lies in the range 1:3-1:7. On traverse lines “0” and 3N, the in-phase profile has unusually large marginal build-ups. Data obtained through the vertical-loop EM survey (Plate 31) show that the conducting zone is continuous throughout the grid area and that the dip of the conducting zone is near-vertical or steep to the southeast. Trends of contours showing variations in vertical magnetic intensity (Plate 32) correlate well with the conducting axis, which lies approximately 100 feet northwest of the only mineralized outcrop. The magnetic relief is hardly spectacular, between 300 and 500 gammas, but the magnetic trend is fairly well defined. On the other hand, the S-P anomalies apparently trend north-south (Plate 33) and the only high-value anomaly (>600 mv) does not coincide with the conducting zone, as mapped. The S-P anomaly does have slight magnetic expression, but EM confirmation is nebulous (slight out-of-phase deflection?). There is no ready explanation for the lack of correlation between the S-P anomaly and magnetic-conductive zones.

On the basis of outcropping sulfides, positive geophysical data and HM content of water, the grid area should be extended northeast-southwest and a comprehensive geo-physical survey completed. Soil sample analysis, on a regular grid spacing, would be of obvious advantage.

INDEX NO. 4: “HERCULES” PROSPECT

Location: Penobscot Twp.

Ownership: Mr. Fred Moseley
Castine, Maine

State of Maine
Maine Mining Bureau
Augusta, Maine

Geology (Plate 34): As well as can be determined, the mineralized zone at the Hercules Prospect is in an outlier of Castine volcanics. A nearly continuous section of rocks is exposed along the west side of the cove and an isolated outcrop is exposed in the area around grid coordinates 4N + 1E (at low tide). Several rock types are present in the section; on the small island at 4N + 1E are thin-bedded flows, more massive andesitic...
flows and spotted schists (mafic clots in flows of intermediate or acid composition); along the west side of the cove, between “0” and 4N, the exposed beds are mostly thin-bedded tuffs and flows which are light gray on weathered surface and dark purple-gray when fresh; on shore immediately west and southwest of the Hercules shaft are “more typically” Castine volcanics, consisting of white vitreous tuff (sericitized and carrying pyrite) and gray tuff with pyrrhotite. Rocks which are host to the mineralized zone apparently do not outcrop on shore in this local area. The sulfide-bearing tuffs which outcrop west of the shaft probably constitute the hanging wall of the mineralized zone.

Where both can be observed, bedding and weak foliation are parallel, striking due North to N.20°E and dipping 70°-75° westward. Drag folds are common and well displayed on the island outcrop at 4N + 1E. At this point the drags are repeated several times and usually involve several lithologies. Drag axes plunge approximately 90° and the fold forms indicate that the east side moved relatively northward. Prominent joint surfaces have these attitudes:

<table>
<thead>
<tr>
<th>Strike</th>
<th>Dip</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.16°E</td>
<td>46°SE, 65°NW</td>
</tr>
<tr>
<td>N.26°E</td>
<td>30°SE</td>
</tr>
<tr>
<td>N.35°E</td>
<td>35°SE</td>
</tr>
<tr>
<td>N.70°E</td>
<td>43°NW</td>
</tr>
<tr>
<td>N.80°E</td>
<td>76°NW</td>
</tr>
<tr>
<td>N.45°W</td>
<td>vertical</td>
</tr>
</tbody>
</table>

Quartz-healed fractures, some carrying minor iron sulfides, strike N.05°E and N.40°W. These veins appear to be definitely joint controlled; some present a sinuous pattern, others are en echelon.

Approximately 350 feet southwest of the main shaft a sulfide-bearing vein outcrops along the high-tide shore line. The host of the vein appears to be a sheared, white vitreous tuff. The vein, which occurs along a minor shear, strikes N.23°E and dips 70°NW. The vein matrix is sugary white quartz and the sulfides recognizable in hand specimens are sphalerite, galena and pyrite. An assay of the outcropping vein yielded the following analysis:

- Copper: 0.113%
- Zinc: 4.9%
- Silver: 0.6 oz./ton
- Lead: 3.8%

The sulfides are not restricted to the quartz vein but also occur as small stringers in the sheared tuff. Sericite is an obvious alteration product usually found on fractures in the tuff near the mineralized zone.

The main Hercules shaft is accessible only at low tide; at high tide it is approximately 115 feet offshore (Plate 35A). The shaft, reportedly 80 feet deep, is vertical and two compartment (4’ x 8’). Sulfides are abundant in the dump material around the shaft collar, and it is assumed that they are representative of the Hercules zone. In decided contrast to the outcropping mineralized vein, sulfides from the shaft are in massive form; usually, the predominant mineral is pyrrhotite (magnetic). In hand specimen, sphalerite appears to be the most abundant ore mineral, occurring as thin, high-grade segregations and disseminated through the pyrrhotite host. Galena follows the same general mode of occurrence, but is far less abundant. The only chalcopyrite observed occurs as small, irregularly distributed grains. Pyrite is widespread, but is definitely subordinate to pyrrhotite in quantity. Wall rocks, as seen on the dump, appear to have undergone mild sericitization and stilification, as a consequence of hydrothermal mineralization. An assay analysis of a composite grab-sample of dump specimens is:

- Gold: 0.020 oz./ton
- Silver: 4.4 oz./ton
- Copper: 2.6%
- Lead: 0.289%
- Zinc: 4.5%

Geophysical Survey: Because of the rather unusual geographic setting of the area of known mineralization, geophysical exploration of the Hercules Prospect encountered rather unusual problems. Only one survey was made, vertical-loop EM (Plate 34). This method was chosen, despite the conductive surroundings (salt water Bagaduce River), because the massive magnetic pyrrhotite should constitute an excellent conductor. In order to energize the conductor as strongly as possible, the transmitter loop was placed adjacent to the main shaft. As can be seen by data plotted on accompanying map, the VLEM survey was eminently successful. Because of the unusual nature of the dip-angle profiles, a few words of explanation are offered. On the east end of the profiles on 4N, 6N and 8N the dip angles were very obviously influenced by the proximity of salt water, with resulting high west dips. However, on 4N and 6N, there are dip reversals and normal cross-overs were recorded (4N + 0.45E and 6N + 1.5E). That these dip reversals occur in the presence of strong surface conductivity is a measure of the high conductivity (and size and/or depth?) of the subsurface mineralized zone.

In addition to the geophysical data supporting the presence of a mineralized zone which might be inferred geologically, a totally unexpected series of strong cross-overs (or indications) was mapped west of the base line on all traverses. The cross-overs are remarkably sharp and display very high dip angles. Horizontal-loop EM profiles across this conductor axis on 6N and 8N display low in-phase readings (~7%), and high out-of-phase readings (~6%), with a ratio of approximately 1:1. All of the EM data indicates a very thin, very shallow conductor. These characteristics, coupled with the orientation, suspiciously straight trace of the conductor axis, and the presence of a spring pond several hundred feet northwest of the cross-over at 11N + 4.1W, indicate that the conductor may be culture. It is proposed that this conductor is a metal pipe, once used to supply fresh water to the mine site.

On the basis of the surprisingly good results obtained in this reconnaissance survey, further VLEM work appears justified to trace and evaluate the conductor marked by the cross-overs at 4N + 0.45E and 6N + 1.5E. In light of the moderate magnetism of the pyrrhotite, magnetometer surveying also appears in order.

CONTOUR INTERVAL. 100 millivolts

DATUM: local

3W 2W 1W 0 3E 2E 1E 0

100 200 FEET

0 100 200
INDEX NO. 5: CLYDE LIMEBURNER PROSPECT

Location: Penobscot Twp.

Ownership: Clyde Limeburner
Brooksville, Maine

Geology: The country rocks at this prospect are fine-grained quartzites and dark schists of the Ellsworth formation. In this immediate area the foliation of the schists strikes due North to N.05°E. and dips range between vertical and 75° westward.

Workings consist of one small pit, five feet deep and ten feet in diameter. Sulfide minerals, identified as sphalerite, galena, chalcopyrite, and pyrrhotite, are relatively abundant in the rock fragments scattered around the pit area, and may be seen in one outcrop in the pit wall. The sulfides occur as disseminated grains and hair-line stringers in quartzite. White mica (sericite?) is nearly invariably present in the areas of sulfide development.

Assay:

Gold: 0.020 oz./ton
Silver: none
Lead: 0.3%
Copper: 0.100%
Zinc: 0.7%

Mixed with the dump rock there are several blocks showing a six-inch granite dike, mineralized as the host rocks. This dike could not be located in outcrop.

Geophysics: This prospect was the last visited during the field season and time was not available for a complete geophysical evaluation. One east-west self-potential traverse, 800 feet long, was run. As shown on the accompanying profile (Plate 36), the position of the area of known mineralization is not reflected; the potential low on the west end of the profile is over very fine-grained, very dark schist (not obviously graphitic).

Because of the nature of the sulfide mineralization (disseminated, non-magnetic grains), it is doubtful that ordinary geophysical means will detect and delimit the mineralized area. However, soil cover in this area appears to be quite thin and geochemical soil sampling may prove of value.
INDEX NO. 6: "PENOBSCOT" PROSPECT

Location: Penobscot Twp.

Ownership: Carl H. Wardwell
Blue Hill, Maine

Geology (Plate 37): The Penobscot Prospect is in a northerly-trending belt of Ellsworth schist lying between the East Blue Hill granite on the east and the South Penobscot granite and diorite on the west. This particular site is in the biotite facies of the Ellsworth schist. Within the grid limits outcrops are relatively scarce; where available for measurement the foliation strikes N.30°E.-N.40°E. and dips in the range 45°-60°SE. Workings consist of two pits; the larger is open and plumbed to a 23' depth, the other is filled but the owner places the depth at 10 feet. These pits were obviously put down on a 12°-15° milky quartz vein which strikes N.85°E. and dips approximately 90°. Samples of the vein show small amounts of a carbonate mineral, probably ankerite. The pyrrhotite is obviously preferentially present in the wall rock adjacent to the vein.

Geophysical Surveys: Because of the presence of pyrrhotite in the host rocks, a small reconnaissance grid was laid out and surveyed in routine manner. Neither type of EM equipment located a conductor and it is assumed that none is present. Magnetic and self-potential surveys did, however, indicate minor anomalies (Plates 38, 39).

INDEX NO. 7: HARBORSIDE MINE (CAPE ROSIER, CAPE ROZIER)

Location: Brooksville Twp.

Ownership: Harborside Mining Corporation
Harborside, Maine

State of Maine
Maine Mining Bureau
Augusta, Maine

Comments: Because of the relatively large amount of drilling and development which has taken place at this property since 1940, the Harborside mine area was not surveyed as part of the 1961 exploration program. U. S. Bureau of Mines Report of Investigations 4344 (September 1948), titled "Investigation of the Cape Rosier Zinc-Copper-Lead Mine, Hancock County, Maine," is the most complete published reference treating of this prospect. The prospect is indexed for purposes of location only.

INDEX NO. 8: "JONES" (JONES-DODGE) PROSPECT

Location: Brooksville Twp.

