PROSPECT EVALUATIONS, WASHINGTON COUNTY, MAINE

by

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ABSTRACT

In 1962 the Maine Geological Survey sponsored a basemetal sulfide exploration program in southern Washington County. The project was completed in the period June 15-September 15, 1962.

The basic geologic framework consists of areas of sedimentary and volcanic rocks intruded by an igneous series, varying in composition from ultrabasic to very acidic. The sedimentary types are fine- to coarse-grained clastics, ranging in age from Ordovician (?) on the west to Devonian on the east. Bedded volcanics consist of tuffs and flows in a multitude of compositional variations; diabase, andesite, rhyolite, and dacite are the more abundant types. Major intrusives are principally discordant stock-like forms of diorite, granodiorite and granite. More basic types, gabbro being most common, are present at several places in southern Washington County. Dikes are in relative abundance.

Sulfide deposits of primary origin are present in several forms, but "veins" predominate. In these, sphalerite, galena, pyrite, and chalcopyrite are the most abundant primary sulfides. Silver, in unknown form, is recorded in assays from dump material at the Frost Prospect indicate a normal gabbro-plus-sulfide intrusive.

As a result of detailed examinations, five prospects are recommended for additional geological or geophysical study. Further, at least three larger areas should be subjected to detailed geochemical analysis.

S.
LOCATION OF AREA

The 1962 exploration area was southern Washington County, consisting of approximately 1100 square miles (Plate 1). More precisely, it is the coastal region between the St. Croix River-Passamaquoddy Bay on the east and the longitude of the village of Steuben on the west, extending inland to the approximate latitude of Route 9 ("the Airline").

Although little of this region can be classified as "summer resort," road access is generally quite good. Principal highways are the coastal U. S. Routes 1 and 1A and the inland State Route 9; State Routes 191, 192 and 193 provide primary access to the countryside between Routes 1 and 9. The county seat, Machias, and Calais are the largest towns and best centers of supply. Principal villages include Milbridge, Cherryfield, Harrington, Columbia Falls, East Machias, Lubec, and Pembroke.

As with a large proportion of the State, nearly all of southern Washington County is covered by modern topographic maps, either 7½' or 15' series, published by the U. S. Geological Survey. For specific areal coverage and the spatial relationship of the various quadrangles, reference should be made to "Index of Maps of Maine," available from the Maine Geological Survey, Augusta.

The factors cited for the choice of southern Hancock County as an exploration area also apply directly to the selection of southern Washington County, as they are both components of the same regional, mineralized belt. The prime geological factor is the fundamentally favorable environment of "granitic" intrusives and metasedimentary-metavolcanic hosts. Historically, the known presence of significant concentrations of basemetal ores and the abundance of prospects from which sulfide-bearing rocks have been extracted cannot be ignored.

MINING AND EXPLORATION HISTORY

There are no known factual data on mineral production from sulfide deposits in Washington County. However, judging from the extent of development at the Cherryfield Mine, the Lubec lead deposits and the Denbow Point Mine, a production contribution must have been made, perhaps several times, from the County.

Because some of the deposits were so conspicuously displayed along the shoreline, sulfide mineral occurrences in Washington County were among the first mentioned in scientific literature covering this area. Since 1860, exploration interest seems to have been reflected by the timing and abundance of publications; a review of significant technical publications is an effective historical review as well.

REGIONAL GEOLOGY

There are only three published maps available which cover southern Washington County, the small scale geologic map of the State by Keith (1933) and compilations covering coastal Hancock and Washington counties by Li (1942) and Chapman (1962). Bastin and Williams' 1914 Eastport Folio presented the geology of a 250 square mile area in the Lubec-Pembroke region. Smith and White's previous effort (1905) was restricted to the Perry Basin, north of the Eastport quadrangle. Terzaghi (1946) mapped, in reconnaissance, the Columbia Falls 15' quadrangle and reported, in some detail, the petrology of the rocks involved. Forsyth (1955) published comments, accompanied by a reconnaissance map, on the geology of a large area in east-central Washington County. The area
involved in Forsyth's work is covered by parts of the Big Lake, Calais, Gardiner Lake, and Wesley 15' quadrangles. Wing (1953) described various aspects of the principal granite bodies of eastern Maine. Amos' work (1958) is a significant contribution; he presents a complete treatment of bedrock, distribution and description, in an area with a good economic potential, the Calais and Robbinston 15' quadrangles. Many basic bodies, similar to the St. Stephen nickel-bearing gabbroic intrusives, were mapped. The geologic maps accompanying Amos' thesis will provide excellent control in any analysis of geochemical values. The most recent specific contribution to Washington County geology is the detailed geologic map of the Cutler and Moose River quadrangles (715' series), published by the Maine Geological Survey (Gates, 1961). Chapman (1962) pointed out the existence of a "recently discovered," regional, bimodal igneous complex, principally gabbroic and granitic types, which trends northeastwardly across southern Washington County. Certain broad geologic relationships are suggested by Chapman.

The following general statement on the geology of southern Washington County is based largely on the broader stratigraphic relationships of Stickleey's (1962) state-wide compilation. Approximately one-half of the area south of Route 9 in Washington County is underlain by unmetamorphosed intrusive rocks. These intrusives may be broadly classified into acid and basic types. The acid group contains such representatives as various granites, quartz porphyries, quartz diorites, and granodiorites. The basic intrusives are best exemplified by basic diorites, gabbro, diabase, and peridotite(?). Intrusives are preferentially localized in a broad, northeast trending belt, cutting across the southern part of the county; smaller bodies are concentrated in the extreme southwestern part of the County. The laminated dark schists and siltstones which crop out in the Cherryfield-Harrington area are depicted by Li (1942) as the Ellsworth formation; certainly, they are lithologically similar. Terzaghi (1946, p. 5) admits the possibility of an Ellsworth correlative within the Columbia Falls quadrangle, but prefers to designate the unit as "the schist of Columbia Falls." The eastern one-third of the area is underlain by a series of volcanic rocks, both intrusive and extrusive, and fine-grained sediments, nearly all of Silurian age. Bastin and Williams (1914) defined the following units: Quoddy shale, Dennys formation, Edmunds formation, Pembroke formation, and Eastport formation. These units, in aggregate, consist almost completely of diabase and rhyolite tuffs and flows and dark shales or slates; andesites, limestones and red shales are present but are definitely subordinate. Gates (1961), in his mapping south of the Eastport quadrangle, retained previous stratigraphic terms for volcanics and sediments northwest of the Lubec shear zone, but used "Cutler diabase," "keratophyre" and "Little River formation" to designate rock types southeast of the Lubec shear zone. The younger, Devonian Perry formation, coarse clastics with interbedded diabase flows, was defined by Smith and White (1905) from their work in the Perry Basin. North and west of the Perry Basin, there is a large number of small intrusives of various lithologies (Amos, 1958). The sedimentary sequence which crops out on the northwest side of the major intrusive belt is described by Forsyth (1955) as consisting largely of slates, impure quartzites and phyllites; a tentative correlation with the pre-Silurian Charlotte Group of New Brunswick was apparently suggested by Forsyth. Such correlation was strengthened by Amos' work (1958).

The only reference which deals specifically with the origin of ore deposits is the work of Ching-Yuan Li (1942). Li believes that all of the sulfide prospects that he studied in the eastern belt are of hydrothermal origin and are distinctly related to the intrusive granites. His conclusions are succinctly stated (Li, 1942, p. 43):

"Toward the eastern part of the area, where the mines in the Silurian rocks are located at a considerable distance from the granite, sphalerite and galena are the chief ore minerals. Pyrrhotite occurs only as inclusions in the sphalerite, and pyrite and chalcopyrite are in very subordinate quantity. In the Big Hill mine, about two miles away from the granite, sphalerite seems to be more abundant than galena. In the Lubec Mine, about 15 miles from the granite, the two appear in equal quantities. 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."

Although sulfide minerals, excluding molybdenite, are present in several modes of occurrence, "fissure veins" or "lodes" predominate. These deposits are obviously structurally controlled, crustal movements providing the openings into which the vein material was emplaced. At the Johnson Prospect, the vein was emplaced, in discontinuous form, in the actual shear zone; at the Lubec Mine, sulfides were emplaced both in shear zones and in fractured rock between faults. In the vein deposits, sphalerite and galena predominate as ore minerals; chalcopyrite and pyrite are present in varying amounts. Silver, in undetermined form, is recorded in nearly all assays of sulfide ore from the vein-type prospects. Gold, if present, is always a very minor constituent; silver may exist in significant proportions. Secondary minerals identified in weathered vein deposits are chalcopyrite, malmosite, azurite, smithsonite, and greenockite(?). Gangue minerals in the veins are quartz and various carbonates.

None of the deposits examined can be classified definitely as "replacement" bodies. In many vein-type occurrences, minor replacement of wall rock has taken place, but this phenomenon is after the fact. There is the possibility that the nickel and copper-bearing sulfide zone at the Frost Prospect constitutes a replacement mass, but so little rock is exposed that a definite statement cannot be made. However, the basic host rock and a large quantity of pyrrhotite with relatively high nickel and cobalt values indicate a normal gabbro (norite)-plus-sulfide intrusive situation, perhaps similar to that at the nearby St. Stephen, N. B., deposits, as described by Houston (1956).

EXPLORATION PROGRAM

A basic objective of the 1962 Survey-sponsored program was that of the previous year; that is, to determine the feasibility of geophysical prospecting for base-
metal sulfides in eastern Maine and to establish certain guide lines for the successful conduct of future geophysical investigations. Standard, commercially available geophysical equipment was utilized. In the course of attaining the primary objective, a number of secondary objectives were also fulfilled. First, a large number of sulfide prospects were accurately located on modern maps; second, a number of significant prospect areas were examined in geologic detail as well as geophysically; third, a limited program of geochemical reconnaissance was carried out. Through integration of all the data obtained, it is possible to recommend areas in which further exploration might logically be undertaken.

Another of the purposes of Operation "62" was to arrive at an estimate of the economic potential of southern Washington County, through inspection of as large a number of individual prospects as possible. With this exploration philosophy, no specific attempts were made to fully evaluate or delimit geophysical or geochemical anomalies; the aim was, rather, to merely demonstrate that they exist.

For the benefit of all interested parties, but especially landowners, it must be strongly emphasized that the reports on individual prospects do not in any way indicate an absolute economic potential. Certain valuable sulfide minerals do not lend themselves to geophysical expression; others which possess properties which can be measured geophysically when in massive form, cannot be detected in disseminated form. Further, other minerals, generally useless, may produce rather spectacular geophysical anomalies. The geophysical and geochemical data presented in this report are offered as factual, reproducible information which should be considered strongly in the evaluation of a particular prospect.

One might well pose the question "why a geophysical investigation rather than a geological one?" As with the remainder of coastal "Downeast" Maine, prospecting efforts have been more or less intensively applied for well over a century, and, although it is certainly true that not all bedrock outcrops or boulder trains have been thoroughly investigated, the possibility of locating a large sulfide body by direct observation is remote, to say the least. Further, outcropping rocks constitute no more than a few percent of the surface area, thus the vast majority of the potentially mineral-bearing region has had no effective coverage. Geophysics and geochemistry are accepted, modern methods of obtaining geological information in areas of extensive soil or glacial debris cover. Geophysical methods, especially, often provide valuable insight into depth characteristics.

GEOPHYSICAL SURVEYS

One of the fundamental decisions which must be made in the initiation of an exploration program involving basemetal sulfides is the choice of instrumentation. Another factor, almost as fundamental, is the detail with which the various investigations will be carried out. The magnetic and electrical properties of sulfide minerals, or associated minerals, are the characteristics tested in most geophysical surveys. Specifically, the electrical properties most frequently measured are conductivity, spontaneous polarization, and inductive response. In most cases, there is a strong contrast between these properties in a sulfide-bearing zone and the host rocks, such contrast constituting an "anomaly."

In the choice of instrumentation for the 1962 program, experience gained in the southern Hancock County evaluation weighed heavily. The high success ratio (significant anomalies: prospects surveyed) obtained during the 1961 program demonstrated that the initial choice of instrumentation was fundamentally good, and the decision was made to continue the 1961 survey procedure. Minor changes were instituted in grid size and control, but they did not in any way change the procedure or philosophy of exploration.

Basic equipment for the evaluation program included self-potential equipment, vertical and horizontal loop electro-magnetic units, and vertical-force magnetometer. Base party instrumentation also included Afmag, D-C resistivity, potential-drop-ratio (or applied potential) equipment, and radiation detectors.

The physical and chemical principles upon which the various survey methods are based are in most cases complex; it is beyond the scope of this report to even enter this domain. For those interested in fundamental theory, as well as other surveying techniques and interpretation, reference may be made to Dobrin (1960), Howell (1959), Eve and Keys (1956), and Jakosky (1950).

As readily seen on accompanying maps, the size, orientation, and traverse spacing of grids on various prospects was not standard. In final form, the size of the grid was generally determined by the geophysical response, large grids mean good response. Exceptions exist where the grid was exceptionally large in order to cover evidence of mineralization or existing workings. Grid orientation was a function of the actual or estimated trend of the subject mineralized zone. Traverse spacing varied from the normal 300 or 400 feet to provide the detail desired on a given anomaly. As well as providing mapping control, the grids provided a standard spacing for geophysical data. The grids were laid out on Brunton compass-and-chain control, with stations established at 50-foot intervals. Grid orientation, as shown on prospect maps, may be subject to minor error in areas of strong magnetic variation (Smith Prospect); astronomic control was not attempted.