Ownership: Miss Emily Jones
Brooksville, Maine

Geology (Plate 40): The geologic relations at the Jones Prospect are somewhat more complex than those previously described. The section is nearly 100 percent exposed along the shoreline of the Bagaduce River; inland, outcrops are scarce. Rocks representative of both the Ellsworth schist and the Castine volcanics are present on the grid. For the specific distribution of each unit, the geologic map of the grid area (Plate 40) may be consulted. Rock types mapped as Ellsworth are: meta-conglomerates, meta-arkoses, meta-greywacke, quartz-hornblend-chlorite schist, and quartz-biotite (-cordierite?) schist. Coarse, massive agglomerates and light-colored tuffs are the most prominently displayed representatives of the Castine volcanics.

Rapid changes in bedding and foliation attitude are common, as are local folds and minor shear zones. Certain of these elements appear on the geologic map.

Sulfide minerals are found in both the Ellsworth schist and Castine volcanics. Iron sulfides predominate in the schists and iron sulfides with locally abundant sphalerite, galena, and chalcopyrite in the tuff.

Prospect workings, both old and recent, are relatively common. For ease of description, these workings are grouped into "pit areas" 1, 2, 3, and 4.

Pit Area #1: Along the shore around the north of grid coordinates 0 + 7E there are several old, partly filled trenches and a series of recent, well-exposed blast-hole pits and trenches. The zone in which sulfide mineralization took place is, in places, rather spectacular, consisting of veins and stringers of sphalerite (ruby and black) galena, chalcopyrite, and pyrite in shattered vitreous tuff. Vein quartz usually accompanies the sulfides predominate in the schists and iron sulfides with locally abundant sphalerite, galena and chalcopyrite in the tuff.

Pit Area #2: The only development in this area is one 8' x 12' shallow pit which lies about 200 feet north of grid coordinates 0 + 3E. The country rocks are quartz-chlorite-biotite schists (Ellsworth), which are sericitic in part. Sulphides consist almost entirely of pyrite, as crystals and disseminated grains, strung out in aggregates parallel to foliation. Occasional chalcopyrite grains may be seen in hand specimen.

Assay: (composite from the recent trenches)

<table>
<thead>
<tr>
<th>Element</th>
<th>Assay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>0.015 oz./ton</td>
</tr>
<tr>
<td>Silver</td>
<td>0.3 oz./ton</td>
</tr>
<tr>
<td>Lead</td>
<td>2.8%</td>
</tr>
<tr>
<td>Copper</td>
<td>0.289%</td>
</tr>
<tr>
<td>Zinc</td>
<td>4.8%</td>
</tr>
</tbody>
</table>

Pit Area #3: The prospect is indexed for purposes of location only.
Assay: (composite dump sample)

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<tr>
<th>Element</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>trace</td>
</tr>
<tr>
<td>Silver</td>
<td>none</td>
</tr>
<tr>
<td>Lead</td>
<td>none</td>
</tr>
<tr>
<td>Copper</td>
<td>0.050%</td>
</tr>
<tr>
<td>Zinc</td>
<td>none</td>
</tr>
</tbody>
</table>

Pit Area #3: The largest amount of prospecting development apparently took place in this area, around grid coordinates 0 + 0. The old workings consist of a shallow 8’ x 8’ pit and a 10’ x 10’ vertical shaft of undetermined depth (at least 20 feet). The Ellsworth schist section is well exposed on the adjacent shoreline and includes impure quartzites, quartz-biotite schist, and quartz-biotite-cordierite schist. There are no local structures except jointing and one zone of sheeting near the pit. Thin quartz veins are prominently developed on the shore point, and sericitic alteration is a striking feature along the sulfide zone. Sulfides are scarce in dump rock, only pyrite was observed.

Pit Area #4: This area centers around grid coordinates 8S + 5E. The bedrock, exposed in a series of trenches and one large pit, is of Castine age and consists of white to gray vitreous tuff and tuff agglomerate. The large pit (12’ x 12’) (Plate 35B) was blasted out in recent years and the mineralized rock is fresh and clean. The principal ore mineral present is sphalerite; subordinate ore minerals are galena, chalcopyrite and chalcocite. Pyrite is fairly abundant, occurring usually as scattered crystalline aggregates, but in one place constituting a two-inch massive seam. The sulfides occupy a shattered zone which trends due north and dips steeply to the east. The mineralized zone extends completely across the pit.

Assay: (composite dump sample)

<table>
<thead>
<tr>
<th>Element</th>
<th>Result</th>
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</thead>
<tbody>
<tr>
<td>Gold</td>
<td>0.010 oz./ton</td>
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<tr>
<td>Silver</td>
<td>0.60 oz./ton</td>
</tr>
<tr>
<td>Lead</td>
<td>5.4%</td>
</tr>
<tr>
<td>Copper</td>
<td>0.705%</td>
</tr>
<tr>
<td>Zinc</td>
<td>7.8%</td>
</tr>
</tbody>
</table>

(composite dump sample — collected by R. G. Doyle)

<table>
<thead>
<tr>
<th>Element</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>none</td>
</tr>
<tr>
<td>Silver</td>
<td>0.42 oz./ton</td>
</tr>
<tr>
<td>Lead</td>
<td>2.85%</td>
</tr>
<tr>
<td>Copper</td>
<td>0.10%</td>
</tr>
<tr>
<td>Zinc</td>
<td>6.0%</td>
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</tbody>
</table>

Geophysical Surveys: The entire grid area, as shown on the geologic map, was covered by vertical- and horizontal-loop EM, self-potential and magnetic surveys. The results of both EM surveys were negative; it is assumed that there is no conductor of
PLATE 37. Geology-Culture: Penobscot Prospect, Penobscot Twp.

EXPLANATION

- foliation attitude
- pit
- outcrop
- rock dump
- --- woods road
- --- trail
- --- stream

ELLSWORTH SCHIST

CONTOUR INTERVAL: 50 millivolts
DATUM: local

CONTour INTERVAL: 50 millivolts
DATUM: locol

0 100 200 FEET

0 100 200 300 400 500 600

0 200 400 600 800

0 300 700 1000

3E 4N

0 100 200

3W
EXPLANATION

- foliation attitude
- plunge of minor fold
- glacial striae
- outcrop
- pit or trench
- shaft
- rock dump
- woods road
- stream

ELLSWORTH SCHIST
CASTINE VOLCANICS

PLATE 40. Geology-Culture: Jones Prospect, Brooksville Twp.
significant length within the grid limits. Most of the S-P activity and magnetic variations occur in the area underlain by Ellsworth schist (Plates 41, 42). The high-value magnetic anomalies at 0 ° 0 (7300 gammas) and 98 ° 5W (7300 gammas) correlate with well defined potential variations. Neither of these anomalies can readily be explained on the basis of outcropping rocks. A soil sample geochemical survey of the area around 98 ° 5W (or the entire grid) would assist in determining the anomaly cause.

INDEX NO. 9: “PERKINS” (AUSTIN) PROSPECT

Location: Brooksville Twp.
Ownership: Clifford O. Austin
Brooksville, Maine

Geology (Plate 43): The Perkins grid is nearly equally divided by the contact between white tuffs of the Castine formation and a gabbro mass intrusive to the Castine. The tuffs are white to buff-gray and vary in grain size from very fine to moderately coarse. The only ore minerals located on the entire grid are in the trench at coordinates 0 ° 0. In the trench, the more glassy white tuff is more frequently and better mineralized than the coarser beds. The primary sulfides identified are pyrite, chalcopyrite and pyrrhotite; their occurrence is predominantly as disseminated grains, but chalcopyrite in thin veinlets was noted. A few grains of secondary chalcocite were identified in hand specimen.

The younger, intrusive rock is gray, fine- to medium-grained gabbro (grading to pyroxenite in places). The finer grained areas are adjacent to the contact and undoubtably represent a border chill-zone. Upon weathering, joint-bounded blocks of gabbro characteristically present a rusty exterior. The gabbro body is a distinct ridge former, holding up the core of Perkins Mountain.

Assay: (chip samples, pit at 0 ° 0)
Gold: none
Silver: none
Lead: none
Copper: 0.819%
Zinc: trace

Geophysical Surveys (Plates 44, 45): Because of the sharp topographic relief within the grid limits, and the attending effect on horizontal-loop EM data, the Perkins grid was surveyed only with magnetometer and self-potential unit. The weak sulfide zone in the trench was not detected in either survey. The entire grid area underlain by the Castine tuffs is magnetically and potentially “flat.” However, this is not true of the area underlain by the gabbro mass. The north-south trend of the contact is reflected in the trends of both magnetic and S-P zones. Sharp, local magnetic variations characterize the interior of the gabbro body, and these are frequently accompanied by strong potential changes. Searches of outcrops in the anomaly areas failed to produce evidence as to the cause of the local changes.

INDEX NO. 10: “BLODGETT” PROSPECT

Location: Brooksville Twp.
Ownership: Dwight Blodgett
Brooksville, Maine

Geology (Plate 46): The country rock at this prospect is the Ellsworth formation; the lithologies present are rusty, biotite schist and impure quartzite. Foliation trends indicate that the beds are involved in a local fold, changing from a northerly strike at the south end of the grid to a distinct northwesterly trend at the north end of the grid. Foliation, in general, dips easterly.

The only evidence of previous prospecting is a small, shallow pit at grid coordinate 0 ° 0. Minor amounts of pyrite and pyrrhotite and traces of chalcopyrite are present in dump rock around the pit.

Geophysical Surveys (Plates 47, 48): The Blodgett grid was surveyed by vertical-loop EM and self-potential equipment and magnetometer. The EM survey did not produce positive results. The S-P and magnetic surveys revealed small anomalies which coincide with areas of outcropping rusty schist. The “rust” is apparently the result of weathering of small amounts of iron sulfide and magnetite in the schist.

INDEX NO. 11: “TAPLEY PROSPECT” (INCLUDING MANHATTAN AND SHEPARDSON)

Location: Brooksville Twp.
Ownership: Paul D. Tapley
Ellsworth, Maine

Geology (Plate 49): The entire Tapley grid area is underlain by Castine volcanics, with the following lithologies represented: acid tuffs, andesitic flows, rhyolitic flows, and breccias of various compositions. If the rocks outcropping on the Tapley grid are true representatives of the Castine volcanics, they are somewhat unusual in their relatively high degree of metamorphism. Schistosity is frequently well developed. These rocks are very similar to those which crop out at the Hercules Prospect.

The property has a long history of exploration and development, reported on by Emmons (1910, pp. 35-36) and Earl (1950, pp. 2-3). It is beyond the scope of this report to reproduce the geologic descriptions contained in these references. However, there are two points in the published descriptions which bear correction. Emmons (1910, p. 36) states that “The lode strikes N.47°E., parallel to the schistosity, and is a wide zone of shattered and altered rhyolite.” The zone of mineralized rock does, in fact, parallel both schistosity and bedding, but the trend is more nearly due north than N.47°E. Also, although some sulfides do occur in the “shattered and altered rhyolite,” the greater proportion of the sulfides (“ore zone”) occur in a more basic rock, a massive andesite (Plate 50A). This is true at the Shepardson pit as well as the Tapley open cut (same andesite at both). This surface evidence is supported by the log of USBM diamond drill hole #1 (Earl, 1950, p. 4), where the best sulfide-bearing intercept encountered in all of the Bureau of Mines' drilling occurs in a unit described thus:

“48° 10'-7° Dark, gray-brown, fine-grained, massive rock, probably andesite.”
PLATE 42. Variations in Self-Potential: Jones Prospect, Brooksville Twp.

CONTOUR INTERVAL: 400 gammas
DATUM: local and arbitrary
PLATE 46. Geology-Culture: Blodgett Prospect, Brooksville Twp.
Diamond drill hole #4, under the open cut area, encountered 55 feet of andesite and 41 feet of "medium to fine-grained diorite (?). The few traces of ore minerals present were in the "diorite (?)" and ten feet of underlying "medium gray rock."

Hydrothermal alteration processes accompanying metatization produced relatively large amounts of quartz and sericite in the mineralized zone and adjacent rocks.

The sulfide suite present in the pits of the Shepardson Prospect is quite similar to that at Tapley; pyrrhotite is present in greater proportion at Shepardson. Chalcopyrite is the only ore mineral detected, occurring as disseminated grains and tiny stringers. The large outcrop at 3W + 17N contains unusually large quantities of iron sulfides, but chalcopyrite is apparently absent.

Assay: (Tapley dump composite)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold:</td>
<td>0.005 oz./ton</td>
</tr>
<tr>
<td>Silver:</td>
<td>0.3 oz./ton</td>
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<tr>
<td>Lead:</td>
<td>none</td>
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<tr>
<td>Copper:</td>
<td>2.184%</td>
</tr>
<tr>
<td>Zinc:</td>
<td>trace</td>
</tr>
</tbody>
</table>

Geophysical Surveys: The Tapley-Shepardson grid, covering some 58 acres, was surveyed with magnetometer, self-potential and vertical-loop EM units. The Tapley grid was covered by VLEM from three transmitter locations: 0 + 0, 0 + 1E, 9N + 4W; the Shepardson Prospect was run from one transmitter set-up at 9W + 14N. There was no indication of a significant conductor at any place on the grid. Horizontal-loop EM traverses on grid lines "0," 3S and 3N also failed to produce positive results.

The magnetometer survey (Plate 51) located two high-value anomalies, both in the extreme northwestern corner of the grid (Shepardson Prospect area). Both of the anomalies occur in areas of outcropping "basic" rocks with abnormal amounts of sulfides. Further, evidence of hydrothermal alteration is rather abundant here. The situation may be similar to that proposed for the Highland anomaly, a center (or centers) of hydrothermal mineralization which includes the introduction of magnetic minerals. The anomaly at 0 + 1E (Tapley) is thought to be related to culture (mining equipment).

The self-potential survey (Plate 52) mapped the sulfide-bearing area with good precision. Apparently, neither the Tapley nor Shepardson zones is more than a few hundred feet long. On the basis of this S-P survey, it would be of particular interest to extend the grid northwestward to investigate the ~300 mv anomaly at 9W + 17N.

INDEX NO. 12: LEIGH LIMEBURNER ("J. S. DOUGLAS?") PROSPECT

Location: Brooksville Twp.

Ownership: Leigh Limeburner
Brooksville, Maine

Geology: This prospect consists of one small (4' diameter) blast hole in an outcrop of fine-grained granite. Sulfides (pyrite, galena, sphalerite) occur in a white quartz vein, or vein system, one inch to six inches wide. The sulfides are present as disseminated...
grains or as crystalline aggregates in the center of the vein. The geologic setting of the outcrop cannot be determined as there are no other outcrops in reasonable proximity. No geophysical surveys undertaken.

**Assay:** (outcropping vein)

<table>
<thead>
<tr>
<th>Element</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>trace</td>
</tr>
<tr>
<td>Silver</td>
<td>2.0 oz./ton</td>
</tr>
<tr>
<td>Lead</td>
<td>0.5%</td>
</tr>
<tr>
<td>Copper</td>
<td>0.176%</td>
</tr>
<tr>
<td>Zinc</td>
<td>2.1%</td>
</tr>
</tbody>
</table>

**INDEX NO. 13: “EGGEMOGGIN MINE”**

*Location:* Sedgwick Twp.

*Ownership:* Unknown

*Comment:* The Eggemoggin Prospect is included in this report only to present assay data and an accurate location. Because of excessive culture, it was not feasible to carry out geophysical exploration in the area of previous workings. The basic geology is described by Emmons (1910, pp. 36-37).

**Assay:** (composite dump sample)

<table>
<thead>
<tr>
<th>Element</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>0.010 oz./ton</td>
</tr>
<tr>
<td>Silver</td>
<td>0.1 oz./ton</td>
</tr>
<tr>
<td>Lead</td>
<td>0.3%</td>
</tr>
<tr>
<td>Copper</td>
<td>0.100%</td>
</tr>
<tr>
<td>Zinc</td>
<td>0.4%</td>
</tr>
</tbody>
</table>

**INDEX NO. 14: HINCKLEY (“SAUNDERS”? - “NORTH BLUE HILL”?) PROSPECT**

*Location:* Blue Hill Twp.

*Ownership:* Robert W. Hinckley

*Hinckley’s Corner*

*Blue Hill, Maine*

*Riley Duffy*

*RFD*

*Blue Hill, Maine*

**Geology** (Plate 53): The Hinckley Prospect is in the north-westerly-trending strip of Ellsworth schist lying between the South Penobscot granite and East Blue Hill granite. Foliation trends, and the trend of the geophysical anomaly, are almost at right angles to that of the gross outcrop belt. Foliation (and bedding?) consistently dip to the south. Exposed bedrock is rusty-weathering schist, more or less typical of the biotite facies of the Ellsworth. From place to place the schist carries thin plateletes and stringers of pyrrhotite which lie parallel to enclosing foliation. The small pit at 4E + 2N was put down on a system of thin (3/4”), brown-stained quartz veins which carry minor pyrrhotite blebs. At the other workings (0 + 0; 3W + 1/8S), sulfides are very scarce; only iron sulfides were identified. At these workings, however, micaeous alteration is prominent, and it may have been the reason for the prospecting.

**Geophysical Survey:** All surveys undertaken at the Hinckley Prospect were at least moderately successful. The vertical-loop EM survey was the most definitive, but a great deal of support was obtained through the S-P and horizontal-loop EM surveys.

The VLEM data reveal the presence of a conducting zone not less than 1400 feet long (and possibly much longer) (Plate 54). The conductor appears to be quite shallow at the west end of the grid, and becomes less conductive or deeper, or both, to the east. The HEM data (Plate 55) do not completely resolve the problem, but suggest that depth may be an important factor. The HEM unit was not run on the western traverse lines because of excessive relief. The principal zone of spontaneous polarization is nearly as well-defined as the conductor axis, extending from 2W to 16E with an interruption at 13E (Plate 56). Although there is magnetic activity, there is no well-defined magnetic zone (Plate 57). The two high-value anomalies (5E + 3½N; 16E + 5N) do not correlate particularly well with other geophysical data. It is assumed that these two anomalies are due to local magnetic accumulations in the Ellsworth schist.

The Hinckley anomaly is best described as a “blind” anomaly; that is, at no place on the surface can its cause be precisely determined. In spite of the problems which often attend geochemical soil sampling in glaciated regions, it appears that this technique is the logical next step. Negative geochemical data will not destroy the validity of the geophysical anomaly, but positive geochemical data will greatly enhance it.

**INDEX NO. 15: “ARCTIC” PROSPECT**

*Location:* Blue Hill Twp.

*Ownership:* Unknown

*Comment:* The prospect consists of one shallow trench (6’ x 30’), trending N.10°W., cut in rocks of the biotite facies of the Ellsworth schist. At this locality, the foliation strikes generally N.85°E., with dips variable to the southeast. Flat-plunge drag folds are abundant. Sulfide development consists of sparse pyrrhotite in quartz veins and irregular blebs in the host rusty schist.
PLATE 53. Geology-Culture: Hinckley Prospect, Blue Hill Twp.
PLATE 55. Horizontal Loop Electromagnetic Survey: Hinckley Prospect, Blue Hill Twp.
INDEX NO. 16: "TWIN LEAD" PROSPECT AREA (INCLUDES YOUNG HECLA, SWAZEY, McINTIREE, BLUE HILL, AND CITY OF BOSTON)

Comments: During the 1961 field season the so-called "Blue Hill District" (Ching-Yuan Li, 1942, p. 29) was the subject of an intensive geophysical survey by Black Hawk Mining Ltd., of Montreal, Quebc. Extensive grids were laid out on selected parts of the district (Twin Lead grid, Mammoth grid, Douglas-Owen grid), and these grids were made available to the State survey party. For several reasons, not all of the grid area made available was surveyed and that part which was covered was done so with selected instrumentation.

The area of the Twin Lead grid was covered, in recent years, by a ground electromagnetic survey. Subsequent drilling by a mining company apparently tested the zones of conductivity delineated by the EM survey. In 1961, Black Hawk Mining completed a horizontal-loop EM survey of the Twin Lead grid and drilled the resulting anomalies (Northern Miner, 6/29/61; 7/6/61). This situation presented the opportunity to correlate and evaluate geophysical data and drilling results. With this aim, a VLEM survey was run over the area of previous workings, known to contain at least one conductor. The results of this survey are shown on Plate 58; several aspects of the EM profiles warrant emphasis. First, the area contains several conductors, parallel in part and overlapping in part. There are two principal zones, each about 1,000 feet long. Because they do overlap and are separated by only one hundred feet or so, they may give the impression, geophysically, of being the same conductor. However, by utilizing vertical-loop equipment and tracing the conductors from their outer limits toward the center, their resolution is clear. Another aspect is the fact that there was no conductor mapped directly connected with the Twin Lead workings. As currently mapped the conductor at Young Hecla apparently sharply changes course from northeast to east-west and its trace extends under a large swamp. Available historical information indicates that the swampy area has never been tested through drilling. Almost without exception, the dip-angle profiles indicate a south-easterly dip for the conducting zones.

Because of the obvious interest of mining companies, it was apparent that a contribution might be made by presenting a survey made with instrumentation other than EM. Thus, the entire Twin Lead grid was run with a self-potential unit; the results are delineated in 1/25,000 contour form, on Plate 59. As would be expected in a large area containing a large number of conductors, there is a high degree of potential activity. On the map, the areas of interest are those enclosed by 400 mv contour lines. These areas should be further evaluated in the light of local geology and additional geophysics.

Plate 60 graphically relates geophysical profiles to precise geologic information obtained through drilling. The S-P profile, run south and north from 10 + 0, shows anomalous negative values between "0" and 1/2N with a negative peak at IN. The vertical-loop EM cross-over (effective axis) lies at approximately 1/2N, when run from a transmitter location 400 feet distant (14 + 1/2N). The dip angle profile indicates that the conductor is shallow at this point and is probably rather thin. The horizontal-loop EM data, on preliminary inspection, indicate a moderately wide (approximately 100') conducting zone dipping at rather low angle toward the south. On the basis of this HEM anomaly, Black Hawk Mining drilled two holes (BH-4, BH-5) in this area. On Plate 60, the drill holes have been projected onto the section from 45 feet west. H. J. Bergmann (personal communication, 12/12/61) provided the following information on these drill holes.