Magnetic surveys: magnetic readings were taken on 25 foot or 50 foot stations with a Schmidt-balance, vertical force magnetometer. Accuracy standards are within ± 5 gammas. Data are presented as traverse profiles or contours depicting variations in vertical intensity. Contour interval varies from map to map, depending on total local relief or characteristics of magnetic features. In each case, the magnetic datum is arbitrary and base-station control is local. Where necessary, magnetic data were corrected for diurnal and day-to-day variation.

Self-potential surveys: S-P maps, through profiles or contours, show local variations in natural earth currents. The origin and flow patterns of the natural potentials can be compared to those of a large buried battery; they result from the oxidation of sulfide-bearing or graphitic bodies and are, therefore, near-surface phenomena. The threshold value of an S-P anomaly is difficult to define and an anomaly is best evaluated in the light of existing local conditions, including depth of cover, amount and character of groundwater, and composition of the oxidizing body.

Depending on required detail, S-P readings were taken on grid spacings of 25 or 50 feet. As the entire grid was surveyed, all S-P values are directly related and final data were reduced such that positive values do not exist. On the maps showing variations in spontaneous polarization, the datum is local.
Electromagnetic surveys: two EM systems were used in the 1962 program, both were designed to measure certain characteristics of the inductive properties of sub-surface materials. Both utilize primary alternating currents of fairly high frequency and both measure a potential response at the surface, but beyond this the systems are quite different.

Vertical-loop system: this method employs a fixed-position, generator-powered transmitter, operating in the 1000 cps frequency range. The transmitting loop is in vertical orientation and the plane of the loop is directed precisely toward the station occupied by the receiver. A portable receiver loop, which also serves as a “direction” (or transmitter) finder, measures distortions in the primary field at 50-foot intervals along the traverses. Transmitter-to-receiver separations of 300 to 1200 feet were used, depending on specific situations. In order that an individual profile may be evaluated in the light of such separation, VLEM maps show transmitter locations, and profiles run from a given set-up bear proper identification.

VLEM data are presented in terms of “dip-angle” profiles, profiles developed by connecting the specific dip-angle recorded at each station. Dip-angles are angular departures from horizontal of the resultant of the primary and secondary fields at receiver stations. The effective conductor axis is marked by “cross-over” points, those points on profiles where dip-angles change from north to south, or east to west.

This particular VLEM unit has a distinct “power” advantage over HEM units, allowing significantly greater depth penetration (perhaps as much as 250-300 feet). Its characteristics are such that, despite its tendency to “average” the details of response, multiple conductors may be identified from traverse to traverse through analysis of the transmitter-receiver coupling.

Horizontal-loop system: with HEM equipment the transmitter is battery-powered, portable, and directly coupled to the receiver loop; in actual surveying both coils are in horizontal attitude. During the 1962 surveys, a coil separation of 200 feet was maintained; other separation intervals, greater and less than 200 feet, have been used. The compensating cable serves two distinct functions; first, it maintains the coil separation at a constant 200 feet, and, second, it transmits a small signal which “bucks out” the primary EM field. Readings are arbitrary percentage values of the in-phase and out-of-phase elements of the vertical component of the secondary field ($S_v$).

Principal advantages of the HEM system are speed of operation, definition of conductor limits, and some evaluation of the composition and physical makeup of the conducting zone.

**INDIVIDUAL PROSPECTS**

In the following prospect descriptions, wherever possible names which have been applied in existing literature are retained (shown in quotation marks), otherwise, names of current landowners are used. In most cases, the name(s) of the principal landowner(s) are included; however, it is possible that landowners other than those listed are involved. It must be emphasized that no attempt was made to verify ownership or property lines. However, to best knowledge, no property was investigated on which the mineral rights were then under lease or option, or did not reside with the surface owner.

Because certain of the prospects lie adjacent to great ponds or tidal areas, it should be pointed out that the State of Maine must be regarded in some ownership considerations. A full explanation of the staking requirements and assessment responsibilities may be found in the **Maine Mining Law for State-Owned Lands**—Chapter 135, Public Laws of 1959. Underwater mineral rights held by the State are open to staking.

**Index to Prospects**

1. Wakefield (French) Prospect
2. Cherryfield Quarry
3. “Cherryfield Mine”
4. “Britton” Prospect
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7. North Harrington Prospect
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9. Wesley (“Rollins”) Prospect
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13. Smith Prospect
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16. “Lubec Mine” and Prospects
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1M. “Catherine Hill” Molybdenum Prospect
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3M. Burke Hill Molybdenum Prospect
Index #1: Wakefield (French) Prospect

Ownership: Edgar French
Cherryfield, Maine

Location: Town of Cherryfield (Plate 3A)
Cherryfield 15’ Quad.

Grid: 600’ x 800’; 3000 linear feet; 10.6 acres.

Geology: Rocks in the immediate area of the 18’ x 18’ x 15’ pit, known as the Wakefield Prospect, may be divided into three broad groups: (a) metasediments (Ellsworth fm?), (b) acid intrusives, and (c) transition rocks (Plate 4). The oldest rocks are dark, thinly bedded metapelites and impure quartzites which dip nearly vertically and strike generally N.5°-10°E. The pit was put down to examine a quartz-carbonate vein system emplaced in the metasediments. The fine-grained metasediments were intruded by small (?) granitic-to-dioritic bodies, some of which display chill zone effects (diminished grain size). At least one-half of the outcrop area within the grid limits expose rocks best described as "transition." In all cases they appear to be metasediments altered by the acid intrusives. Except for distinct foliation, compositionally and texturally the rocks appear to be typically "diabasic" or "gabbroic." Jointing is especially prominent in intrusives and transition rocks. Thin dikes, both acid and basic, are exposed.

The vein system appears to be of very limited extent on the surface and dips vertically. Individual veins are composed of white quartz and buff to brown calcite, in varying proportions. Local residents describe the workings as a "silver mine"; however, there are no specimens now available which support such classification. The only sulfide detected in hand specimen is pyrrhotite, occurring as sparse, finely disseminated grains in selected sedimentary beds.

Geophysical Surveys: The reconnaissance grid was surveyed with magnetometer and HEM and S-P units. Data secured from HEM and S-P surveys indicate that there is no near-surface sulfide zone of significant proportions. The magnetic survey revealed moderate value local variations which appear to be related to areas of transition and sedimentary rocks (Plate 5).

Stream sediment (bank and active) samples taken at grid coordinates 3S + 4E showed background concentration of cxHM.ª

Index #2: Cherryfield Quarry

Ownership: Unknown

Location: Town of Cherryfield (Plate 3B)
Cherryfield 7½’ Quad.

Grid: 400’ x 400’; 1200 linear feet; 3.6 acres.

ª cold-extractable heavy metals (see Hawkes & Webb, 1962, p. 151)
Plate 4

GEOLOGY - CULTURE: WAKEFIELD (FRENCH) PROSPECT TOWN OF CHERRYFIELD CHERRYFIELD 15' QUAD.

i = diorite-granitic intrusives
m = metasediments
\( \text{t} \) = transition rocks

500 yd. to Old County Road

0 100 200 FEET
Comments: Routine examination of the fine-grained, dark schists (Ellsworth fm?) exposed in the quarry led to local geophysical sampling. Iron sulfides, principally pyrrhotite, are locally abundant in the schists, from place to place making up several percent of the rock; chalcopyrite was noted in trace amounts.

Two short traverses were laid out at right angles to the bedding and each some 400 feet distant from the north end of the pit. Both traverses and the base line were run with S-P equipment and magnetometer. Attempts to survey with HEM equipment were defeated by local power line interference.

The results of S-P and magnetic surveys are shown on Plate 6. Magnetic relief of several hundred gammas was measured; magnetic variation may be related to a specific sedimentary unit. S-P variation was slight; the one significant deflection corresponds to a magnetic high measured over the outcrop zone at ½N on the base line.

Additional magnetic and S-P surveys and geochemical testing should be carried out over strike projections of this zone.

Index #3: “Cherryfield Mine” Prospect

Ownership: Frank E. Patten
3020 N. Nottingham St.
Arlington 7, Virginia

Location: Town of Milbridge (Plate 3B)
Cherryfield 7½’ Quad.

Grid: 800’ x 1600’; 5,600 linear feet; 28.5 acres.

Geology: The general setting of this deposit and its development was briefly described by Emmons (1910, p. 43). Li (1942, pp. 42-43) summarized the mineralogy of the sulfide-bearing vein and petrography of the host rocks.

For mapping purposes, rock cropping out within the grid limits are classified into five groups: (a) schist (Ellsworth fm?), (b) intermediate igneous intrusive (“diabase”), (c) pyroxene-rich alteration zone, (d) acid dikes, and (e) basic dikes (Plate 7). The schist, tentatively identified as Ellsworth, is normally very fine-grained and nearly always dark. Outcrops in the southern part of the grid may show one to two inch light-colored laminae. Color varies between dark green and brown, depending on relative proportions of chlorite and biotite. The intermediate intrusive, from very sparse outcrop, is best described as diabase, although textural variations are prominent. The rock is typically non-foliate, highly jointed, and may show chill contact effects. The magnetic survey indicates an unusually low susceptibility range for this rock type. The pyroxene-rich alteration rocks are difficult to classify; they appear to be a transition phase. The mineralogy and texture of these rocks, and some aspects of their physical relations, appear intrusive. However, most outcrops show poorly to well-defined foliation; its physical relation to bedding and schistosity of nearby metasediments suggests complete gradation. It is proposed that the foliation of the pyroxene-rich zone is relict from the schist. Basic dikes, basaltic in nature and which characteristically weather chocolate-brown, are relatively abundant. These dikes are usually several feet wide and their emplacement appears to have been joint controlled. They are best identified by color of weathered surface, lack of foliation, and cross-cutting relations. The acid dikes, exposed at several places on the eastern end of the grid, constitute an exotic rock type, one not noted at any other prospect. In unweathered form, this dike rock is light gray, very fine-grained feldspar liberally set with small (1-2mm) colorless to white phenocrysts. Some phenocrysts are rounded, others show crystal outlines. On weathered surface, the acid dikes are a conspicuous chalky white.

G. O. Smith (in Emmons, 1910, p. 43) reported that the shaft was put down on a 12-20 inch fissure vein striking N.85°W. and dipping steeply northward. Except for a shallow (9 foot) prospect pit located about 500 feet east of the main shaft, workings are not available for examination. Dump rocks have been scattered or used locally as road metal, consequently it is difficult to specifically identify the type of deposit. Certainly, however, the few remaining mineralized specimens corroborate the descriptions of Emmons (1910) and Li (1942).

On the basis of mineralogy and form, judging from dump samples around the main shaft, the deposit is a low-temperature, shallow, fissure-filling of hydrothermal origin. Sphalerite, dark-brown to black, is the predominant sulfide; galena, pyrite, and chalcopyrite are also present. Secondary products, derived from weathering of the sulfide-bearing veins, are malachite, smithsonite and greenockite(?). Except for several semi-massive specimens of pyrite, galena and chalcopyrite, the sulfides generally occur as crystalline aggregates or disseminated grains in vein matter. The vein material is largely milky quartz, but locally calcite and siderite are abundant. Both sphalerite and galena were deposited in several stages of mineralization, but both were relatively late in the sequence of deposition. Comb structure of the vein quartz, banded veins, lack of wall alteration, and small, drusiform openings attest to open space deposition and low temperature of mineralizing fluids.

In the prospect pit at 4½E on the baseline, the host rock is altered schist, heavily pyroxenized but displaying definite relict bedding. In the pit wall two thin (2"-3"), sulfide-bearing veins are exposed, striking N.77°W. and dipping 65°NE. The veins are principally quartz, but also contain late calcite and minor sulfide (only ZnS positively identified). The veins pinch and swell radically over short distances. As an apparent result of slight silica enrichment, the vein walls in unweathered outcrop are brown, in contrast to the dark gray-green host.

A composite sample of high-grade ore from the shaft area yielded the following assay:

Sample: ME-62-4

Gold: 0.020 oz./ton
Silver: 18.2 oz./ton
Lead: 11.0%
Copper: 0.567%
Zinc: 19.8%
CULTURE-MAGNETIC-SELF POTENTIAL COMPOSITE
CHERRYFIELD QUARRY, TOWN OF CHERRYFIELD
CHERRYFIELD 7½' QUAD.
a - acid dikes  d - diabase  t - transition zone (pyroxene rich)
b - basic dikes  s - schist

GEOLOGY - CULTURE: CHERRYFIELD MINE
TOWN OF MILBRIDGE
CHERRYFIELD 7½' QUAD.
PLATE 8

CHERRYFIELD MINE PROSPECT, TOWN OF MILBRIDGE
COMPOSITE OF S-P AND MAGNETIC SURVEYS

Magnetic Contour Interval = 100 gammas
Magnetic Datum: Arbitrary
Self-Potential Contour Interval = 20 millivolts
S-P Datum: Local
Geophysical Surveys: The entire Cherryfield grid was surveyed with HEM and VLEM units, S-P equipment and magnetometer. Both EM surveys indicate the absence of conducting bodies of significant size. S-P and magnetic variations show little correlation and both sets of data appear to be non-definitive, with respect to known mineralized zones (Plate 8). Magnetic variations may be related to the distribution of diabase.