BH-4: Coordinates: 10.45W 0.95S
Inclination: -47½'
Bearing: North
Sulfide zone: 53.6'-54.8' disseminated, 0.91% Cu
54.8'-58.4' 50% sulfides, irregularly distributed, 5.27% Cu
58.4'-60.1' disseminated, 1.66% Cu

BH-5: Coordinates: 10.45W + 0.95S
Inclination: -90°
Sulfide zone: 73.5'-75.5' minor amounts, disseminated 0.45% Cu
75.5'-80.0' 40% sulfides, 3.36% Cu
80.0'-84.0' 15% sulfides, 1.87% Cu
84.0'-89.0' weak sulfides, 1.66% Cu

When the drilling data are compared with the geophysical profiles it becomes obvious that the sulfide zone cut in BH-4 and BH-5 is not responsible for the principal anomaly. As a matter of fact, the only indications of this sulfide zone are: (1) a minor S-P deflection, (2) good out-of-phase HEM readings, and (3) a significant in-phase curve break (at Sta. "0"'). In other words, all methods indicate that there is relatively a more important conducting sulfide zone between "0" and 1/2N than that between "0" and 1S. Further substantiation for such a zone lies in the physical position of the Young Hecla shaft (projected onto the section from about 70 feet to the cast). Admittedly, if this northerly zone lay parallel to the known zone, as might be expected, then it would have been cut at about 125 feet, inclined, in BH-4. Either of two possibilities might explain this rather simply, (a) the sulfide zone was vertical or dips to the north, or (b) the sulfide zone is parallel the known zone but does not extend to the depth of the drill hole. Because of the apparent regularity of the mineralized zones throughout the Blue Hill district, possibility (b) seems the more likely. Further, an extension of the trend of the northerly zone falls near the Twin Lead workings. An additional day's work with vertical-loop EM equipment will undoubtedly resolve the geometry of the mineralized zones at this critical point.

INDEX NO. 17(A): "DOUGLAS" - "OWEN" PROSPECT
Location: Blue Hill Twp.

Ownership: various properties under lease or option as of August 30, 1961, to Black Hawk Mining Ltd., Montreal, P. Q.

Comments: The Douglas Mine was one of the few producers of note in the entire southern Hancock County exploration area. Because of its economic importance, it has been described rather frequently in the literature. The most useful references are Emmons (1910, pp. 31-32), Gillson and Williams (1929, pp. 182-194), Li (1942, pp. 17-51), and Earl (1950, 17 pp). Most important of these are Li (petrographic relationships) and Earl...
There is no published map which satisfactorily portrays the geologic relations of the Blue Hill district.

The Bureau of Mines drilling (seven holes aggregating 2,117.4 feet) was based on a strike projection of N.80°E, and vein dip of 40°-55°SE. A reference line to which drill hole location may be related is one connecting the Douglas open cut and the Atlantic shaft. The Douglas Mine area was also drilled by Texas Gulf Sulphur in 1957 (seven drill holes). Examination of the core recovered in the Texas Gulf Sulphur drilling showed numerous traces of base metal sulfides, but nothing that could be considered an ore zone. The results of the Bureau of Mines program is concisely stated by Earl (1950, p. 3), “No significant mineralization was found in any of the holes drilled.”

In order to determine whether those fourteen drill holes had adequately tested the Douglas-Owen-Atlantic zone, electromagnetic surveys (VLEM and HEM) were run on the grid established by Black Hawk Mining Ltd. Results of these surveys are shown on Plates 61 and 62. Both surveys showed that while conducting zones are present, they are quite irregular in form and conductivity characteristics. The VLEM equipment mapped conductor axes on traverses covering a strike length of at least 1800 feet (Line 8—Line 26). On the basis of VLEM cross-over position, dip-angle profiles and the spatial relations of transmitter-receiver, it seems likely that there are at least two conductors, and there may be as many as four. HEM data generally corroborate the dip-angle data, especially in evaluating relative conductivity. On the basis of apparent width and conductivity, the Douglas-Atlantic zone is most significant. The length of the zone is estimated at 1000 feet (Line 15 to Line 25); its surface trace is somewhat arcuate and the dip is apparently variable.

Zone #2 is about 800 feet long (Line 7 to Line 15) and lies to the south of the Douglas-Atlantic conductor. Its surface pattern is also arcuate, and the conductor dip is indeterminate except on Line 12 where it is dipping southeastward. Except in the area of the electrical axis on Line 12, Zone #2 appears less promising as a prospect than Zone #1.

Zone #3 is a weak, probably discontinuous, conductor lying parallel to and 150 feet south of Zone #1. It extends at least 200 feet to the northeast beyond Zone #1. It would appear that this zone is unimportant in terms of near-surface sulfide mineralization.

In addition to these zones, HEM equipment mapped a very weak short (estimated 400 feet) conductor which lies about 100 feet south of the base line and parallel to it, in the vicinity of the Owen pit.

On the basis of EM survey data and the broad aspects of the geology as seen in drill holes, the following conclusions appear valid:

(a) there is a rather broad zone in the Ellsworth schist in which sulfide mineralization preferentially occurs,
(b) within the broad zone, the distribution of important accumulations of base metal sulfides is erratic and probably unpredictable,
(c) the individual sulfide zones are likely to: (1) be 1200 feet or less in strike length, (2) dip to south or southeast, (3) present an arcuate plan pattern, and (4) occur en echelon with other, overlapping zones,
(d) the known conductors, showing desirable characteristics, have been adequately tested to shallow depths by drill holes or underground development,
(e) the possibility of the mineralized zones extending to significant depths, down dip, has not been resolved.

INDEX NO. 17(B): SECOND POND PROSPECT

Location: Blue Hill Twp.
Ownership: State of Maine
Maine Mining Bureau
Augusta, Maine

Comments: One of the most important contributions to the geologic knowledge of the Blue Hill district was the discovery in 1956 of evidence of a sulfide body beneath Second Pond and later proof of its existence by four drill holes put down in 1957. As ownership of the minerals under the pond rests with the State of Maine, drill core from the four holes was donated to the State Survey. Because of technical procedures utilized and fundamental interpretations, EM data on which the drilling was based are not available for publication. However, generalized graphic drill logs (Plates 64-67), drawn from core inspection by W. F. Stickney (MGS), are included in this report, along with a hole location map (Plate 63).

Black Hawk Mining has announced plans to drill additional holes in this sulfide zone when Second Pond freezes over (The Daily Packet, 7/13/61; Northern Miner, 10/5/61). On the basis of operational procedures followed in the past, it is assumed that the Black Hawk drilling will also be laid out on the results of an EM survey.

INDEX NO. 18: "OWEN LEAD" PROSPECT

Location: Blue Hill Twp.
Ownership: Weston Varnum
Blue Hill, Maine

Geology: Emmons (1910, pp. 34-35) and Li (1942, p. 29,30, 31, 32) point out the somewhat unusual nature of the Owen Lead (Pb) Prospect, that is, in or very near granite and displaying large proportions of galena. The pit identified by a Black Hawk Mining representative as the "Owen Lead" is also noteworthy because of the abundant sphalerite visible in the dump rock. Sphalerite occurs, with very small amounts of chalcopyrite, as stringers and disseminated grains in sugary quartz and fine-grained, quartz-feldspar-biotite granite.

An assay of a composite dump sample ran as follows:

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold:</td>
<td>0.010 oz./ton</td>
</tr>
<tr>
<td>Silver:</td>
<td>0.2 oz./ton</td>
</tr>
<tr>
<td>Lead:</td>
<td>0.7%</td>
</tr>
<tr>
<td>Copper:</td>
<td>0.201%</td>
</tr>
<tr>
<td>Zinc:</td>
<td>11.2%</td>
</tr>
</tbody>
</table>

A horizontal-loop EM survey, run by Black Hawk Mining, indicated that no conductor was present in this area, a fact not surprising in view of the large amount of sphalerite and the small amount of iron sulfides present in dump rock.

In some instances mineralized zones of this type are best delineated by spontaneous polarization effects, and such a survey was completed over the immediate environs of the Owen Lead pit. The results of this survey, as shown on Plate 68, show that there is no local S-P anomaly, and it is assumed that this high-grade zone is of very limited extent.
platE 64
Graphic Log of Drill Hole SP-1
Second Pond, Town of Blue Hill, Hancock Co., Maine
Bearing of hole: N 40° W.
Inclination: -46.5°
Logged by: W. F. Stickney, Maine Geol. Surv.

water (0 - 30')
silt and sand (30' - 60')
boulders (60' - 86')
heavy sulfide 86'-87'
weak sulfides 87'-93'
heavy sulfide 93'-99'
95.0'-101.5'
6' of 1.1% Cu
pegmatite 104'
PbS traces 105½'-106'
oxidation at 112'
Cu-Pb zone 113-114'

12" granite vein with biotite alteration zone
oxidation 135-140'
heavy pyrite at 142'
traces of Cu at 149½'
gangue sealed breccia

Total depth attained.

Ellsworth Schist, biotitic
Ellsworth Schist, chloritic
granite or granite pegmatite

Assays by Texas Gulf Sulfur, Inc.
0

10

20

30

40

50

60

70

80

90

100

110

120

130

140

150

160

170

180

190

200

210

220

240

water (0 - 21' )

silt (21' - 45' )

boulders

disseminated sulfides 64-86'

oxidation at 80'
pseudo-conglomerate 80-81'

weak Cu and Fe sulfides 84-148'

moderate to good mineralized zone 90-128 3/4'; Pb begins at 110'

105.8'-125.8'

20' of 2.03% Cu

126-126 1/2

90% red ZnS 128 3/4 - 134'
128.9'-137.4' 8.5' of 19.0% Zn
quartz gangue with moderate Cu, Fe, Pb sulfides 134-136'
90% red zinc sulfide 136-137'

gray-green granitic material with disseminated sulfides

scattered traces of FeS2 to 154'

schist micaceous between granite lenses

weak mineralized zone 171-177 1/2

heavy oxidation 177-178'

heavy chalcopyrite 177 1/2-178'

weak Cu and Fe zone 178-186'

gangue sealed fractures

oxidation 200 1/2-201'

fractures smeared with FeS2

moderate Cu-Fe mineralized zone 201-212'; heavy Cu at 212-213'

considerable silica gangue in mineralized interval

galena clot at 219'

very siliceous 224-225'

siliceous 229-231'

scattered disseminated FeS2

logged by: W. P. Stickney, Maine Geol. Surv.
chalcopyrite shows at 133, 134½ and 136½'.
fault gouge and oxidation
1" fault gouge
gangue silica 142-145'

weak mineralization 150-154½',
PbS, CuFeS₂, ZnS, Fe₃S₈, FeS₂

heavy sulfides
shale parting
1" heavy PbS
weak mineralized zone to 169½'
mainly Cu and Pb with iron sulfides

heavy chalcopyrite 169½-177½'
176.2'-191.2' 15' of 1.0% Cu
coarse sericitized schist
175-184½'
weak Cu, Pb, Fe sulfides to
184½'; fault 183-185½'; heavy
CuFeS₂ in lower 6'
90-95% ZnS and CuFeS₂ 185-191'
184.8'-191.2' 6.4' of 39.1% Zn
granite with Pb and Cu traces
fine-grained basic dike

weak Cu, Pb and Fe sulfide minerali-
ization, cut off by basic dike at
215'

dark green to black basaltic dike
rock to 242'
scattered sulfide traces on hair-
line fractures cutting the dike

sulfide show

Schist carries traces of Fe₂

total depth attained 248'

Exposures by Texas Gulf Sulfur, Inc.

Second Fault, Town of Blue Hill, Hancock Co.
PLATE 67

Graphic Log of Drill Hole SP-4

Second Pond, Town of Blue Hill, Hancock Co., Maine

Bearing of Hole: N. 70° E.
Inclination: -60°

Logged by: W. F. Stickney, Maine Geol. Surv.

Assays by Texas Gulf Sulfur, Inc.

- Ellsworth schist, biotitic
- Ellsworth schist, chloritic
- granite

0

water (0 - 23')

20

silt (23' - 44')

40

boulders (44' - 65')

60

gangue quartz 65-69'

70

scattered FeS2 and Fe3S4 throughout

80

good FeS2 show at 79'

100

SiO2 sealed breccia

110

3rd shale parting

120

4th oxidized zone

130

90% SiO2+FeS2 133-134'

140

2nd SiO2+FeS2 138'

150

fault gouge and breccia

160

4th SiO2+FeS2 157'

170

considerable gangue SiO2 170-178'

180

breccia 178½-179½'

190

3rd shale parting

200

pure quartzite 188-190'

210

heavy SiO2 gangue 194-197'

220

FeS2 show 197'

230

sulfide show 204½'

240

shale parting

250

scattered traces FeS2 206-222'

260

brecciated 224-225'

270

heavy silica segregation 226-238'

280

SiO2 showed at 238'

290

fault gouge and breccia

300

shale partings 284½ - 285½'

ZnS show 285½'

310

granite vein 296-297'

320

good combined Cu-Zn 296-299½'

weak Cu-Fe 299½-303½'

330

serpentinitized and sericitized 308-312'

340

weak Cu-Fe sulfides

350

gangue sealed fractures 316-323'

360

total depth attained 323'

370

weak Cu, Zn, Pb, Fe sulfides 269-281½'

380

thin fault gouge

390

shale partings 284½ - 285½'

ZnS show 285½'

400

granite vein 296-297'

410

good combined Cu-Zn 296-299½'

weak Cu-Fe 299½-303½'

420

serpentinitized and sericitized 308-312'

430

weak Cu-Fe sulfides

440

gangue sealed fractures 316-323'

450

total depth attained 323'

460

weak Cu, Zn, Pb, Fe sulfides 269-281½'

470

thin fault gouge

480

shale partings 284½ - 285½'

ZnS show 285½'

490

granite vein 296-297'

500

good combined Cu-Zn 296-299½'

weak Cu-Fe 299½-303½'

510

serpentinitized and sericitized 308-312'

520

weak Cu-Fe sulfides

530

gangue sealed fractures 316-323'

540

total depth attained 323'

550

weak Cu, Zn, Pb, Fe sulfides 269-281½'

560

thin fault gouge

570

shale partings 284½ - 285½'

ZnS show 285½'

580

granite vein 296-297'

590

good combined Cu-Zn 296-299½'

weak Cu-Fe 299½-303½'

600

serpentinitized and sericitized 308-312'

610

weak Cu-Fe sulfides

620

gangue sealed fractures 316-323'

630

total depth attained 323'

640

weak Cu, Zn, Pb, Fe sulfides 269-281½'

650

thin fault gouge

660

shale partings 284½ - 285½'

ZnS show 285½'

670

granite vein 296-297'

680

good combined Cu-Zn 296-299½'

weak Cu-Fe 299½-303½'

690

serpentinitized and sericitized 308-312'

700

weak Cu-Fe sulfides

710

gangue sealed fractures 316-323'

720

total depth attained 323'

730

weak Cu, Zn, Pb, Fe sulfides 269-281½'

740

thin fault gouge

750

shale partings 284½ - 285½'

ZnS show 285½'

760

granite vein 296-297'

770

good combined Cu-Zn 296-299½'

weak Cu-Fe 299½-303½'

780

serpentinitized and sericitized 308-312'

790

weak Cu-Fe sulfides

800

gangue sealed fractures 316-323'

810

total depth attained 323'

820

weak Cu, Zn, Pb, Fe sulfides 269-281½'

830

thin fault gouge

840

shale partings 284½ - 285½'

ZnS show 285½'

850

granite vein 296-297'

860

good combined Cu-Zn 296-299½'

weak Cu-Fe 299½-303½'

870

serpentinitized and sericitized 308-312'

880

weak Cu-Fe sulfides

890

gangue sealed fractures 316-323'

900

total depth attained 323'

910

weak Cu, Zn, Pb, Fe sulfides 269-281½'

920

thin fault gouge

930

shale partings 284½ - 285½'

ZnS show 285½'

940

granite vein 296-297'

950

good combined Cu-Zn 296-299½'

weak Cu-Fe 299½-303½'

960

serpentinitized and sericitized 308-312'

970

weak Cu-Fe sulfides

980

gangue sealed fractures 316-323'

990

total depth attained 323'
INDEX NO. 19: "GRANGER" PROSPECT

Location: Blue Hill Twp.
Ownership: not determined

Comments: Included in this report for purposes of accurate location only. The shaft has been filled and the dump rock has apparently been used as road metal.

INDEX NO. 20: "WHITE STAR" PROSPECT

Location: Blue Hill Twp.
Ownership: Harold G. Hall
          South Street
          Blue Hill, Maine
          Waldo Collins
          South Street
          Blue Hill, Maine

Geology (Plate 69): The entire grid area is underlain by quartz-biotite and quartz-chlorite-biotite schists of the Ellsworth formation. Sizeable outcrops are scarce, the best display of schist is along the small stream at coordinates 12E + 1S. The schist outcrops often contain small amounts of iron sulfides, which when weathered impart a rusty surface. Foliation attitudes vary from place to place; it generally strikes nearly east-west and dips southward.

The workings, none of which are recent, consist of several small pits and one 10' x 12' shaft reported to be 37 feet deep. The dump rock around the shaft contains vein quartz with pyrrhotite and traces of chalcopyrite, and the same sulfides in quartz-biotite schist as disseminated grains and veinlets.

Geochemical water samples were only slightly anomalous, 0.035 ppm in the shaft and 0.025 ppm at 12E + 1S.

Assay: (dump rock grab sample)

Gold: none
Silver: none
Lead: none
Copper: 0.126%
Zinc: none

Geophysical Surveys: The White Star grid was covered by magnetometer, self-potential unit, and HEM and VLEM units. All methods produced anomalies which correlate quite well. The zone with best geophysical expression, along the base line between "0" and 10E, is a "blind" anomaly; that is, there is no bedrock exposed which provide clues to the anomaly origin.

At White Star, the zone of apparent mineralization is best delineated by horizontal-loop EM (Plate 70). This survey indicates a conductor estimated at 900 feet long, showing good apparent width ( > 10') and good conductivity. The conductor is quite steep in dip at Line 6E and dips to the south at Line 2E. A short conductor (< 400') was mapped at 4E + 2S. The vertical-loop EM survey confirmed the presence of the main conductor along the base line and, in addition, mapped cross-overs at $0 + 2.35S$ and $2W + 4.15S$ (Plate 71). Two possibilities which may be used to explain the conductor relations are: (a) two conductors, the main, base line zone and a less well-defined zone of undetermined length in the southwest corner of the grid; or (b) the main conductor sharply changes trend between "0" and 2E and continues in a more northerly trend. The apparent electrical continuity between the two, which may be seen by the various receiver-transmitter relationships, certainly supports (b). The magnetic anomaly (Plate 72) distinctly correlates with the best developed conductor zone, especially on traverse 6E. Contours showing variations (Plate 73) in natural potentials are less regular and less definitive than the results obtained through the other methods. The highest S-P value ( > 400 mv) corresponds with a weak HEM deflection, but in general the trend of the conductor is not well marked by polarization effects.

The soil cover over the principal conductor is probably quite thin and a geochemical soil survey would be of advantage in evaluating the prospect.

INDEX NO. 21: "VICTORIA" PROSPECT

Location: Blue Hill Twp.
Ownership: David P. Heilner
          "The Farmhouse"
          Blue Hill, Maine

Geology: The Victoria Prospect at one time consisted of a 38-foot vertical shaft adjacent to the eastern shore of Salt Pond. The shaft has been filled and its precise location is in doubt. Dump material can be found along the shore, near an outcrop of sulfide-bearing rock. The outcropping beds of impure quartzite and quartz-chlorite-biotite schist are members of the Ellsworth formation. Foliation and bedding are generally parallel, striking N 65° E. and dipping 80°SE.

The dominant sulfide is pyrite; traces of chalcopyrite may be seen in dump rock specimens.

Assay: (dump grab samples)

Gold: 0.010 oz./ton
Silver: 0.2 oz./ton
Lead: none
Copper: 0.176%
Zinc: none
LEGEND

- strike and dip of foliation
- pit and dump rock
- outcrop
- field road
- wire fence
- stream
- water sample, arbitrary scale with background at 10–20.

Ellsworth Fm., quartz-biotite and quartz-chlorite schist

PLATE 69. Geology-Culture: White Star Prospect, Blue Hill Twp.
PLATE 70. Horizontal Loop Electromagnetic Survey: White Star Prospect, Blue Hill Twp.
Geophysical Surveys: A small grid was laid out, centered on the dump area, and run with magnetometer and self-potential units. Data recorded were not anomalous.

INDEX NO. 22: “TRIO” PROSPECT

Location: Blue Hill Twp.
Ownership: Wayne and Kermit Allen
Sedgwick, Maine

Geology (Plate 74): The only evidence of previous development at the Trio Prospect is the caved or filled shaft (5' x 10') and a small trench, which lie about 50 feet west of Rt. 172. The waste rock has apparently been used in local road construction; mineralized specimens are difficult to locate.

The shaft was put down in the Ellsworth schist about 175 feet east of the north-trending contact of the schist and Sedgwick granite. The western half of the grid is nearly all outcrop and the contact zone is generally well displayed. The granite is mostly medium-grained and composed of quartz, feldspar and muscovite; there is, apparently, no well defined chill-zone. The Ellsworth is all basically quartz-biotite schist, garnetiferous near the contact and exhibiting varying degrees of "soaking." The soaking is manifest by the development of quartz in the schist in lit-par-lit form, as irregular blebs, or silicification.

No linear elements were mapped in the granite mass; foliation in the schist was generally contorted and indistinct because of silicification. As may be seen on Plate 74, foliation trends lie in the range N.22°W. to N.53°E.; foliation dips are rather low, mostly to the east between 30°E and 65°E.