Culture: All buildings and mining and milling equipment have been removed; the main shaft (two compartment) is choked or filled with rock and timbers.

Index #4: "Britton" Prospect
Ownership: Harold Dinsmore
Milbridge, Maine
Location: Town of Milbridge (Plate 3B)
Cherryfield 7½' Quad.
Grid: 800' x 1100'; 4,300 linear feet; 19.5 acres.

Geology: The Britton Prospect is a single pit (6' x 8' x 15') on a quartz vein system in granite, within a few hundred feet of the granite/sediment contact (Plate 9). The medium-grain granite, ranging in color from gray to pale pink, is generally non-porphyritic; only one xenolith was noted. Quartz veins near the shaft strike N.60-70°W. and dip vertically or to the northwest at a steep angle. Vein width varies from 1 inch to approximately 5 feet; it is difficult to trace even the widest veins for more than a few tens of feet along strike. The veins are usually massive, but there is local splitting and coalescence. The granite between the veins is distinctly foliate, indicating that the white quartz may have been introduced along a minor shear zone.

All of the sulfides found were in dump rock around the prospect pit or as finely disseminated grains (pyrite) in granite between the veins. Sulfides in the vein quartz were pyrite and chalcopyrite, and secondary "sooty" chalcocite. All sulfides are present as disseminated blebs or crystals; no massive zones or stringers were noted. Sulfide mineralization was obviously very weak and sporadically distributed.

A small, composite sample of high-grade dump material provided this analysis:

Sample: ME-62-13
Gold: trace
Silver: 0.5 oz./ton
Copper: 0.844%

Near the western end of the grid, the Ellsworth (?) fm. crops out in several places. The outcrops are mostly quartz-biotite schist and thinly laminated metasiltstone, all of which strike generally northeast and dip southeast into the granite. Certain of the schist layers are rusty-weathering, due to about ½ % disseminated pyrite. In addition, one thin basaltic dike was mapped as well as several outcrops of a fine-grained, intermediate intrusive.

Geophysical Surveys: The Britton grid was surveyed by the four standard methods; HEM, VLEM, S-P, and magnetic. Results of the first three methods listed were negative. Magnetic data, used with geologic information, indicate that the quartz vein system was emplaced very close to the concealed granite/sediment contact (Plate 10).

Index #5: "Pillsbury-Stevens" Prospect
Ownership: Horace Haskell
Steuben, Maine
Location: Town of Steuben (Plate 11A)
Cherryfield 7½' Quad.
Grid: 550' x 800'; 2,950 linear feet; 9.8 acres.

Geology: Past prospecting efforts on this sulfide occurrence consist of two pits; the larger, 12' x 12' and estimated at 18' deep, is at the center of the grid; the other, a shallow trench, is about 200 feet to the south (Plate 12). The larger pit was dug to test an anastomosing quartz vein system in a gray to pink, fine- to medium-grained granite. The veins, seldom more than a few inches wide, are composed of quartz and calcite; some carry very minor sulfides. Primary sulfides identified in hand specimens are pyrite, chalcopyrite and sphalerite, all occurring in tiny stringers. Secondary products, derived from chalcopyrite, are minor "sooty" chalcocite and conspicuous malachite and azurite. The host quartz veins, striking about N.10°W., are tension-fracture fillings caused by nearly horizontal movement on a N.10°W. shear zone, well exposed in one wall of the pit. The granite wall rocks were, in some places, strikingly altered for several inches from the veins by epidotization.

A composite dump sample yielded the following assay:

Sample: ME-62-16
Gold: 0.005 oz./ton
Silver: 2.4 oz./ton
Lead: 0.4%
Copper: 0.415%
Zinc: trace
PLATE 9

area of abundant outcrop
(granite)

g - granite      qv - quartz veins
s - schist       i - intermediate intrusives

GEOLOGY - CULTURE: BRITTON PROSPECT
TOWN OF MILBRIDGE
CHERRYFIELD 714' QUAD.
BRITTON PROSPECT, TOWN OF MILBRIDGE
MAGNETIC SURVEY: VARIATIONS IN VERTICAL MAGNETIC INTENSITY
Contour Interval: 100 gammas
Magnetic Datum: Arbitrary
**Geophysical Surveys:** Power line interference effectively prevented surveying with HEM and VLEM equipment. S-P and magnetic surveys did not define significant anomalies.

**Index #6: “Petit Manan” Prospect**

**Ownership:** William Mague
Milbridge, Maine

**Location:** Town of Steuben (Plate 11B)
Petit Manan 7½' Quad.

**Grid:** 600' x 800'; 3,000 linear feet; 10.6 acres.

**Comments:** The workings at this prospect consist of one shaft (Plate 13) and several small blast holes, all within a 100-foot radius. The 10' x 13' shaft is estimated (by property owner) to have been open to a depth of 40-45 feet. The long dimension of the shaft, N.45°E., was controlled by prominent joints, not the mineralized trend. There is no evidence to indicate the former presence of a mill or furnace. No drill holes were noted.

**Geology:** The country rock in the immediate area is a white to gray, medium-grain granite, cut by minor sulfide-bearing zones and basic dikes (Plate 14). The largest dike, that in the center of the grid, appears to be a highly altered ultrabasic (pyroxenite?). The orientation of this dike, as with all the others, is joint controlled. Although quartz veins are locally present, the sulfides are found in poorly defined, altered zones in granite. It is difficult to determine if an actual mineralized trend exists; the grid was laid out on the apparent trend of the mineralized zone exposed in the shaft. Sulfides, pyrite and red-brown sphalerite with traces of chalcopyrite and galena, are abundant in dump rock around the shaft. The normal mode of occurrence is as irregular, small (2-5 mm) replacement masses, rather evenly distributed through altered gray-green granite. The dump also contains representatives of a very fine-grained, dark brown, porphyritic rock which apparently is not exposed at the surface. This rock, provisionally identified as a lamprophyre, carries 2-3% pyrite, as disseminated 1 mm grains.

A composite sample of mineralized granite from the dump provided this assay:

**Sample:** ME-62-7

- Gold: trace
- Silver: 1.2 oz./ton
- Lead: 0.8%
- Copper: 0.151%
- Zinc: 3.5%

**Geophysical Surveys:** The results of all surveys, VLEM, HEM, S-P, and magnetic, were negative.
GEOLOGY - CULTURE: PILLSBURY-STEVENS PROSPECT
TOWN OF STEUBEN
CHERRYFIELD 7¼' QUAD.

ALL OUTCROPS GRANITE

0 100 200
FEET
Index #7: North Harrington Prospect

Ownership: Perley Grant
Harrington, Maine

Location: Town of Columbia
Cherryfield 15' Quad.

Grid: None

Comments: This prospect is known locally as the "silver mine." The workings consist of an 8' x 12' shallow pit which revealed a series of quartz-carbonate veins, which strike approximately east-west, enclosed in a crumpled chlorite schist. The vein system is more than eight feet wide, with individual veins up to ten inches wide. The only sulfide observed was pyrite, very minor amounts, occurring as cubic crystals and thin veinlets.

No geophysical surveys were attempted.

Index #8: "Bacon & Snow" Prospect

Ownership: Miss Alice Bacon
R.F.D.
Machias, Maine

Location: Town of Wesley (Plate 15B)
Wesley 15' Quad.

Grid: None

Comments: One small pit (4' x 5' x 10') was put down on a thin (1"-12") quartz-carbonate vein. The vein, sinuous and discontinuous, appears to have been emplaced in a small shear, developed in the pale-green, highly altered host rocks. A similar vein crops out approximately 75 feet N.30°E. from the pit.

Sulfides are very scarce in vein material; pyrite and sphalerite grains were identified. The owner produced a letter from the Maine Development Commission which cites the following assay of material reportedly from the prospect pit:

- Gold: 0.01 oz./ton
- Silver: 0.3 oz./ton
- Lead: none
- Copper: 0.25%
- Zinc: 1.3%

Because of the high degree of shearing and alteration it is difficult to identify the exposed host rock. Outcrops in the immediate area lie on a prominent structural element, well displayed on aerial photographs (GSM 5-39; 8-28-40). The existence of this feature is pointed out by Forsyth (1955). Examination of rocks cropping out along and near the linear element indicate that the structural feature is a zone of strong shearing, and that some of the pale-green, fine-grained rocks are highly altered mylonites and micro-breccias.

Large boulders of white vein quartz and abundant pyrite were found at several places along the south shore of Seavey Lake. These boulders, some of which are weathering rapidly, were apparently quite angular and probably had a not too distant source.

Index #9: Wesley ("Rollins") Prospect

Ownership: Roger Gray
Machias, Maine
Pejepscot Paper Company
Cutler Division
Cutler, Maine

Location: Town of Wesley (Plate 15B)
Wesley 15' Quad.

Grid: 2,400' baseline, max. width 1100'; 11,750 linear feet; 53.3 acres.
PLATE 14

all outcrops granite except dikes as noted.

GEOLoGY - CULTURE:
PETIT MANAN PROSPECT
TOWN OF STEUBEN
PETIT MANAN 7 1/2' QUAD.
**Comments:** A mining prospectus and several letters, now in the possession of Miss Alice Bacon, Wesley, Maine, indicate that an attempt was made to exploit this property shortly after 1900. Judging from surface workings, the attempt was casual and short-lived. The largest pit, trending nearly east-west, is 12' x 25' and is estimated to be less than 25 feet deep. Remaining workings are a trench, small pit, and several shallow blast holes.

**Geology:** The Wesley Prospect lies less than one mile outside the Meddybemps area (airborne magnetic survey) and comments on the local geology by Forsyth (1955, pp. 39-40) appear valid. Although unable to assign a definite stratigraphic position to the sedimentary rocks near Wesley, Forsyth (1955, p. 39) points out that rocks of the Pre-Silurian Charlotte Group (Can. Geol. Surv.) were identified in nearby areas. The rocks outcropping around Wesley village are described as a mixture of phyllites, “sedimentary gneisses,” and micaceous quartzites.

As may be seen on Plate 16, outcrops are abundant only in the central part of the large grid. Lithologic types exposed are gray phyllites, fine-grained micaceous quartzites, and knotty, gray mica schists. Knotty areas in schists appear to be andalusite developments. Despite the dark gray color exhibited by the schists, graphite was not positively identified. Practically all of the weathered surfaces show conspicuous iron oxide coatings or stains. Because of thin bedding and alternating beds of varying competency, fracture cleavage is well developed in nearly every outcrop.

The only significant concentrations of sulfides were confined to the area around grid coordinates 0+0. Sulfides identified in hand specimen were pyrite, arsenopyrite and sphalerite. Pyrite is the most abundant, occurring along fractures in both country rock and vein quartz. Arsenopyrite is found as disseminated grains and thin stringers in country rock adjacent to quartz vein development; rarely is it found within quartz. Sphalerite, of the “black-jack” variety, was noted exclusively and alone in fractures in white vein quartz. The focus of sulfide mineralization appears to have been in the area of the large pit. Sphalerite is restricted to dump rock around this pit and both pyrite and arsenopyrite are most abundant here. The trend of the vein(s) in the large pit cannot be determined, but there is some evidence to indicate that it might run transverse to local foliation.

A composite sample containing both mineralized vein quartz and country rock yielded the following assay:

<table>
<thead>
<tr>
<th>Sample</th>
<th>ME-62-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>0.005 oz./ton</td>
</tr>
<tr>
<td>Silver</td>
<td>2.5 oz./ton</td>
</tr>
<tr>
<td>Lead</td>
<td>none</td>
</tr>
<tr>
<td>Copper</td>
<td>0.063%</td>
</tr>
<tr>
<td>Zinc</td>
<td>4.0%</td>
</tr>
</tbody>
</table>

**Geophysical Surveys:** Surveying of the Wesley grid with the various standard methods outlined the most extensive anomaly located during the 1962 field season. In addition to the considerable extent, there is excellent correlation between con-
WESLEY (ROLLINS) PROSPECT, TOWN OF WESLEY
SELF-POTENTIAL SURVEY
S-P Datum: Local
All Contour Values Negative, Interval: 100 millivolts
WESLEY (ROLLINS) PROSPECT, TOWN OF WESLEY
MAGNETIC SURVEY: VARIATIONS IN VERTICAL MAGNETIC INTENSITY
Contour Interval: 200 gammas
Magnetic Datum: Arbitrary
WESLEY (ROLLINS) PROSPECT, TOWN OF WESLEY
VERTICAL-LOOP ELECTROMAGNETIC SURVEY
West dips plotted above datum, east dips below.
ductivity, polarization, and magnetic variation. At no place on the grid is the conductor-magnetic zone exposed; the nature of anomaly source must be inferred.

Self-potential survey (Plate 17): The easternmost anomalous zone was first detected by an S-P survey run on the initial 400' x 1200' reconnaissance grid. With the exception of two areas of heavy swamp, the S-P survey defined three, more or less continuous, narrow, potential lows which angle northeastwardly across the grid. Potential relief of nearly 0.5 volt (500 mv) was measured, attesting to the steep potential gradient. The symmetrical trace of S-P profiles indicates that the natural "batteries" are in near-vertical attitude.

Magnetic survey (Plate 18): Magnetic data greatly enhance the significance of the S-P anomalies. The linear nature of nearly all magnetic zones suggests a source identical with that of the S-P anomalies. Magnetic relief is moderate (approx. 4,000 gammas), well within the range of magnetic pyrrhotite.