Jointing in the granite is poorly developed; the principal directions are:

<table>
<thead>
<tr>
<th>Strike</th>
<th>Dip</th>
</tr>
</thead>
<tbody>
<tr>
<td>North-south</td>
<td>65°W</td>
</tr>
<tr>
<td>N.35°E.</td>
<td>82°NW</td>
</tr>
<tr>
<td>N.35°W.</td>
<td>64°NE</td>
</tr>
<tr>
<td>N.47°W.</td>
<td>72°SW</td>
</tr>
</tbody>
</table>

Contrary to the preceding statement, joints are abundant in the schist, not less than a dozen joint directions may be mapped. The joints which are best developed or which repeat most often are:

<table>
<thead>
<tr>
<th>Strike</th>
<th>Dip</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.4°E. to N.5°W.</td>
<td>variable dip, steep, variable</td>
</tr>
<tr>
<td>N.50°E.</td>
<td>70°NW</td>
</tr>
<tr>
<td>N.65°E.</td>
<td>steep</td>
</tr>
<tr>
<td>N.78°E.</td>
<td>variable</td>
</tr>
<tr>
<td>N.45°W.</td>
<td>74°SW</td>
</tr>
<tr>
<td>N.65°W.</td>
<td></td>
</tr>
</tbody>
</table>

From existing specimens, it is difficult to postulate the type of mineralized zone present at the Trio Prospect. The samples which were collected for assay consisted of thin veinlets and disseminated grains of sulfides in silicified quartz-biotite schist.

Assay:
- Gold: 0.020 oz./ton
- Silver: 0.3 oz./ton
- Lead: none
- Copper: 0.567%
- Zinc: 0.1%

Geophysical Surveys: The Trio reconnaissance grid was surveyed by S-P unit, magnetometer and vertical-loop EM. Self-potential data were inconclusive. Reverse VLEM coss-overs recorded on all traverse lines between the base line and IE were attributed to an overhead, lead-covered cable on the west side of Rt. 172. Moderate variations in vertical magnetic intensity were recorded and these are presented on Plate 74. The pattern and intensity of variation are typical of contact zone Ellsworth, and the map demonstrates how this contact may be mapped with magnetometer.

INDEX NO. 23: “REVERE” “SILVER REEF” PROSPECT

Location: Blue Hill Twp.
Ownership: Paul Westcott
Blue Hill, Maine
William Anshury
30 Pidgeon Hill Road
Weston, Maine

Geology: Good outcrops are exposed along the coast near the workings; no outcrops were located on the grid other than along the shore. All of the rocks exposed are meta-sediments of the Ellsworth formation; three distinct lithologies were mapped. Quartz-chlorite-sericite schist is the dominant rock type of the local area, frequently carrying foliation-controlled, sugary quartz pods and stringers. These small quartz bodies may contain as much as 25 percent total sulfide. A closely related lithology is the more or less typical Ellsworth quartz-chlorite schist. Outcrops of this rock type may contain intercalated pyrite-bearing schist bands up to twelve inches wide. The third lithology is massive, thick-bedded quartzite.

Along the shore the bedding strikes N.40°-50°W., and dips 35°SW, without significant departure. The principal structural elements are abundant crenulations and occasional drag folds in the quartz-chlorite and quartz-chlorite-sericite schists and jointing. The crenulations and drags apparently control the location and development of sulfide-bearing...
quartz pods, zones of which probably constituted the ore zones. In most instances, the quartz-rich areas also show sericitic alteration. Joints are relatively few in number but well developed. The principal joints directions are:

<table>
<thead>
<tr>
<th>Strike</th>
<th>Dip</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.20°E.</td>
<td>vertical</td>
</tr>
<tr>
<td>N.45°E.</td>
<td>70°SE</td>
</tr>
<tr>
<td>N.75°E.</td>
<td>vertical</td>
</tr>
<tr>
<td>N.75°W.</td>
<td>55°NE to vertical</td>
</tr>
</tbody>
</table>

The sulfide mineralization consists of pyrite and traces of chalcopyrite as disseminated grains in vein and sugary quartz, and as disseminated grains and crystals of pyrite in schist.

The Revere shaft, reported to have been 130 feet deep, was filled or covered and the Westcott cabin built over it. The dump has been leveled. The Silver Queen shaft, 150 feet N.50°W. of the Westcott cabin, is approximately 6' x 8' and wasplumbed to a depth of thirty feet. A moderate waste-rock dump remains around this shaft.

Geophysical Surveys: A small, reconnaissance grid (400' x 600') was laid out, centered on the Silver Queen shaft. The grid area was surveyed with S-P unit, magnetometer, and vertical-loop EM. The results of all surveys were negative.

INDEX NO. 24: "LADY ELGIN" PROSPECT
Location: Blue Hill Twp.
Ownership: Leon F. Sylvester
South Blue Hill, Maine
H. Lewis Cutler
South Blue Hill, Maine

Geology: The country rocks of this prospect are quartz-chlorite schists of the Ellsworth formation. The schists carry abundant white quartz in "lit-par-lit" pods and as cross-cutting veins. Workings were apparently confined to a quartz vein system, vertical and striking N.65°E., which contains very sparse iron sulfides (principally pyrite).

Visible workings consist of a small open cut, which extends from the shore toward the shaft. The shaft was apparently multi-compartment; the size is estimated at 5' x 15'. The shaft is largely filled and is covered by a heavy plank platform.

INDEX NO. 25: "CANDAGE" PROSPECT
Location: Blue Hill Twp.
Ownership: Uzial F. Candage
South Blue Hill, Maine

Geology: The Candage Prospect consists of a small shaft, of unknown depth, sunk on a quartz vein enclosed in Ellsworth quartz-biotite schist. The foliation of the schist is greatly contorted, but averages N.60°E. with variable dip. The only sulfide detected was pyrite, occurring as disseminated grains in vein quartz. A water sample taken from the shaft was only very slightly anomalous in total heavy metal content.

Opposite the Candage residence, in the field between Rt. 175 and Blue Hill Bay, there is a small, apparently unrecorded, prospect pit. Dump rock around the pit is quartz-chlorite schist with barren, white vein quartz.

INDEX NO. 26: "DEER ISLE" PROSPECT
Location: Deer Isle Twp.
Ownership: Dr. Alan M. Chesney, M. D.
700 North Charles Street
Baltimore 1, Maryland

Comments: The extent of underground workings, lithology of the host rocks and mineralogy of the ore zone are adequately described by Emmons (1910, pp. 37-38) and will not be repeated in this report.

A 22-acre grid was laid out to cover the area of known development and the trend of the mineralized zone, north-eastward from the shore at Dunham Point. The five traverse lines and base line were run with magnetometer, S-P unit and vertical-loop EM. Small, low-magnitude S-P and magnetic anomalies were mapped. Because of the low values, limited size, erratic distribution, and lack of correlation, these anomalies are dismissed as unimportant. The VLEM survey failed to locate a conductive zone within the grid.

A culture-geology map of the Deer Isle Prospect is included in this report, as Plate 75, principally to present accurate locations of existing workings to aid those interested in further prospecting.

Assay: (selected dump samples)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>0.310 oz./ton</td>
</tr>
<tr>
<td>Silver</td>
<td>2.0 oz./ton</td>
</tr>
<tr>
<td>Lead</td>
<td>none</td>
</tr>
<tr>
<td>Copper</td>
<td>4.216%</td>
</tr>
<tr>
<td>Zinc</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

INDEX NO. 27: CAMPBELL PROSPECT
Location: Surry Twp.
Ownership: John W. Campbell
32 Forest Avenue
Bangor, Maine

Geology (Plate 76): The Campbell Prospect is a series of small pits and trenches in an area mapped by Wingard (1961) as “coarse grained East Blue Hill granite.” In detailed analysis, the geologic setting is unusual and seemingly consists of roof pendants of...
PLATE 76. Geology-Culture: Campbell Prospect, Surry Twp.
Ellsworth schist in granite. As may be seen on the accompanying geologic map, outcrops of schist are relatively abundant in the grid area. The widely divergent foliation attitudes may indicate a fundamental structural complexity, or rotation of the schist blocks "floating" in granite. The foliation is essentially undisturbed in all outcrops except that at 5.5S + 0.4E where drag folds are particularly well developed. The schist is basically quartz-biotite, which has undergone varying degrees of silicification ("soaking"). From place to place, notably in the pit at 2.7S + 0.3E, the schist is distinctly red-purple due to a high percentage of very fine-grained garnets.

The East Blue Hill granite, in the prospect environs, is a fine- to medium-grained quartz-feldspar-biotite granite, in which the decrease in grain size may definitely be related to border chilling.

The sulfide minerals, identified in hand specimen, are arsenopyrite, pyrrhotite, pyrite and chalcopyrite, all of which occur in granite as well as schist. The sulfides are usually found disseminated, but some specimens are best described as "near massive" (dump rock near pit at 0.3N + 0.2W). With the exception of the mineralized granite in the extreme northwestern part of the grid, the sulfides preferentially occur at or near the granite/schist contact. Because the host-sulfide relations can be best observed in pits and adjacent dump rock, a few notes on each pit follow:

1. 0.3N + 0.2W: fine-grained granite with disseminated and near-massive pyrrhotite, pyrite and chalcopyrite; minor pegmatites in the granite;
2. 0.5S + 0.95E: fine-grained granite with a few thin (1") quartz-muscovite pegmatites; granite carries disseminated pyrrhotite, pyrite and chalcopyrite; highest chalcopyrite: iron sulfide ratio observed is here;
3. 2.7S + 0.3E: schist and granite, both mineralized, outcrop on opposite sides of the pit; sulfides most abundant in the fine-grained granite, but the copper content is higher in the schist; the Ellsworth is a silicified quartz-biotite schist, garnet-rich in places;
4. 1.5N + 5.25W: chalcopyrite-pyrite-pyrrhotite disseminated through fine- to medium-grained quartz-biotite granite; dump rocks include coarse-grained pegmatite with pyrite crystals.

Assay: (composite dump sample)
- Gold: trace
- Silver: 1.8 oz./ton
- Lead: none
- Copper: 0.617%
- Zinc: 0.5%

The sulfide minerals, identified in hand specimen, are arsenopyrite, pyrrhotite, pyrite and chalcopyrite, all of which occur in granite as well as schist. The sulfides are usually found disseminated, but some specimens are best described as "near massive" (dump rock near pit at 0.3N + 0.20W). With the exception of the mineralized granite in the extreme northwestern part of the grid, the sulfides preferentially occur at or near the granite/schist contact. Because the host-sulfide relations can be best observed in pits and adjacent dump rock, a few notes on each pit follow:

1. 0.3N + 0.2W: fine-grained granite with disseminated and near-massive pyrrhotite, pyrite and chalcopyrite; minor pegmatites in the granite;
2. 0.5S + 1.95E: fine-grained granite with a few thin (1") quartz-muscovite pegmatites; granite carries disseminated pyrrhotite, pyrite and chalcopyrite; highest chalcopyrite: iron sulfide ratio observed is here;
3. 2.7S + 0.3E: schist and granite, both mineralized, outcrop on opposite sides of the pit; sulfides most abundant in the fine-grained granite, but the copper content is higher in the schist; the Ellsworth is a silicified quartz-biotite schist, garnet-rich in places;
4. 1.5N + 5.25W: chalcopyrite-pyrite-pyrrhotite disseminated through fine- to medium-grained quartz-biotite granite; dump rocks include coarse-grained pegmatite with pyrite crystals.

Assay: (composite dump samples)
- Gold: trace
- Silver: 0.1 oz./ton
- Lead: none
- Copper: 0.063%
- Zinc: none

Anomalous heavy metal contents were recorded for water (spring) samples taken approximately one-quarter mile distant. A brief examination of the area around the sample site revealed several large outcrops of Ellsworth schist. This local area is favorable for more intensive prospecting.

**Geophysical Prospecting:** The 800' x 900' Campbell grid was surveyed with vertical- and horizontal-loop EM, self-potential unit, and magnetometer. Very restricted S-P anomalies, of low potential relief, are present around each known mineralized area. Low magnitude magnetic variations were recorded over those areas known, or suspected, to be underlain by Ellsworth schist; granite areas are magnetically "flat." There are, apparently, no conductive zones within the grid limits.

**INDEX NO. 28: "OAKLAND" PROSPECT**

**Location: Surry Twp.**

**Ownership:** Howard Carter
D. H. McGraw
Richard A. McGraw
Surry, Maine

**Geology:** Bedrock outcrops are scarce within the 600' x 800' grid limits; best exposures are in the pit and in the road cut adjacent to the pit (schist) and between traverses "0" and 3W in the extreme south part of the grid (granite). The zone of sulfide mineralization is approximately five feet thick and consists of pyrite grains evenly distributed through a fine-grained quartzite. Beds immediately above and below the sulfide zone appear bleached and are lightly sericitized.

**Assay:** (composite dump sample)
- Gold: trace
- Silver: 0.1 oz./ton
- Lead: none
- Copper: 0.063%
- Zinc: none

**Geophysical Surveys:** The Oakland Prospect area was subject to the normal geophysical evaluation; electromagnetic methods, self-potential, and magnetometer. Results of all surveys were negative.

**INDEX NO. 29: DONLON PROSPECT**

**Location: Surry Twp.**

**Ownership:** Wendell Smart
10 Grant Street
Ellsworth, Maine

**Geology:** The country rocks at this prospect are the typical chlorite schist facies of the Ellsworth formation. An 8' x 8' vertical shaft is located adjacent to the shore, on an
anastomosing vein system of massive quartz, sugary quartz and ankerite (?). The individual veins are a maximum of six inches in width and contain minor amounts of disseminated pyrite.

INDEX NO. 30: “EASTERN STAR” PROSPECT

Location: Ellsworth City

Ownership: George Sullivan
Gardner Milliken
Ellsworth, Maine

Geology: A 6' x 8' shaft, inclined 35°SE, was dug to develop a quartz vein, reportedly bearing free gold, in contorted quartz-chlorite schist. Cursory examination of waste rock in the large dump revealed neither sulfides nor native metals.

INDEX NO. 31: “BRIMMER” PROSPECT

Location: Ellsworth City

Ownership: Martyn L. Hall
RFD #1
Ellsworth Falls, Maine

Geology: On this property, a 24-inch quartz vein in quartz-biotite schist was developed as a “silver” prospect. Development work was minor, apparently consisting of a single 8' x 12' shaft, the depth of which is estimated at 25 feet. In the shaft, the vein strikes parallel to the foliation of the enclosing schist (N.60°E.), but cuts across the dip (vein 75°NW; foliation 70°SE). Pyrrhotite is by far the most common sulfide in the dump rock. The pyrrhotite is in quartz and in schist adjacent to the vein. Minor amounts of chalcopyrite were detected in the quartz only. Veinlets of sugary quartz, lying parallel to foliation, also carry sulfide minerals.

Assay: (selected dump samples)
Gold: none
Silver: none
Lead: none
Copper: 0.037%
Zinc: trace

Jointing is not particularly well developed; the best developed occupy these attitudes:

<table>
<thead>
<tr>
<th>Strike</th>
<th>Dip</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.45°E</td>
<td>35°NW</td>
</tr>
<tr>
<td>N.55°E</td>
<td>80°SE</td>
</tr>
<tr>
<td>N.40°W</td>
<td>10°NE</td>
</tr>
<tr>
<td>N.85°W</td>
<td>60°SW</td>
</tr>
</tbody>
</table>

Geophysical Surveys: A 600' x 800' grid was established and surveyed in routine manner. The generators at nearby Graham Dam interfered greatly with the electromagnetic surveys, but the data are sufficiently definitive as to indicate the absence of near-surface conductors within the grid limits. Several weak, short natural potential anomalies are present which may represent zones of disseminated sulfides. Without EM confirmation, the S-P anomalies do not appear to be worthy of more detailed exploration. Variations in vertical magnetic intensity are erratic in distribution and poorly defined in trend.

INDEX NO. 32: “DUNHAM” PROSPECT

Location: Ellsworth City

Ownership: R. W. Hogan
RFD #1
Ellsworth, Maine

Geology: This prospect is similar in all respects to the nearby Brimmer. The workings consist of one, irregularly shaped pit, estimated to be 25 feet deep, sunk on a zone of quartz stringers in quartz-chlorite-biotite schist (Ellsworth). The only sulfides present in available specimens are pyrrhotite and pyrite, both of which occur in sugary quartz and disseminated in the schist.

A water sample from a spring brook approximately fifty feet from the pit contained a background content of heavy metals.

INDEX NO. 33: “FRANKLIN” “FRANKLIN EXTENSION” PROSPECT

Location: Franklin Twp.

Ownership: Forrest Coombs
West Franklin, Maine

Geology (Plate 77): The geologic setting at the Franklin Prospect, although considerably more complex, is similar in many respects to that which exists at the Campbell Prospect in Surry Twp. The mineralized zone is along the contact between quartz-chlorite and quartz-biotite schists and a biotite-granite. Gneissoid structure, indicative of transition zones, and areas of xenolithic inclusions (Plate 78A,B) are widespread along the contact zone. Sulfides identified in dump specimens are: pyrite, pyrrhotite, arsenopyrite, sphalerite, galena, chalcopyrite, and chalcocite. The sulfide minerals, although found in both schist and fine-grained granite, appear to be restricted to a thin shear zone,
which strikes N.16°E-N.20°E. The relation of the mineralized shear zone to the host schist and granite may be seen at the Franklin shaft (Fig. 2). It cannot be conclusively demonstrated that this shear zone extends from the Franklin to the Franklin Extension shaft and controlled the mineralization at both; however, it appears to be a justifiable assumption.

The principal joint directions are:

<table>
<thead>
<tr>
<th>Granite:</th>
<th>Strike</th>
<th>Dip</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.35°E.</td>
<td>N.35°E.</td>
<td>65°NW</td>
</tr>
<tr>
<td>N.75°E.</td>
<td>N.75°E.</td>
<td>85°SE</td>
</tr>
<tr>
<td>N.05°W.</td>
<td>N.05°W.</td>
<td>78°SW</td>
</tr>
<tr>
<td>N.13°W.</td>
<td>N.13°W.</td>
<td>80°SW</td>
</tr>
<tr>
<td>N.37°W.</td>
<td>N.37°W.</td>
<td>73°SW</td>
</tr>
<tr>
<td>N.70°W.</td>
<td>N.70°W.</td>
<td>70°SW</td>
</tr>
<tr>
<td>Transition rocks:</td>
<td>N.15°E.</td>
<td>vertical</td>
</tr>
<tr>
<td>N.58°E.</td>
<td>N.58°E.</td>
<td>vertical</td>
</tr>
<tr>
<td>N.25°W.</td>
<td>N.25°W.</td>
<td>vertical</td>
</tr>
<tr>
<td>Schist:</td>
<td>N.15°E.</td>
<td>vertical</td>
</tr>
<tr>
<td>N.25°E.</td>
<td>N.25°E.</td>
<td>vertical</td>
</tr>
<tr>
<td>N.27°W.</td>
<td>N.27°W.</td>
<td>75°NE</td>
</tr>
<tr>
<td>N.85°W.</td>
<td>N.85°W.</td>
<td>70°NE</td>
</tr>
</tbody>
</table>

The details of rock type and sulfide relationships are presented by Li (1942, pp. 35-36).

**Assay:** (composite sample, Franklin dump)

- **Gold:** 0.020 oz./ton
- **Silver:** 1.2 oz./ton
- **Lead:** 1.5%
- **Copper:** 0.088%
- **Zinc:** 0.8%

**Geophysical Surveys:** The 800' x 900' Franklin grid was covered by four geophysical surveys; magnetic, self-potential, vertical- and horizontal-loop EM. One short, but well-defined, conductor was mapped by HEM equipment in the vicinity of the Franklin shaft (3S + 0) (Plate 79). The VLEM survey revealed that this conductor does not extend to adjacent traverse lines. A weaker, or deeper, conductor was mapped at 3S + 3½E. Both of these conducting zones have reasonable S-P confirmation, and that at 3S + 0 has striking magnetic support. It is possible that a third, very weak, conductor exists in the area on traverse 3N between the base line and 1E. In addition to the S-P trend along the known mineralized zone (Plate 80), there is a sharp anomaly centered at 0 + 2½E which correlates with an 800-gamma magnetic peak. The schist/granite contact appears to be marked by a series of sharp magnetic peaks; the granite area shows little magnetic variation; and the schist area is characterized by moderate to high values and linear trends which essentially parallel the schistosity (Plate 81).

Judging from the geological characteristics of this prospect, it would appear that shear zones in or near the contact may have acted as loci of sulfide mineralization. As demonstrated, it is possible to detect even small zones by the geophysical methods utilized in the Franklin surveys. Exploration should be extended along the schist/granite contact, especially toward areas of outcropping sulfides.

**INDEX NO. 34: "EARLY DAWN" PROSPECT**

- **Location:** Hancock Twp.
- **Ownership:** D. A. Cushman
  Hancock, Maine

**Comments:** This prospect is mentioned in this report to present current ownership and an accurate location. The main shaft is covered and the dump destroyed. Prior to covering the shaft, the present owner plumbed it to a vertical depth of 200 feet. Local residents reported that drifts on at least two levels extended under the bay.

**INDEX NO. 35: "GOLDEN CIRCLE" PROSPECT**

- **Location:** Sorrento Twp.
- **Ownership:** undetermined

**Comments:** The only evidence of previous prospecting at this location is a small, filled shaft at the extreme southeastern end of Treasure Island. Pyrrhotite is present in a quartz vein system which trends north-south through a very narrow part of the island.

**INDEX NOS. 36-40: WEST SULLIVAN GROUP**

- **Location:** Sullivan Twp.
- **Ownership:** undetermined

**Comments:** Since their discovery in 1877, the large number of mines and prospects which lie between Sullivan and West Sullivan have been the subject of a great deal of geologic investigation, the results of which have appeared in the literature. The most useful of the published reports are Kempton (1879, pp. 349-359), Emmons (1910, pp. 39-40) and Li (1942, pp. 37-39).