Electromagnetic surveys: Results of the EM surveys were both positive and puzzling. The VLEM survey was eminently successful, delineating two continuous conductors, from 75 to 150 feet apart, extending completely across the grid area (Plate 19). Further, there is the suggestion of another conducting zone, about 200 feet to the northwest. Dip-angle profiles indicate parallel, steep and narrow zones of moderate conductivity.

The HEM survey, which normally provides data closely approximating S-P anomalies, mapped the zones but identified them as very weak or deep conductors. Maximum deflections were —3; —1 at 18N + 1E and —2; —3 at 9N + 2W. The reason for the lack of correlation between the two EM systems is not apparent. However, depth to the effective conducting axis and disseminated character of conducting particles are possibilities.

Despite the obvious fact that the length, character and continuity of the several anomalies present suggest the so-called "stratigraphic" anomalies (those due to graphitic or sulfide zones in sedimentary units), attempts should be made to positively identify the anomaly cause. It is possible that a more extended search for outcrop along the anomaly trend will provide the necessary information.

Index #10: "Marion & Gardner" Prospects
Ownership: George F. Piper
100 Garfield Road
Bristol, Conn.
Fred E. Dennison
East Machias, Me.
Robert W. Wright
Box 232
Machias, Me.

Location: Towns of Marion and Whiting (Plate 20A)
Gardner Lake 15' Quad.

Grid: 1000' x 1200'; 6,050 linear feet; 26.7 acres.
Geology: Outcrops are very scarce around the Gardner Prospect and it is quite possible that some of the ground-level "outcrops" shown on Plate 21 are, in fact, glacial boulders. Nonetheless, it is safe to state that the mineralized zone was emplaced in rocks of igneous origin and basic composition. Textures of the outcropping rocks range between fine-grained diabasic (or andesitic) to gabbroic. Generally, the rocks are massive and equigranular; around local mineralized centers the presence of biotite imparts a definite foliation to the rocks. Silicification also accompanied mineralization, and was particularly effective in rocks exposed at the main pit (0 + 0).

Copper, in the form of chalcopyrite, occurs disseminated through the basic host. From sparse outcrop data, the copper appears to occur in a zone lying parallel to the grid baseline and passing through the pits. The mineralized zone has no definite boundaries, but grades laterally into more or less "barren" diabase. It should be noted that all of the outcrops examined carry sulfides in accessory amounts. The presence of tiny stringers or veinlets of chalcopyrite in the pit at 0.5E + 0 indicates some minor, late sulfide remobilization.

A composite sample from outcrop and dump samples at the main pit (0 + 0) gave the following assay:

<table>
<thead>
<tr>
<th>Sample</th>
<th>ME-62-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>trace</td>
</tr>
<tr>
<td>Silver</td>
<td>0.2 oz./ton</td>
</tr>
<tr>
<td>Lead</td>
<td>0.4%</td>
</tr>
<tr>
<td>Copper</td>
<td>1.348%</td>
</tr>
<tr>
<td>Zinc</td>
<td>trace</td>
</tr>
</tbody>
</table>

Geophysical Surveys: Sharp, local magnetic variations are frequently present over basic igneous rocks such as those exposed on this prospect. However, the 5,000 gamma dipolar anomaly (Plate 22) mapped on grid line "0" at 2N to 3N takes on special significance when compared with results of the self-potential survey. Most of the grid area displayed unusually low potential relief, but the magnetic anomaly was strikingly outlined by the -150 mv contour (Plate 23). Maximum potential relief was 280 millivolts. There are no rocks exposed in the immediate anomaly area.

Electromagnetic surveys did not detect conducting zones.

Location: Town of Alexander (Plate 20B)
Calais 15' Quad.

Grid: 1000' x 1800'; 11,100 linear feet; 40 acres.

Comments: According to one of the owners, Mr. Frost, the sulfide-bearing outcrop was first prospected by a local resident about 1890. Shortly after 1900, the prospect was evaluated by "an engineer from New York" and at that time a 35-foot exploration shaft was dug (Plate 24A). Apparently the property received no further attention until the 1954-56 period when it was leased by a major mining company, then exploring the general area. Judging from the characteristics of the grid laid out by that mining company, the local area was probably thoroughly evaluated geophysically. Also, Mr. Frost pointed out the location of one drill hole (25'; 90'; EX) near the shaft.

Geology: With the possible exception of a small area of gabbro exposed at 9 SW + 4½SE, there are no outcrops known within the grid limits except those exposed in and adjacent to the shaft (Plate 24B). Immediately north of and 75 feet south of the shaft, small areas of heavily weathered basic rock and gossan are exposed (Plate 25). These areas are conspicuously free of vegetation.

The host rock, judging from dump material, was a coarse-grained, pyroxene-rich gabbro or norite, now highly altered. Mineralized specimens carry up to 70-80% total sulfides; only pyrrhotite and chalcopyrite have been identified, with pyrrhotite heavily predominating. The pyrrhotite occurs in irregular, often lacy, masses interstitial to silicate grains. Some of the chalcopyrite occurs in similar manner, but most of it appears fracture-controlled and may be considerably later than the pyrrhotite. Also, the high-copper zones appear to have been silicified.

Basic rock float (gabbro to peridotite) is relatively abundant at several places on the grid; some boulders carry 10-15% total sulfides. No attempt was made to determine the source of these boulders.

Areal reconnaissance revealed the presence of several outcrops of metasedimentary rocks in the open fields 300-400 feet northeast of the grid area (Plate 26). The exposures were composed of contorted fine-grained, impure quartzite and brown-weathering, quartz-sericite schist.

Two large samples were collected from the dump, both were "average" or "representative"; assays of these samples follow:

Sample: ME-62-1

<table>
<thead>
<tr>
<th>Gold</th>
<th>0.005 oz./ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver</td>
<td>0.8 oz./ton</td>
</tr>
<tr>
<td>Lead</td>
<td>none</td>
</tr>
<tr>
<td>Copper</td>
<td>0.655%</td>
</tr>
<tr>
<td>Zinc</td>
<td>0.2%</td>
</tr>
<tr>
<td>Nickel</td>
<td>0.305%</td>
</tr>
<tr>
<td>Cobalt</td>
<td>0.103%</td>
</tr>
<tr>
<td>Platinum Group:</td>
<td>trace</td>
</tr>
</tbody>
</table>
GEOLOGY - CULTURE: MARION-GARDNER PROSPECT
TOWNS OF MARION AND WHITING
GARDNER LAKE 15' QUAD.
PLATE 22

MARION-GARDNER PROSPECT, TOWNS OF MARION AND WHITING
MAGNETIC SURVEY, VARIATIONS IN VERTICAL MAGNETIC INTENSITY
Contour Interval = 300 gammas
Magnetic Datum: Arbitrary

34
Core correlation. Positive responses were recorded on horizontal- and vertical-loop electromagnetic surveys, as well as self-potential and magnetic evaluations. The Frost Prospect does not specifically mention the Frost Prospect and, thus, its potential mapped by Forsyth cannot be determined. It is, perhaps, significant to note that the most significant anomaly mapped in the course of the 1962 Washington County survey. Its significance lies as much in the geological environment as with the results of each survey are shown on accompanying maps (Plates 25-30).

The area of the Frost grid is within the limits of a reconnaissance geologic map compiled by Forsyth (1955); however, the published scale of this map greatly decreases its usefulness. The precise relation of this mineralized zone to features mapped by Forsyth cannot be determined. It is, perhaps, significant to note that Forsyth does not specifically mention the Frost Prospect and, thus, its potential was apparently not evaluated in his published “Economic Aspects of the Area” (1955, pp. 44-45).

Geophysical Surveys: The Frost Prospect presents what is interpreted to be the most significant anomaly mapped in the course of the 1962 Washington County survey. Its significance lies as much in the geological environment as with the magnitude of “values” recorded through the various geophysical surveys and their correlation. Positive responses were recorded on horizontal- and vertical-loop electromagnetic surveys, as well as self-potential and magnetic evaluations. The results of each survey are shown on accompanying maps (Plates 27-30); the anomaly is somewhat complex and a brief explanation of geophysical data is in order.

The near-surface characteristics of the zone causing the anomaly are shown in greatest detail by the variations in spontaneous polarization (Plate 27) and conductivity (Plates 28-29). The S-P map outlines the general area of exposed mineralized rock and, more important, reveals the existence of a similar zone several hundred feet to the west. High potential relief indicates a state of strong oxidation of sulfide bodies. In addition to the two separate anomalies, there is an S-P trend which extends southward from the center of the grid. S-P readings were taken on 25-foot centers over the entire grid.

HEM information corroborates and refines the S-P anomalies. At least three, and probably four, separate conductors are present within the grid (Plate 28). The in-phase and out-of-phase return demonstrates that the sulfide zones are excellent conductors and that they are very shallow.* The south-trending, weak S-P zone was confirmed as a conductor.

Although lacking comparable specific detail, the VLEM data (Plate 28) added significant information to the HEM interpretation. First, the presence of multiple conductors was readily confirmed and electrical continuity demonstrated between the rather widely spaced traverse lines. Second, and more important, the conducting zone(s) was extended to a length of at least 1800 feet. The low dip-angles recorded and low degree of resolution on the limiting traverses may be a function of depth to the effective conducting axis as well as composition of the conducting unit.

The magnetic survey (Plate 30) afforded, in this case, unusually good correlation with chemical and electrical characteristics. If it can be assumed that magnetic variation is due to either: (a) pyrrhotite, (b) high susceptibility basic intrusives, or (c) magnetite wall-rock alteration, then the magnetic data also indicate that the largest, most massive zone of sulfide accumulation has not been tested. Further, magnetic confirmation of the “weak” conductor on the south end of the grid emphasizes the need for additional work in this direction. (Note: Magnetic variations were not recorded at stations on grid traverses 1½ NE and 1½ SW, thus the interpretation shown on Plate 30 may be subject to considerable revision of anomaly detail.) The mineralized zone on the Frost Farm shows up as a well-defined anomaly of significant extent on the aeromagnetic survey of the Meddybumps area (Plate 31).

Stream sediment samples were collected at seven points within the grid and analyzed in the field for cxHM. Anomalous concentrations of HM were recorded at each station; individual values for bank and active samples are shown on the culture map (Plate 26). A fact which must be emphasized is that the more westerly stream, that which crosses the baseline at 8 SW, is in a drainage basin separated from the local area of outcropping sulfides. This strongly suggests another basemetal sulfide accumulation to the northwest. A detailed areal drainage basin survey is recommended.

Index #12: “Johnson” Prospect
Ownership: Commander John Day
C/o Holly Woods
Mattapoisett, Mass.
Mrs. Malcolm McGhie
Canaan, Conn.

Location: Town of Cutler (Plate 20C)
Cutler 7½° Quad.

Grid: 800' x 800'; 3,050 linear feet; 14 acres.

* The 90% IP and 0% OOP recorded at several stations makes portions of the zone, technically, “perfect conductors.” No other such case seems to have been reported on in the literature.
MARION-GARDNER PROSPECT, TOWNS OF MARION AND WHITING
SELF-POTENTIAL SURVEY
Contour Interval = 50 millivolts, above — 100 mV
S/P Datum: Local
Comments: "Johnson's Silver and Copper Mine" is mentioned and located in Colby's Atlas of Washington County, Maine (1881). Gates (1961, p. 64) made the following comments:

"An old digging on Eastern Head, once a copper prospect 50 to 60 years ago according to local knowledge, consists of a quartz vein about 3 feet wide in a vertical shear zone cutting gabbro. The vein strikes north and can be traced by a notch in the topography and patches of white quartz float almost to Money Cove. The ore mineral is chalcopyrite associated with pyrite and siderite."

According to the 1951 edition of the U.S.G.S. 7½' Cutler quadrangle, the Johnson Prospect is located on Eastern Knubble; Eastern Head is approximately 8.5 miles to the northeast.

Geology: According to Gates (1961), rocks in the immediate area belong to the "Cutler diabase," and the characteristics of this heterogeneous unit are well described. All of the rocks observed within the mapping limits can be depicted as altered intrusives of highly variable grain size (Plate 32). Most exposed rocks are moderately coarse-grained gabbro, but porphyritic diabase is present in places.

Chloritization and epidotization are the most common alterations in exposed sections; both chlorite and epidote have replaced original rock constituents to a large degree. Irregular areas of high epidote content are conspicuous in rocks along shore.

A small, fine-grained diabase dike is exposed along the shoreline for about 30 feet at 0.5N + 3.5E. It reaches a maximum width of one foot and pinches seaward (Plate 33A). Dike strike varies from N. 40-45°E. and the dip is nearly vertical. Several larger dikes, up to 5 feet wide, are exposed along the shore, immediately south of the grid (Plate 33B).

The largest working at the Johnson "Mine" is a trench nearly 300 feet long, cut along a sulfide-bearing quartz vein (Plate 32). Maximum depth in the trench is about 15 feet, at the point where a step was cut in the trench floor at 0.25N on the baseline. An untimbered shaft is located at the north end of the trench; it measures 5 x 8 feet and was plumbed to a depth of 10 feet. A quartz vein, about one foot wide, is exposed in the north wall of the shaft. Several shallow pits and trenches are scattered over the grid; dump samples at the 3N + 0.5W pit carry sulfides, the others do not.