On the accompanying location map, five mines of the Sullivan group are accurately located: 36-Millbrook; 37-Portland & Sullivan (?); 38-Fannueil Hall & Sullivan (?); 39-Pine Tree; 40-Milton. The identification of Index No. 37 and 38 is questionable because of the discrepancy between published location (Mineral Resources Index No. 3) and those established in the field. The Sullivan and Waukeag mine is almost precisely midway between locations 38 and 39, and is easily identified by existing buildings (Plate 82). The main shaft is under the largest existing building.
Reconnaissance electromagnetic traverses were run in the vicinity of locations 37-39 and the Sullivan-Waukeag mine.

Traverse lines were laid out extending from the shore of Taunton River to points 500 feet inland. Each line was approximately 300 feet from the shaft on the vein to be surveyed. In VLEM surveys, the transmitter was set up on the shaft collar and the receiver run along the traverse. In the HEM survey, the traverse lines were run in usual tandem configuration. Both surveys were greatly hampered by the proximity of "noisy" power lines and telephone cables. The only "conductor" mapped was a VLEM crossover on the traverse run from the Sullivan shaft; this "conductor" was attributed to the presence of a nearby, buried telephone cable.

There do not appear to be any extensive conductors in the vicinity of the four veins tested in this reconnaissance survey.

INDEX NO. 41: "MORANCY" PROSPECT
Location: Sullivan Twp.
Ownership: Fremont Preble
Ashville, Maine

Geology (Plate 83): The Morancy vein is in the quartz-biotite facies of the Ellsworth schist. The schists appear to be unusually silica rich (soaked?), and there are local areas of chloritic and sericitic alteration. Sulfide mineralization led to the development of pyrite and chalcopyrite in veins of sugary quartz and in wall rocks adjacent to the veins. Two outcrops contain a basic igneous rock which is very fine-grained (basaltic to diabasic) near contacts with schist and coarser grained (gabbroic) away from contacts. At one place (0.9S + 0.3E), the intrusive appears to truncate a mineralized, 6-inch quartz vein. However, in this same outcrop, the contact between the schist and intrusive is mineralized; pyrite and chalcopyrite are found in both lithologies. If, as it appears, the intrusive is post vein emplacement, there may have been a sulfide remobilization effect associated with intrusion.

The mineralized vein is best developed in the wall of the shaft at coordinates 0 + 0. Secondary chalcocite is best developed here, but it is also present in the outcrop at 0.9S + 0.3E. Another small (1'-3") copper-bearing vein outcrops near the Preble residence, about 300 feet south of 3S + 2E.

In the relatively few outcrops present on the grid, the schist foliation strikes consistently northeastward and dips rather gently northwestward. Joints are moderately well developed and occupy these principal directions:
CONTOUR INTERVAL: 50 MILLIVOLTS, ALL VALUES PLOTTED NEGATIVE.

DATUM: LOCAL PLATE 80.

Variations in Self-Potential: Franklin Prospect, Franklin Twp.
The mineralized vein is controlled by a N.35°W joint.

Development on the vein has been limited, several shallow trenches and pits (some recent) and one 10' x 12' shaft inclined at 65°SE. The shaft is now nearly completely choked, but reportedly extends to an inclined depth of 40 feet.

**Assay:** (composite dump samples)
- Gold: 0.050 oz./ton
- Silver: 0.1 oz./ton
- Lead: 0.3%
- Copper: 0.567%
- Zinc: trace

**Geophysical Surveys:** In order to evaluate the prospect geophysically, a 600' x 800' grid was established. A VLEM survey was run on lines 3N and 3S from a single transmitter set-up at 0 + 0. The results of this survey, as with the HEM traverses on lines 3N, 0, and 3S, were negative. The S-P (Plate 84) and magnetic surveys (Plate 85) produced low-value anomalies which correlate well with one another and with the known distribution of basic rock. These anomalies indicate that the intrusive is of limited size and is generally oriented parallel to host rock foliation.

**INDEX NO. 42: “GOULDSBORO” (GOULDSBOROUGH) PROSPECT**

Location: Gouldsboro Twp.

Ownership: Enos Tracy
- Orin Whitaker
- Kenneth Foss
- Florence Guptill
- Gouldsboro, Maine

**Comments:** The Gouldsboro Prospect, with its extensions, has a history dating to at least 1878; it was included in the Sullivan Mining District by Kempton (1879, p. 349). According to Emmons (1910, p. 41) some ore was shipped “in the early eighties.” The mine development and general geological relations are adequately described by Emmons (1910, pp. 40-41) and the petrography-mineragraphy by Li (1942, pp. 28, 33-35).

The Gouldsboro vein was recently prospected by trenching and a series of shallow drill holes. In the trenches, the relation of the vein to the host diorite can be seen quite clearly. The thin vein system (Plate 86A) is remarkably persistent over a strike length of at least 1,000 feet; it may be controlled by a zone of shearing, as the diorite near the vein has pronounced foliation (sheeting) (Plate 87). The vein was not seen in the pit at 3E + 0; however, typical shearing and alteration are present.

**Assays:** (dump sample, Tracy property)
- Gold: trace
- Silver: 8.8 oz./ton
- Lead: 1.6%
- Copper: 1.422%
- Zinc: 0.6%

(composite of vein outcrops in trenches)

- Gold: trace
- Silver: 6.7 oz./ton
- Lead: 0.9%
- Copper: 2.154%
- Zinc: 0.1%
Gold: trace
Silver: 31.5 oz./ton

Geophysical Surveys: Vertical-loop and horizontal-loop EM surveys show that the known sulfide-bearing veins are (a) not sufficiently continuous and/or (b) not sufficiently mineralized to act as even local conductors. The magnetometer mapped considerable intensity variation (Plate 88), but the contour pattern does not appear to be controlled by the hydrothermal mineralization or alteration. The sulfide zones may be outlined by potential contours of ~150 mv or greater (Plate 89), but the natural potential anomalies are too broad to be used as anything other than "areas suspect of containing sulfide minerals."

INDEX NO. 43: "WEST AND SOULE " PROSPECT
Location: Gouldsboro Twp.
Ownership: Arthur Robbins
Gouldsboro, Maine

Comments: The prospect consists of a 6' x 15" vertical shaft, depth reportedly 70 feet, sunk on a quartz-vein system at high-tide level on West Bay. There are no sulfides in scattered dump rock nor vein outcrop.

INDEX NO. 44: "HOME" ("YOUNG ")? PROSPECT
Location: Gouldsboro Twp.
Ownership: Bud Haney
Prospect Harbor Road
Gouldsboro, Maine

Comments: This prospect is one of the few in the district which is found in granite and shows no apparent relationship to a contact. Pyrite, pyrrhotite, galena, and chalcopyrite occur in thin veinlets and disseminated through the granite near quartz veins. The granite is normal, fine- to medium-grained, and does not exhibit any evidence of alteration in the mineralized areas.

Assay: (selected dump samples)
Gold: none
Silver: none
Lead: trace
Copper: 0.063%
Zinc: none
PLATE 83. Geology-Culture: Morancy Prospect, Sullivan Twp.
### TABLE 1. Assays of samples collected at selected prospects. See prospect description for details of sampling.

<table>
<thead>
<tr>
<th>Prospect Index Number</th>
<th>Gold oz./ton</th>
<th>Silver oz./ton</th>
<th>Lead wet on ore</th>
<th>Copper %</th>
<th>Zinc %</th>
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<td>6.4</td>
<td>0.163</td>
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<td>none</td>
<td>0.504</td>
<td>none</td>
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<tr>
<td>3</td>
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<td>4.4</td>
<td>2.6</td>
<td>0.289</td>
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<td>4</td>
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<td>0.6</td>
<td>3.8</td>
<td>0.113</td>
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</tr>
<tr>
<td>5</td>
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<td>0.100</td>
<td>0.7</td>
</tr>
<tr>
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<td>0.289</td>
<td>4.8</td>
</tr>
<tr>
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</table>

PLATE 86

A. Mineralized vein system in wall of main shaft at 0 + 0, Tracy property, Gouldsboro Prospect. View is to northwest.

B. Mineralized ladder vein system in altered diorite, near West Bay workings at the Gouldsboro Prospect.
PLATE 87. Geology-Culture: Gouldsboro Prospect, Gouldsboro Twp.
CONTOUR INTERVAL: 400 gammas

DATUM: local and arbitrary

PLATE 89. Variations in Self-Potential: Gouldsboro Prospect, Gouldsboro Twp.

CONTOUR INTERVAL: 50 millivolts
DATUM: local
CONCLUSIONS – RECOMMENDATIONS

1. The geophysical surveys, completed as described on the individual prospects, demonstrate conclusively that these, or similar, methods are valid tools for sulfide exploration in the southern Hancock County area. All four methods proved useful, the electromagnetic techniques and measurements of spontaneous polarization appear to be the more valuable. HEM equipment is excellent for reconnaissance (search-patterns) and detailing shallow conductors. Unfortunately, power (depth penetration) is sacrificed for portability. VLEM units, more costly to operate in search-patterns, have a distinct power advantage and are, thus, necessary to detect and trace deep or weak conductors. Spontaneous polarization effects proved important in outlining mineralized “trends” which were expressed by disseminated sulfides in some places, as well as verifying the position and dimensions of the larger sulfide zones. The magnetometer will definitely prove useful in locating the granite-host contact, thereby providing a limit to local areas of exploration where the contact cannot be directly observed.

2. All drill core, from this area, available to the survey party was logged by radiation detectors, as were all specimens collected during prospect evaluation. No anomalous radioactivity was noted.

3. Geochemical prospecting may prove to be the most valuable method for locating “new” mineralized areas, in which geophysical surveying may be applied to greatest advantage. Water sampling or stream sediment analysis should be utilized in all reasonable detail. On certain of the prospects with blind geophysical anomalies, detailed soil sampling should prove definitive.

4. There is no geological reason to assume that all mineralized zones must have surface expression. Many of those at the surface have properties which can be detected by selected geophysical instruments. Blind anomalies which possess physical characteristics like those of the surface zones must be considered high-priority targets, probably representing deep sulfide deposits.

5. Observations on the geology of the region tend to confirm the conclusions of Li (1942) regarding the zonal distribution of sulfide deposits about plutons of acid igneous rocks. Sulfide bodies most likely to be conducting zones (high in iron sulfides and/or chalcopyrite) logically will be found nearer the intrusive mass, a situation exemplified by the Blue Hill district. However, zones of massive sulfides, indicated by specimens from the Cape Rosier mine, Hercules, and Emerson-North Castine Prospects, show that conducting zones may be found in other geological environments.

On the basis of known deposits and indicated geological conditions the following are priority exploration areas:

1. the Castine Peninsula, south of the Wallamatogus granite;
2. the Cape Rosier Peninsula;
3. the north-trending strip of Castine volcanics and Ellsworth schist extending from Buck Harbor on the south to the Bagaduce River Narrows on the north;
4. the northwest-trending belt of Ellsworth schist lying between the South Penobscot granite and diorite and the East Blue Hill granite;
5. the contact zone in the local area north of the Campbell Prospect, near Surry;
6. the contact zone between the Franklin Prospect and Great Pond, to the north.
REFERENCES CITED