Wall rocks exposed along the trench are typical gabbro. In the open cut, two quartz veins are exposed in cross-section in the north face of the stop. The larger vein, on the western side, varies in width from slightly over three feet near the top of the exposure to less than one foot at the bottom. The eastern vein is about one foot wide. All veins in the main trench contain sulfides; those observed in hand specimen are: sphalerite, by far most abundant and the only semi-massive sulfide mineral present, and pyrite, as thin films and plates in narrow fractures. Chalcopyrite is very scarce and galena was not identified. Chlorite and epidote are associated with the vein quartz.

As pointed out by Gates, the main quartz vein system was emplaced along a shear zone. Exposures in the open cut indicate that vein quartz, which may or may not be mineralized, occurs as discontinuous pods and lenses along the entire extent of the prominent shear lineament. The shear zone is vertical at the shaft.
and near the step but dips 75° NW at the south end of the open cut. The shear zone is not exposed on the coast line near Little River Ledge.

A composite sample of vein material gave the following assay:

Sample: ME-62-8
Gold: 0.003 oz./ton
Silver: 0.5 oz./ton
Lead: 0.4%
Copper: 0.088%
Zinc: 16.2%

**Geophysical Surveys:** Electromagnetic and self-potential surveys did not detect anomalous conditions. One small magnetic anomaly was mapped (Plate 34), but it does not appear to be associated with the sulfide-bearing vein system.

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**Index #13: Smith Iron Prospect**
**Ownership:** Frank M. Smith
**Location:** Town of Trescott (Plate 35)
West Lubec 7½' Quad.
**Grid:** 600' x 700'; 5,400 linear feet; 9.3 acres.

**Geology:** The Smith Prospect lies in an area mapped by Bastin and Williams (1914) as being underlain by the Pembroke formation, specifically rhyolite tuffs and flows. In detail, three rock types were mapped on the grid (Plate 36). Acid to intermediate composition, very fine-grained tuffs, flows and breccias crop out on the central part of the grid. Bedding, generally striking northeast, is well-defined in these outcrops. The northern part of the grid is apparently underlain by medium-grained, unaltered gabbro. Representatives of the third lithology, fine-grained, massive diabase, crop out in two small areas on the grid. This latter lithologic type may be a part of the "diabase flow" member of the Pembroke formation; contact relations cannot be determined on the grid.

Epigenetic mineralization resulted in the deposition of unusually large amounts of specular hematite. The only sulfide mineral identified in hand specimen was pyrite, seen as sparsely distributed, disseminated grains. The hematite is not exposed in outcrop but is abundant in dump rock scattered around the exploration shaft at 0 + 0. The host for mineralization was a dark, red-brown tuff, which apparently does not crop out at any other place on the grid. Hematite occurs as fracture-controlled stringers and bunches as well as irregular replacement areas. In places, hematite makes up at least 50 percent of large dump specimens.

**Geophysical Surveys:** Because of the unusual nature of the mineralized zone, the prospect was surveyed only by S-P equipment and magnetometer.

Reconnaissance S-P lines revealed that the iron oxide zone would not be expressed through spontaneous polarization. However, the magnetometer survey was successful and several local anomalies with relief in excess of 10,000 gammas were delineated. On the accompanying map (Plate 37) showing variations in vertical intensity, it should be noted that contours in the area of the high-relief anomalies are diagrammatic only. Because of the spectacular values recorded, magnetic stations were positioned at much closer intervals than for normal survey practice. For this reason, the position, shape, and relation of the various local poles are accurate. Because of auxiliary magnet limitations, the magnetic stations marked "—10,000" have values somewhere in excess of this figure; otherwise, specific values cited are accurate.

In most cases, it was not possible to directly correlate high magnetic values to mineralized zones or rock type, as most anomalies were mapped over covered ground. It was noted, however, that some specimens of the dark, hematite-bearing tuff from the dump area were highly magnetic.

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**Index #14: Bradley Prospect**
**Ownership:** James Eugene Bradley
**Location:** Town of Lubec (Plate 35)
West Lubec 7½' Quad.
**Grid:** 900' x 900'; 4,700 linear feet; 18 acres.

**Geology:** The only rock observed in outcrop on this grid is a massive, basic igneous rock, in which the texture varies from diabasic to gabbroic (Plate 38). For descriptive purposes, the rock is classified as a fine-grained gabbro. Pyrite
PLATE 26

GEOLOGY-CULTURE:
FROST PROSPECT, TOWN OF ALEXANDER
CALAIS 15' QUAD.

39
FROST PROSPECT, TOWN OF ALEXANDER
VERTICAL-LOOP ELECTROMAGNETIC SURVEY
West dips plotted above datum, east dips below.
FROST PROSPECT, TOWN OF ALEXANDER
MAGNETIC SURVEY: VARIATIONS IN VERTICAL MAGNETIC INTENSITY
Contour Interval: 200 gammas
Magnetic Datum: Arbitrary
A part of the Meddybemp magnetic survey showing the location of the Frost anomaly.

is a common accessory mineral in the gabbro, found in nearly all outcrops as fine, disseminated grains.

Quartz veins, filling fractures, can be seen in numerous outcrops on the grid; some such occurrences are quartz-healed joints whereas others appear to have been emplaced along drag-induced openings. Sulfide minerals are associated with selected quartz veins; this relation is especially well exposed in the walls of the pit at 6W + 3.2N. The sulfide ore minerals are sphalerite, galena and chalcopyrite, with sphalerite being by far the most abundant. The chalcopyrite occurs as small crystalline aggregates disseminated through sugary vein quartz. The galena also occurs as discrete grains but is more often observed as irregular stringers parallel to vein walls. Sphalerite, most abundant at the 0 + 0 pit, is found as semimassive coarsely-crystalline masses several inches wide. The sphalerite displays an unusual gray-green color, similar to certain of the “Valley-type” ores of the Central Appalachians. Small amounts of pyrite, calcite and malachite were also noted in the veins.

An assay of high-grade material from the east pit (0 + 0) ran as follows:

Sample: ME-62-9
Gold: 0.003 oz./ton
Silver: 0.8 oz./ton
Lead: 5.7% 
Copper: 0.743% 
Zinc: 13.95% 

Geochemical surveys, both water and stream sediment, were largely negative. The specific data are shown on Plate 38.

Geophysical Surveys: The grid was surveyed by magnetic, self-potential and electromagnetic equipment. Results of all surveys were negative.

Index #15: Basley Prospect
Ownership: Blanche Basley
Lubec, Maine
Location: Town of Lubec (Plate 35)
West Lubec 7½’ Quad.
Grid: none

Comments: Mention of this prospect is essentially for location purposes as the owner would not allow more than cursory examination. The workings consist of one pit and one trench, both partly filled, in a pasture north of the Basley residence. The vein is not exposed, but a great deal of white vein quartz is present on dumps. The vein matter is mostly barren, but small amounts of chalcopyrite, sphalerite and galena were noted in scattered fragments in the dump.

Index #16: “Lubec Lead Mine”
Ownership: Judge Hubert Saunders Estate
Location: Town of Lubec (Plate 35)
West Lubec 7½’ Quad.
Grid: 9,750 linear feet; 41 acres.

Comments: Despite the relative antiquity of this sulfide occurrence and the repeated attempts to mine it, there is relatively little useful information in the
GEOLOGY-CULTURE:
JOHNSON PROSPECT, TOWN OF CUTLER
CUTLER 7 1/2" QUAD.

all outcrops basic intrusive (Cutler diabase)
sparse published references. Reportedly discovered in 1828, the prospect was described by Manross in 1862. Emmons (1910, pp. 44-45) indicated the extent of the workings, mentioned the mill equipment, and commented on the local geology. Bastin and Williams (1914, p. 15) summarized the occurrence in a short paragraph. Li (1942, pp. 41-42) briefly presented his interpretation of petrographic and mineragraphic relations within the local ore zones. The geologic map accompanying this report (Plate 39) is apparently the only published map with sufficient detail to evaluate local geologic conditions.

Geology: Bastin and Williams (1914) map the prospect environs as "Silurian and later intrusive diabase," and in the text (p. 15) refer to the host as "trap." Emmons (1910, p. 44) also applied the term "trap," but in reference to "an altered surface lava." Li (1942, p. 41) describes the country rocks as "vesicular lava, shale, and diabase." Certainly, there is a relative multitude of lithologies, textures and grain size variations present. The majority of the rock can be described as fine-grained diabase, but the grain size varies widely and basaltic rocks and, to a lesser extent, gabbro are present. Amygdaloidal diabase flows are fairly abundant; carbonate is probably the most common filling, but quartz, epidote and even sulfides were noted. Large epidote amygdules may be seen in the outcrop at 3W + 6.5N. The massive, green, aphanitic rock exposed on the shoreline near the main workings is thought to be a welded tuff.

Shale is exposed on the eastern part of the grid in several places (Plate 40A). Small outcrop areas, in obvious faulted relationship to adjacent igneous rocks, were mapped at four places along the shoreline (Plate 39). Best exposures are at 4E + 0.3N and 4.5E + 1N. Bastin and Williams (1914) indicated these exposures and placed the shale in the Silurian Pembroke formation (Leighton gray shale member). All shale in the area is dark gray when fresh, thin-bedded, and breaks into blocky masses. Local areas on the grid which display soil with a high shale content suggest the presence of similar shale fault blocks.

A large "felsite" dike strikes N.10°E. across the center of the map area (Plate 39). The rock outcrops well and may be traced for a distance of 550 feet along strike on the hill.

In a well-exposed section on the road leading to the open cut, the dike width was measured at slightly less than 70 feet. Apparently, the dike pinches slightly to the north. An attempt was made to extend the dike northward, but no outcrop or float could be located in that direction. The dike must (1) pinch out, (2) radically change direction, or (3) be fault terminated between 5W + 2.5N and 3W + 6N, for the large exposure at the latter point contains only diabase. Fault termination seems most likely and can be accomplished by extending inland one of the prominent faults exposed along the shoreline.

This sulfide prospect is the result of low-temperature, hydro-thermal mineralization with the ore minerals occurring with quartz and carbonate minerals as fillings of small fissures. The mineralization was fundamentally restricted to a wide zone of fracturing, resulting from relatively large-scale faulting. Ore minerals are argentiferous galena and sphalerite; subordinate sulfides are pyrite and chalcopryite. Smithsonite and malachite are readily identifiable secondary products. The zinc sulfide is mostly light brown or honey-colored, indicating a low iron content. Over the prospect, limonite staining is not uncommon, but only in a few places is the rock "burned."
JOHNSON PROSPECT, TOWN OF CUTLER
MAGNETIC SURVEY: VARIATIONS IN VERTICAL MAGNETIC INTENSITY
Contour Interval = 100 gammas
Magnetic Datum: Arbitrary
Smith Prospect, Index #13; Bradley Prospect, Index #14; Basley Prospect, Index #15; Lubec Mine, Index #16; Horan Head Prospect, Index #17; Denbow Neck Prospect, Index #18; Denbow Point Prospect, Index #19; West Lubec and Eastport 71/2' Quads.
GEOLOGY - CULTURE:
SMITH IRON PROSPECT
TOWN OF TRESOFFT
WEST LUBE 7½' QUAD.

d - diabase

g - gabbro

t - tuff + flows
White quartz and white to buff calcite are the chief gangue minerals (Plate 40B). Quartz predominates except in the vein at 5E + 1.75N where carbonate is much more plentiful. The outcrop at 6E + 1.2N was strongly shattered and the fractures completely healed by carbonate (Plate 41A). Quartz veins carrying sulfides in varying amounts are numerous in the overall fault zone. Most are very narrow but some of the shear zones containing a network of quartz veins are over 4 feet wide. Detailed mapping shows that some of the larger veins switch from one fracture system to another, thus presenting an arcuate surface trace (Plate 42).

Chloritization was the most obvious alteration process involved; in many places the wall rocks adjacent to or between veins is a conspicuous "bleached green." The sericitization mentioned by Li (1942, p. 41) is not prominent in hand specimen. Silicification is noteworthy by its absence. In this case, there is no doubt of the structural control of the ore deposit. The veins were emplaced in fractures which were the direct result of local tension, resulting from the movement of blocks within a somewhat complicated fault system. The main fault system appears to be some 600 to 800 feet wide, and its character is faithfully reproduced in the sharply angular outline of the shoreline involved (Plate 39). Most of the major faults are thought to be nearly vertical normal faults (Plate 43), although some of the northeast-trending faults dip at approximately 60°. In this latter type, footwall shattering and veining is a prominent feature, leading to local ore zones (Plate 41B). Although the net result of movement on the major vertical, northeast-trending faults is significant vertical displacement ("down-dropped" shale blocks) subsidiary structures, such as mullion, grooving and slickensides, indicate considerable strike-slip displacement. Mullion grooves suggest a true displacement along a line plunging 25° (Plate 43B) to the southwest.

On the mapping scale chosen, it was not possible to indicate more than the major shear zones, literally tens of significant faults are present within the overall fault zone which are not shown on the map. In overall aspect, ground preparation prior to sulfide mineralization was remarkably complete. It seems obvious that if the zone of shattering persists for any distance along its trend, there is the possibility of developing large tonnages of sulfide-bearing rock. To present knowledge, this possibility has not been thoroughly explored through a diamond drilling program.

Workings: There are no permanent surface installations remaining from previous mining efforts. Several of the short, exploration adits are open for examination (Plate 44A); all of the shafts are choked with debris or filled to the surface with water. A now inoperative conveyor, about 130 feet long, was used in recent years to lift high-grade ore from the main open cut (Plate 44B). The development effort, which took place in the mid-1950's, was apparently quite informal and short-lived.

Geophysical Surveys: The entire Lubec grid was covered in detail by HEM, S-P and magnetic surveys. The only significant EM deflection (—10%) mapped was at Sta. 4 on the shoreline traverse (Plate 39). This indicates a minor conductor extending seaward from the main open cut area. No S-P anomalies were detected. The magnetometer survey did reveal considerable magnetic variation (Plate 45), but it is doubtful that the anomalies are specifically associated with the mineralized zone.
SMITH PROSPECT, TOWN OF TRESSELT
MAGNETIC SURVEY: VARIATIONS IN VERTICAL MAGNETIC INTENSITY
Contour Interval: 800 gammas with 400 and 1200 half-contours
Magnetic Datum: Arbitrary
PLATE 38

GEOLOGY - CULTURE: BRADLEY PROSPECT
TOWN OF LUBEC
WEST LUBEC 7 1/4 QUAD.

ALL OUTCROP IGNEOUS ROCK,
GABBROIC TO DIABASIC
epidotized and silicified. As shown on the geologic map (Plate 48), small basic bodies have been intruded into the layered tuffs.

The grid was laid out to cover a sulfide-bearing shear zone. The shear zone strikes N.10°-15° W., and is well-exposed along the shoreline (Plate 49). Width appears variable, but at the head of the inlet it is approximately 18 inches. Ore minerals are sphalerite and galena, both irregularly distributed through the shear zone. An assay of a high-grade portion of the vein is:

Sample: ME-62-14  
Gold: 0.005 oz./ton  
Silver: 6.7 oz./ton  
Lead: 12.8%  
Copper: 0.163%  
Zinc: 20.6%  

Geophysical Surveys: The grid was surveyed by magnetic, self-potential and electromagnetic equipment. Results of all surveys were negative.

Index #19: "Denbow Point" Prospect  
Ownership: Valerie Mullholland  
Doris Denbow  
Lubec, Maine  
(represented by Denbow & Green, Inc., Lubec, Maine)  
Location: Town of Lubec (Plate 35)  
Eastport 7½’ Quad.  
Grid: 4,200 linear feet.

Comments: Although the Denbow Point Prospect was obviously the subject of a considerable amount of development work, published references are few and contain scanty information. Jackson (1837, p. 25) described the then-exposed mineralized zone as follows: "The vein is 14 inches wide, and the lead ore is 9 inches in thickness; the remainder of the vein consists of black blende, or sulphuret of zinc, and calcareous spar." Emmons (1910, p. 45) described the prospect thus: "On Denbow Point a shaft is sunk in basic tuffs, but has been lost through caving. The country rock thrown up on the dump shows stringers of ore composed of quartz, zinc blende, galena, and pyrite." Bastin and Williams (1914, p. 15) state that an attempt was made in 1862 to develop the vein, but that the effort was shortly abandoned.

Geology: Because of the unusually fine display of outcrop and structural features, Denbow Point was mapped, geologically, in considerably more detail than that accorded most prospects. This appeared to be an opportunity to contribute significantly to the understanding of structural and lithologic control of the thin, but high-grade, mineralized zones likely to be encountered in this general geologic environment.

Geologic Setting: The rocks on the Point have been placed by Bastin and Williams (1914) in the Pembroke formation of Silurian age. The general characteristics of this formation are discussed on pages 6 and 7 of the Eastport Folio. All rocks on the Point proper are alternating flows and tuffs. Bastin and Williams state that the flows and tuffs are of diabasic texture and originally of diabasic composition, although some of the rocks have since been altered and the original components replaced by secondary minerals.

Some of the flows are tuffaceous in places and layers of what appear to be flow breccia were observed. The larger flows are massive, very well jointed, and have fine-grained and porphyritic texture. It is often difficult to distinguish flow lines. The "flow-breccias," containing blocks of foreign material several inches across, were noted in some of the more massive flows. Texture and appearance of most flows and nearly all tuffs are extremely variable throughout the individual units, and contacts, except where faulted, are nearly always gradational.

Some of the tuffs, and to a lesser extent flows, are extremely vesicular. These occur in zones, and since only weathered surfaces were observed, they may once have been filled. Bedding is well-displayed in the tuffs by parallel alignment of vesicles and included particles and alternating units of differing grain size. Tuffaceous zones in flows parallel the bedding. Included blocks in the tuff agglomerates may be up to several inches in diameter; most are very angular but a few rounded, "shaly" inclusions were noted. In some areas, the tuffs are welded.

A rather striking "stylolite" is present on the east shore between lines "0" and "35." This feature is very irregular in outline and strike, is open along much of its length, and persists, in some places following joint planes, for more than 8 feet.

Nearly all of the rocks contain disseminated pyrite and marmacite(?), and probably some pyrrhotite. One unit ("g"), exposed on the northeast shore, is very rich in disseminated iron sulfides.

Structure: Jointing is generally well-developed in rocks on the Point. Some units, particularly the more massive members, are extremely well-jointed, and the shape of the shoreline may be controlled by joint sets. The most prominent and best developed sets measured were: N.52°E., vertical; N.5°E., vertical; N.55°W., 48°SW; N.50°W., 10°SW; N.18°W., vertical; N.72°W., 56°SW.

The Point has been extensively divided by strike-slip faults (Plate 50). Most of these trend in a northeasterly direction at nearly right angles to the strike of the rocks. These faults agree in attitude with most of the faults, both major and minor, in the region (Bastin and Williams, 1914, p. 13). The shear zones vary in width from a few inches to several feet; some show slickensides and thin gouge. As evidenced by offset of beds, there has been considerable movement along some of the surfaces. A wide zone of extensive shearing occurs in units "1" and "m" on the northeast shore. Many filled-fractures, containing both carbonates and quartz, resulting from the rock displacement in this area (Plate 51A). Grooves on the west wall of the shear zone at 0.9N + 0.75W attest to the dominant strike-slip movement; many other shears also show this feature. Small shears are common throughout the sequence (Plate 51B) and are especially well-developed on the head of the point, in unit "n." Bedding of the rocks throughout the sequence shows a surprising regularity of strike, despite the intensive faulting that has taken
GEOLOGY - CULTURE:
LUBEC MINE PROSPECT, TOWN OF LUBEC
WEST LUBEC 7¼' QUAD.
place. This feature indicates non-rotational deforming forces, and relief principally through jointing and faulting.

**Sulfide Mineralization:** The sulfides at Denbow Point are associated with quartz and carbonate veins. Galena is by far the most abundant sulfide in the samples collected from the rock dump. Although sphalerite was reported to have been rather plentiful in the vein, only a few dump specimens contained it. Small patches of chalcopyrite, and its alteration product, malachite, are not uncommon, but they are subordinate in quantity. Only minor pyrite is present, a few small cubes and some fine-grained blebs. The only prominent evidence of alteration accompanying vein emplacement is the development of local chlorite concentrations.

Much of the dump has been removed for roadway construction, and it is probable that a great deal of ore was included with these shipments.

**Assay of sample ME-62-15, a composite dump sample:**

- **Gold:** 0.005 oz./ton
- **Silver:** 1.9 oz./ton
- **Lead:** 14.3%
- **Copper:** 0.882%
- **Zinc:** 9.35%

**Development:** The shaft at 0.1N + 0.3E was put down on a shear zone, exposed in the shaft wall, which appears to strike N.5-8°E. No carbonate vein, such as that described by Jackson, could be located in the walls. It is possible that this open shaft was sunk on a shear zone containing disseminated sulfides, and the other shaft at 0.2S + 0.45W, now covered, followed the carbonate vein. According to a nearby resident, both shafts were once covered with timbers; those on the eastern shaft are normally covered with 3 feet of water. This shaft was plumbed to a depth of 50 feet. The total extent of underground development is not known.

**Lithologies:** Following are brief descriptions of the mapping units shown on the accompanying geologic map (Plate 50). The sequence of presentation is the order in which the beds occur along the point, from southeast to northwest; this is not necessarily proper stratigraphic order.

- **Unit “a”:** mapped by Bastin and Williams as the Leighton gray shale member of the Pembroke formation; many shale fragments present in the cove, but no outcrops.

- **Unit “b”:** fine- to medium-grained, poorly indurated tuff; gray-green on fresh surfaces, very dark gray on weathered surfaces; alternating layers of various sized fragments, some blocks more than 1” in diameter; few areas appear welded; many holes weathered out on outcrop surface, the holes are normally elongated parallel to the bedding.

- **Unit “c”:** medium gray, fine-grained tuff; fracture cleavage well developed; bed contains vesicles (amygdules weathered out?) and layers of coarser grained material that is less well cleaved; may be a flow.

- **Unit “d”:** coarse-grained, “rotten,” purple tuff (Plate 52); purple grades to a green color in the upper few feet of the section; green portion slightly finer.
grained, and bedding not as obvious; purple rocks contain some large shaly blebs with the long dimension parallel to bedding; largest measured was 7" x 14"; some movement on joint surfaces.

Unit "e": fine-grained, diabasic flow with small feldspar phenocrysts visible on weathered surfaces; gray on fresh surfaces, brown to gray-green on weathered surfaces; upper contact gradational with unit "f"; tuffaceous in places in western exposures; variable in sulfide content; evidence of minor movement on some joint faces.

Unit "f": acidic flow, light colored and often "bleached" white; blocky jointing; no bedding observed; many white (feldspar) phenocrysts on weathered surfaces; abrupt color change to black on weathered surfaces near upper contact; becomes gradually more basic toward top; grain size fairly constant; some disseminated pyrite.

Unit "g": very coarse tuff in easternmost outcrops, becomes finer grained and higher in disseminated sulfides along strike to west and upper section; rock light gray on fresh surfaces, green and brown on weathered faces; alternating layers of differing sized material in upper 10 feet; normal contact with overlying unit.

Unit "h": medium- to fine-grained tuff with amygdules and some 1"-2" bombs; a small, well preserved brachiopod shell noted; light, spotted gray on weathered surfaces, light gray on fresh; bedding moderately well shown in section, less so in upper.

Unit "i": gray to brown tuff with many alternating layers of fine- and coarser-grained particles; bedding very well shown; fairly high in disseminated pyrite; fresh surfaces are medium gray color; sharp shear surface near middle of section with marks of movement; bed becomes coarser in upper part of section; brachiopod shell noted in place on upper contact.

Unit "j": similar to unit "i"; contact is probably slippage within same unit with the result that slightly different parts are opposed.

Unit "k": purple tuff, alternating fine- to medium-grained layers; many "stylolites," some follow joint faces, others wander randomly through rock; becomes brown on weathered surfaces and dark gray on fresh surfaces in upper few feet of section; many shears present in upper part.

Unit "l": fine-grained, pale green tuff with pink partings; many red to pink blotches on weathered surfaces; movement along many surfaces in lower part of section; bedding very difficult to detect except on southeast side of small promontory where coarse- and fine-grained layers alternate; strike-slip shown on shear face just northwest of promontory.

Unit "m": fine-grained tuff with small "phenocrysts"; bedding cannot be seen in lower part, gradually becomes more obvious up section; layered zones in upper part (thin alternations); becomes vesicular (weathered amygdules?) in places; bottom part may be a flow and gradational to tuff up section.

Unit "n": light-colored tuff beds with so little change in composition and shades that it was necessary to map as a single unit; some fairly large blocks scattered throughout section; bedding usually well shown and quite constant in strike; some major zones of shearing.

Geophysical Surveys: The grid was covered by a horizontal-loop electromagnetic survey, but no zones of conductivity were detected.
Index #20: Barrett ("Sinclair Farm") Prospect

Ownership: Granville A. Barrett
Pembroke, Maine

Location: Town of Pembroke (Plate 53)
Pembroke 7½' Quad.

Grid: 800' x 1000'; 5,800 linear feet; 23 acres.

Comments: This prospect, described as the "Sinclair Farm," was apparently first mentioned by Smith (1907, pp. 118-119) and Emmons (1910, pp. 46-47); there is no reference to it in Colby's Washington County Atlas. The description by Emmons is considerably more complete than that of Bastin and Williams (1914, p. 15).

Geology: The prospect pits are located on the eastern edge of Leighton Ledges, fairly prominent ridges that strike approximately N.30°W. These ridges are held up by tufts and flows of varying composition and texture (Pembroke and Dennys formations). To the east, a belt of the Leighton gray shale, striking about N.30°W., underlies the valley between the Ledges and Big Hill. Float fragments of this unit can frequently be seen, particularly along old logging roads, but no outcrops were observed. The approximate contact between the shale and igneous rocks lying to the west, determined by the distribution of shale fragments in soil, cuts across the extreme eastern edge of the Barrett grid.

Bastin and Williams (1914, pp. 3-4; 6-7) describe formation characteristics and Emmons (1910, p. 46) gives a good description of local geology. All of the exposures within the grid limits consist of very fine-grained, green to gray-green, igneous rocks (Plate 54). From megascopic analysis, the rock is classified as andesite, occurring in the form of flows. The rocks are in places porphyritic; the largest phenocrysts are about 4 mm. long and are apparently basic feldspar. Such porphyritic andesites are common in the large open cut near 0 + 0, where they appear to be concentrated in zones. The andesite may also be vesicular or amygdaloidal. Many of the openings are lined with quartz crystals; carbonates or sulfides are common filling materials.

In the main trench, at 0 + 0, the andesite is highly shattered (Plate 55); the overall fracture zone strikes N.60-70°E. There is no evidence of movement along the fractures. This entire face is mineralized for a width of more than fifty feet, with the sulfides occurring disseminated or in small stringers. Chalcopyrite and sphalerite predominate at this particular place. A few quartz stringers are present in this zone; these do not appear to be healed joints or fissures, but wander randomly through the country rock. Also, some silicification of the wall rock is apparent, but its relationship to the sulfides could not be determined.

The mineralization expressed in the small northern pits is quite different from that in the main trench as is the wall rock. Here the sulfides are sphalerite and galena, with minor chalcopyrite and pyrite, with carbonate-quartz gangue in veins of varying thickness.

Bastin and Williams (1914) have the Dennys-Pembroke formational contact
A. Short exploration adit exposed along the shore Lubec grid; rock face is a fault surface.

B. Coast line and dump rock sites, Lubec Prospect; conveyer leading from open cut to upland surface in upper right of photo.

and a probable fault passing through the area covered by the grid, but no evidence was found in outcrop mapping which supports their interpretation.

Assay, Sample ME-62-11; composite sample from main open cut:
- Gold: 0.010 oz./ton
- Silver: 1.4 oz./ton
- Lead: 0.4%
- Copper: 7.119%
- Zinc: 4.1%

Assay, Sample ME-62-12; composite sample of vein material from the northern pit:
- Gold: 0.005 oz./ton
- Silver: 0.7 oz./ton
- Lead: 2.1%
- Copper: 0.252%
- Zinc: 4.1%

Geophysical Surveys: The Barrett grid was traversed with the magnetometer, S-P and EM equipment. The magnetic survey showed very little, apparently non-systematic variation. The S-P survey was quite successful in delineating a small, but high-value, potential anomaly (Plate 56). A local grid was laid out to detail the anomaly. There are no rocks outcropping in the immediate area with which the anomaly can be correlated. There is weak electromagnetic (HEM) confirmation of the S-P anomaly, maximum values recorded were in-phase —10% and out-of-phase —1%.

Index #21: "Big Hill" Prospects
Ownership: Ernest L. Mains
West Pembroke, Maine
Location: Town of Pembroke (Plate 53)
Pembroke 7¼' Quad.
Grid: 7,000 linear feet; 32 acres.

Comments: Despite the mention of the Big Hill Prospects in Colby's Washington County Atlas (1881, p. 44), which includes a location map, it appears that the deposits were not described technically until 1942 (Li, 1942, pp. 39-41). The location map in the Atlas shows four principal veins:
(a) East Vein: apparently the small pit near the Old County Road, about 150 feet northeast of the entrance to the prospect property;
(b) Farnsworth Vein: also known as the "Big Spruce" pit or vein, found at grid coordinates 2.4S + 7.8E;
(c) Silver Vein: found at grid coordinates 1.4S + 4.9E;
(d) West Vein: the main open cut near 0 + 0 on the 1962 grid.

Li (1942, pp. 39-41) described the petrography of the host rocks and the mineragraphy of the mineralized zones.
Several reports, including geological and geophysical evaluations, on the Big Hill area were made available by Mr. Thomas E. Batey, Weston, Mass. The 1962 survey grid was designed to best re-evaluate certain geophysical data contained in Mr. Batey’s reports.

**Geology:** According to Bastin and Williams (1914, map) the Big Hill grid area (Plate 57) is underlain by several members of the Silurian Pembroke formation, especially (a) rhyolite tuffs and flows, (b) diabase tuffs and flows, and (c) gray shale (Leighton member). Li (1942, pl. 2) verified the presence of each lithologic type.

Because the rocks and mineralized zones are best exposed for examination in the various workings, descriptive notes from several of the areas follow:

Main open cut or “West Vein” (near 0 + 0): the petrologic aspects of this pit or open cut were described in considerable detail by Li (1942, pp. 39-41, pl. 2). Diabase, rhyolite and dacite flows are well-exposed in the western wall. The gray shale, striking because of its cleavage (Plate 58A), is prominently displayed at the southern end of the pit. Because the open cut trends sharply across the strike of the rocks, the dacite/diabase fault contact is best seen in the eastern wall (Plate 58B). Jointing is prominently developed, and an excellent breccia is present, waist-high on the west wall about half-way in the pit. Many small quartz stringers are present, bearing more or less sulfides. Most of the veins have an irregular trace and do not appear to be controlled by either joints or shear planes. Further, their distribution is extremely erratic, although they are present in both walls over the entire length of the pit. Sulfides are intimately associated with the quartz, but also occur as small blebs disseminated throughout the host rocks. Galena and sphalerite are most plentiful; chalcopyrite and pyrite are present, as well. Some “honey-colored” sphalerite is present, and appears to be related to the darker blackjack in a zonal arrangement, the lighter variety forming centers that are surrounded by the darker material. Quartz is by far the predominant gangue; only minor carbonate was seen. Some chlorite (alteration) is developed in the host rocks.

Big Spruce or Farnsworth Vein (2.4S + 7.8E): the host rocks in this pit are andesites, more or less altered by hydrothermal solutions. Much of the sulfide here is disseminated in host rocks; small sulfide veins and sulfides in thin quartz stringers are also present. Areas of significant sulfide concentration are marked by conspicuous “bleached” zones of alteration (Plate 59). The most abundant sulfide is sphalerite, others identified are galena, chalcobyrite, pyrite and chalcopyrite.

“Silver Vein” (1.4S + 4.9E): this shallow pit contains one continuous vein, 1”-3” wide, best exposed in the north wall. The vein, highly oxidized, is composed principally of galena, apparently argentiferous, and quartz lenses.

Western Pits (8N + 7.3W): these pits are in diabase; the sulfides occur as disseminations and include pyrite, pyrrhotite(?), chalcobyrite, and sphalerite.

Batey’s report contained a number of assays of samples taken from the larger workings on Big Hill. These assays were not verified; however, it is assumed that they are correct and they are presented below.

**Sample #1:** Big Hill Pit #1 (main open cut), across northwest vein 15 feet, about 10 feet down.

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Au(oz)</th>
<th>Ag(oz)</th>
<th>Cu%</th>
<th>Pb%</th>
<th>Zn%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.02</td>
<td>3.20</td>
<td>0.05</td>
<td>5.4</td>
<td>15.1</td>
</tr>
<tr>
<td>2</td>
<td>0.01</td>
<td>1.50</td>
<td>0.10</td>
<td>2.0</td>
<td>4.6</td>
</tr>
<tr>
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<td>0.01</td>
<td>7.60</td>
<td>0.60</td>
<td>6.9</td>
<td>13.4</td>
</tr>
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<td>0.02</td>
<td>153.50</td>
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<td>2.4</td>
</tr>
<tr>
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<td>0.01</td>
<td>2.10</td>
<td>0.20</td>
<td>22.2</td>
<td>7.8</td>
</tr>
</tbody>
</table>

**Geophysical Surveys:** Because of prior geophysical information (VLEM survey), the Big Hill grid was covered with extreme care and detail, especially with HEM and VLEM instruments. The results of these surveys were negative; not even indications of weak conducting zones were found. EM information was corroborated by S-P data; potential relief is less than 100 millivolts and the higher values are apparently erratically distributed.

Sulfide deposits in the Pembroke-to-Ayers Junction area appear to be restricted to the igneous-rock members of the Pembroke formation (tuffs and flows). Magnetic surveys will probably prove effective in delimiting such areas. Judging from shale float and topographic relations, the 600 gamma contour on the magnetic intensity map (Plate 60) apparently approximates the shale/igneous rock contact.

Geochemical data in this particular area appear to be especially significant. The distribution of anomalous cxHM values does not everywhere coincide with or reflect known sulfide concentrations. This point is discussed in more detail under the section on Geochemical Prospecting. Nonetheless, it should be emphasized here that stream sediment analysis will be an effective prospecting tool in this general region.

**Index #22:** Cross Island (“Neptune”? Prospect

**Ownership:** Unknown

**Location:** Town of Cutler (Plate 61A)
Cross Island 7½’ Quad.

**Grid:** none

**Comments:** This prospect consists of one pit, 18’ x 10’ x 12’, approximately 50 feet from shore and 250 yards north of the point at the north end of Seal Cove. Although the vein is not exposed in the pit wall, dump specimens of barren vein quartz surround the pit. Nearly all of the nearby shoreline is outcrop; however, no well-defined vein could be located. Exposed rocks do contain many small quartz pods and stringers, all in lit-par-lit relationship. Rocks cropping out along the shore are bedded volcanics, in alternating thick- and thin-bedded sequence, regularly striking N. 45-50°E and dipping 65°NW.
LUBEC MINE PROSPECT, TOWN OF LUBEC
MAGNETIC SURVEY: VARIATIONS IN VERTICAL MAGNETIC INTENSITY
Contour Interval: 100 gammas
Magnetic Datum: Arbitrary
A cursory examination of the pit, dump area and immediate shoreline exposures indicates that the only sulfide present in any appreciable quantity is iron sulfide, found disseminated through certain massive beds exposed along the shore. Minor amounts of pyrrhotite are present in vein quartz and the vein walls.

Local residents were not able to identify the prospect as the “Neptune,” mentioned by Austin and Hussey (1958, p. 29).

No geophysical surveys were undertaken.

Prospect: Gold Mine Ledge
Ownership: Eastern Pulpwood Co.
Machias, Maine
Location: Town of Steuben
    Cherryfield 7\(\frac{1}{2}\) Quad.
Grid: none

Comments: The two small pits comprising this prospect are 1.7 miles northwest of Smithville, on a line between Smithville and the center of the heath (see topographic map). The larger of the pits, 10' x 8' x 4', is in a stained, gneissic zone in a medium-grained, pink to gray granite. Pyrrhotite was the only sulfide noted; it occurs as disseminated grains and in late fractures. The mineralized zone, in both pits, appears to be restricted to a thin (3'-4") shear zone.

No geophysical surveys were attempted.

Prospect: Harmon Wooley (West Harrington)
Ownership: Harmon Wooley
Harrington, Maine
Location: Town of Milbridge
    Harrington 7\(\frac{1}{2}\) Quad.
Grid: none

Comments: One circular pit, 7 feet in diameter and 5 feet deep, is present in a blueberry field on the east side of Route 1A, 0.45 mile southwest of the bridge over Mill River. The pit lies within a few feet of the abandoned road bed. The pit was obviously dug to test a number of thin, white quartz veins, emplaced in coarse-grained gabbro. There are no sulfides visible in local outcrop or dump rock specimens.

No geophysical surveys were attempted.

Prospect: “Edwards and Walker”
Location: Town of Wesley
    Wesley 15' Quad.
Ownership: Unknown
Grid: none

Comments: The area pointed out by local residents as the Edwards & Walker Prospect contains a few scattered, shallow pits of uncertain origin.

Minor quartz-carbonate veins are present in the fine-grained, heavily silicified host rocks. Because of local silicification, the rocks are brittle and closely jointed. No sulfides are present in the vein system, although iron oxide staining on late fractures indicate that they may have been present. Altered granite, exposed in a road cut 200 feet to the north, also contains barren, thin quartz veins.

This prospect area lies on the southern end of the prominent lineament mapped by Forsyth (1955).

No geophysical surveys were attempted.

Prospect: “Silver Vein” (Washington Co. Atlas)
Ownership: Merrill Leroy Cushing
Pembroke, Maine
Location: Town of Pembroke
    Pembroke 7\(\frac{1}{2}\) Quad.
Grid: none

Comments: Colby's Atlas of Washington County (p. 44) shows a prospect location marked simply “silver vein.” Search in the indicated area revealed a quartz-filled shear zone 12 to 20 inches wide, striking N.10°E. The vein was traced for more than 30 feet across a prominent gabbro outcrop. The vein goes under cover southward, but terminates in exposed bedrock on the north end. There is no evidence of sulfide mineralization in the vein or adjacent wall rock.

Prospect: Mitchell Point Vein
Ownership: John Clark
Dennysville, Maine
Location: Town of Pembroke (Plate 61B)
    Pembroke 7\(\frac{1}{2}\) Quad.
Grid: none

Comments: A quartz vein system, maximum width 18", is exposed along shore for approximately 20 feet, going underwater on both ends. The vein is variable in width, and in many places is a network of quartz stringers. Strike is variable, N.50-80°W., and dips 60° and greater to the northeast. Sulfides identified in hand specimen are pyrite, chalcopyrite, galena, chalcocite; malachite “staining” is prominent. The vein system is mostly barren; sulfides are restricted to localized concentrations. Host rocks are volcanic tuffs.

As the vein system is parallel to the shoreline and on the edge of a low bluff, with rapid drop-off into deep water, geophysical surveying was not attempted.
HORAN HEAD PROSPECT, TOWN OF LUBEC
MAGNETIC SURVEY: VARIATIONS IN VERTICAL MAGNETIC INTENSITY
Contour Interval = 200 gammas
Magnetic Datum: Arbitrary
Miscellaneous:

Several efforts were made to locate the "Deblois Silver Mine" and the "Narraguagus Gold & Silver Mine" mentioned on pages 8 and 9 of Colby's Washington County Atlas. There is no trace of workings at the map site of the Deblois Mine, and the older residents do not recall mention of its presence. Although the Narraguagus shaft was not located, signs of prospecting were noted in the local area. Prospecting efforts consisted of digging shallow pits and trenches to test the rather abundant quartz-carbonate veins.

Several residents in the Cooper-Alexander area mentioned extensive geophysical prospecting efforts by a mining company on Breakneck Mountain, south of Pleasant Lake in the Town of Alexander. W. F. Stickney, of the Maine Geological Survey, visited the area and reported evidences of a large survey grid. Rock specimens collected by Stickney from the grid area were gray, micaceous quartzites and graphitic, quartzose mica schists. Certain of the impure quartzite specimens contained about 1% iron sulfide. No attempt was made to survey this area, as part of the State-sponsored program, principally because of the apparent absence of significant epigenetic sulfide concentrations.

MOLYBDENUM OCCURRENCES IN EASTERN MAINE

The occurrences of molybdenum-bearing minerals in the granites of eastern Maine (Hancock and Washington Counties) have been the objects of numerous prospecting efforts and at least one mining venture. Because economic deposits of molybdenum minerals are sparsely distributed in North America, the Maine occurrences have been described a number of times in the literature. The references listed below treat various aspects of the deposits with differing degrees of emphasis.

It was beyond the scope of the 1962 exploration program to evaluate completely the geology and development efforts at the principal prospects. For this reason known references, which are more or less readily available, are listed below in chronologic order. The reader is referred to the appropriate publication for further detail.


Catherine Hill, Hancock County, and the Cooper Mine, Washington County, are the two principal known molybdenite deposits; survey-mapping grids were laid out on these two prospects. For reference, a third occurrence, that at Burke Hill, Washington County, is mentioned.

Index #1M: "Catherine Hill" Molybdenum Prospect

Ownership: Tract A: Margaret M. Ross
378 Center St.
Bangor, Maine

Tract B: John M. Pierce
Woodstock, Vt.
Prentiss-Carlisle Co., Inc.
Bangor, Maine

Location: T10S, Hancock County (Plate 62A)
Tunk Lake 15' Quad.

Grid: 9,050 linear feet; 20.8 acres.

Comments: The molybdenite occurrence on Catherine Hill has not been commercially exploited; workings consist of numerous blast-holes, pits and trenches scattered along the crest of the hill (Plate 63). Many outcrops were exposed by recent bulldozer work. In the 1962 study, molybdenite was noted on the east-west trend for a distance of more than one-half mile; however, no attempt was made to delimit the molybdenite-bearing area. Within the area of study, molybdenite, the only molybdenum-bearing mineral noted, was found in two definite modes of occurrence:

(a) as disseminated grains or grain clusters, with or without minor pegmatitic developments and/or minor iron sulfide, scattered through apparently unfractured granite;
(b) as molybdenite books or clusters plastered on joint surfaces, invariably with minor iron sulfide and in some cases near or in pegmatitic areas; this mode of occurrence is restricted to the steeply dipping N.85°W. joint set (see Plate 63). Because of the associated iron sulfide, the joint-controlled mineralized zones are conspicuously marked (iron oxide) on weathered outcrop (Plate 64A).
1000' to Denbow Neck road.

Feet

Intermediate to acid tuffs and flows with local intrusives

Geology - Culture:
Denbow Neck Prospect, Town of Lubec
Eastport 7½' Quad.
In overall aspect, the host granite is a medium- to coarse-grained, gray granite with local pale pink zones and biotite developments. From place to place, the granite contains conspicuous thin pegmatitic areas, consisting principally of glassy quartz. Thin siltite dikes, the contacts of which are completely welded to the granite, were mapped at three places on the grid (Plate 64B).

The following notes refer to the specific pit areas identified on Plate 63.

Pit Area #1 (11W + 2N): two small, shallow (4-5') pits and one blast hole; host is medium-grained, gray, equigranular granite with minor biotite; mineralized zone consists of sparsely distributed molybdenite grains, 1/16"-1/4"; control of molybdenite crystals not apparent; mineralized fractures not important; no obvious pegmatization associated with molybdenite.

Pit Area #2 (9.5W + 0): large trench (12' wide, 49' long, max. depth 10') and one blast hole; most extensive prospecting effort; host is medium- to coarse-grained granite with pink zones; molybdenite present in both mineralized fractures and disseminated grains (Plate 65); iron sulfides associated with molybdenite in both occurrences, staining pronounced to pit depth; mineralized fractures are N.80°W. joints; best developments of disseminated grains are between mineralized fractures; no obvious pegmatization associated with molybdenite mineralization.

Pit Area #3 (5W + 3.5N): one 62 foot, N.15°E. oriented narrow trench with an eight-foot deep pit at the southwest terminus; host is medium-coarse gray granite with pinkish overtones; molybdenite found both in mineralized fractures and as unusually large (up to 1" diameter) disseminated crystals; oxidation of associated sulfides prominent on both mineralized fractures and disseminated grains; no obvious pegmatitic areas associated with molybdenite.

Pit Area #4 (0 + 1.3N): one large, irregular blast hole, maximum 5' depth; host granite compositionally as in other pits, grain size slightly smaller than at Areas #2 and #3; most striking area characteristic is the abundance of small pegmatitic developments, which are frequently but not necessarily associated with molybdenite and pyrite; pronounced oxidation around molybdenite clusters; molybdenite occurs plastered on mineralized N.85°W. joints, as disseminated grains, and in clusters in pegmatite zones; largest molybdenite clusters seen on the prospect are here; best developed, coarse molybdenite clusters are in pegmatite areas, which are on or near joints; pegmatites contain clear, colorless quartz, orthoclase and white mica.

Pit Area #5 (6E + 0): three pits and one shallow trench; host granite compositionally as in other pits, grain size slightly smaller than at Areas #2 and #3; most striking area characteristic is the abundance of small pegmatitic developments, which are frequently but not necessarily associated with molybdenite and pyrite; pronounced oxidation around molybdenite clusters; molybdenite occurs plastered on mineralized N.85°W. joint; in the south pit the pegmatite is distinctly pink; in the other pits molybdenite is quite scarce and occurs as small (up to 1/4") disseminated grains.

Geophysical Survey: The entire Catherine Hill grid was covered by a self-potential survey; readings were taken at 25-foot intervals on all traverse lines. The relation of S-P contours to known mineralized areas (Plate 66) indicates that such surveys may be effective in locating covered molybdenite-bearing zones, especially if such areas also carry iron sulfides.

Index #2M: “Cooper Molybdenite Mine”

Ownership: George Edgerly
Alexander, Maine
Post Office: Baring, Maine

Location: Town of Cooper (Plate 62B)
Gardner Lake 15' Quad.

Grid: 800' x 800'; 4,800 linear feet; 14.25 acres.

Comments: Hess (1908, p. 231, 233) indicates that the principal mining effort on this prospect was carried on by the American Molybdenum Company, of Boston, apparently in the period 1903-1906. Adjacent land, prospected but not
molybdenite, with readings spaced at 25-foot intervals on all traverses. The area
The open pit apparently stays filled with water to the uppermost bench; the total
lected from the mill site, assayed 0.106% Mo. 
attitudes: N.75°E.,
Molybdenite, as disseminated grains, is relatively abundant in dump rock, south­

Outcrops are not nearly as abundant here as at the Catherine Hill Prospect
(Plate 67). Most outcrops are of medium- to fine-grained, gray to buff granite. The mineralized fractures, so obvious at Catherine Hill, were not noted in avail­able outcrop. Joint surfaces may be oxidized but do not preferentially carry molybdenite. The oxidation (iron oxide stain) extends into unfractured granite up to several inches; such staining apparently has no relationship to molybdenite distribution. Judging from both dump and outcrop material, the bulk of the molybdenite occurs as small (1-3 mm) grains disseminated rather evenly through unaltered granite. There were no specimens collected which were representative of the “high grade ore” mentioned in the older reports. Jointing is the most prom­inent structural feature in the massive granite outcrops, and it obviously influenced rock removal in the open pit. The best-developed joint sets measured had these attitudes: N.75°E., 80°SE; N.20°W., vertical; N.82°W., 78°SW; N.45°E., 40°NW, 75°NW; near-horizontal sheeting. The horizontal sheeting is especially well-developed in the main pit wall at 1E + 0 (Plate 68A). By far the most heavily mineralized zone seen in outcrops, still with less than 1% MoS₂, is in the western wall of the main pit near O + 1/2 S. At this point there is no obvious change in the character of the host, except for more numerous joints (Plate 68B). Molybdenite, as disseminated grains, is relatively abundant in dump rock, south­east of the mill site. The amount of molybdenite in the waste rock indicates a much higher grade of ore was mined than that now exposed in the open cut. The two pits near 0.5W + 1.2N were put down on prominent joints in sugary, buff granite; disseminated molybdenite is present but very scarce.

The workings from which ore was extracted are not open for inspection. The open pit apparently stays filled with water to the uppermost bench; the total depth of the pit was not ascertained. The 50-foot shaft mentioned by Hess (1908, p. 233) is also filled; its position is marked by service pipes.

In a brief reconnaissance traverse between the Cooper Mine and the Cooper Mountain fire tower, several small prospect pits and blast holes were seen. Only one of these displayed molybdenite.

A bulk sample of material presumed to be mill feed (minus 1” grind), collected from the mill site, assayed 0.106% Mo.

Geophysical Survey: The Cooper grid was surveyed with self-potential equipment, with readings spaced at 25-foot intervals on all traverses. The area of most intensive sulfide mineralization was apparently outlined in the survey, but the potential variation was quite low, less than 10 millivolts (Plate 69). 

Index #3M: Burke Hill
Ownership: on State right-of-way
Location: Town of Cherryfield (Plate 62C)

Cherryfield 7½' Quad.

Grid: none

Comments: In the prominent road cut at elevation 262 on Burke Hill, several thin sulfide-bearing veins are exposed. The host rock is a coarse-grained, normal granite, composed of orthoclase, quartz and hornblende. Because of incipient feldspar alteration, the rock in places has a distinctive green cast. On the south side of Rt. 182 in the cut, several thin, vertical veins are exposed. These veins, rarely more than ½ inch wide, are composed of arsenopyrite, molybdenite and very minor pyrite. The areas adjacent to the veins are conspicuously stained by secondary iron oxides.

No attempt was made to extend the mineralized zones, either in outcrop or through geophysical survey.

GEOCHEMICAL SURVEY

In order to cover as may facets as possible of the geology of Washington County, a reconnaissance geochemical survey was carried out. The fundamental method employed is known as “drainage sediment analysis”; active stream sediments and floodPLAIN sediments were analyzed in the field for exchangeable heavy metals. Because of time limitations, no attempt was made to insure 100 percent coverage, but a definite effort was made to insure that there were no large areas left unchecked.

There are a number of readily available publications which contain good presentations of fundamental theory, exploration philosophy and survey methods. Those of especial interest are Hawkes (1957), Wing (in Doyle et al., 1961), and Hawkes and Webb (1962). It is beyond the scope of this report to present more than a brief outline of the more pertinent, major considerations.

Hawkes and Webb (1962, p. 271) make a brief statement which contains the economic justification for geochemical prospecting in Washington County: “The two outstanding areas of applicability of geochemical drainage surveys are (1) primary reconnaissance, as a method of locating both individual deposits and entire mineralized districts, and (2) in the appraisal of prospects, geophysical anomalies, and favorable geological features.”

As will be pointed out, use was made of both applications in the 1962 program. In a geochemical survey utilizing drainage sediments (active and floodplain), the premise is made that the heavy metal content of the fine fraction (minus 60 mesh) of the sediments will represent that of the entire drainage basin involved. Obviously, there are many factors which influence this relationship, but, as a fundamental statement, it is true. Further, it is also obvious that the heavy metals in an anomalous sediment sample may have reached that specific location in a number of ways: first, as ions adsorbed on mineral grain surfaces (principally clays) and obtained directly from stream waters: second, as clastic products derived from weathering of mineralized zones or their secondary products; or, third, relocation of clastic particles from hydromorphic anomalies in headwater spring or swamp areas. Because of the usually poorly developed drainage systems in coastal Maine, the assumption is made that the larger portion of anomalous metal in the sediments was precipitated directly from metal-bearing stream waters. If this as-
GEOLOGY - CULTURE: DENROW POINT PROSPECT
TOWN OF LUPEN
EASTPORT 7 1/2' QUAD.
A. Shattered tuff, unit “m,” with prominent quartz-carbonate veins; Denbow Point Prospect, northeast shore.

B. Minor shear zone exit “e,” northwest shoreline; Denbow Point Prospect.

sumption is valid then sediment sample values can be directly compared over large areas.

For many years the major problem in geochemical prospecting was the actual procedure or method of analysis. The real value in reconnaissance is the ability to cover large areas at low cost and deliver definitive, reproducible information. A number of procedures are now available which allow attaining these aims; that described in detail by Wing (in Doyle et al., pp. 53-54) appears to be best suited to this particular region.

During the 1962 field season more than 400 stations in Washington County were tested, principally in the area between the coast and Route 9. The vast majority of the stations lay within reasonable proximity of truck-accessible roads or trails. In a few cases, semi-detailed prospect (grid) evaluations were carried out, such as the Frost Prospect (Plate 26). At nearly all stations samples representative of both the active sediment load and flood-plain material were analyzed. Frequently, it was possible to eliminate anomalies, due to culture, by additional, up-stream sampling. Field samples which apparently contained “threshold” concentrations of heavy metals (7 ppm cxHM*) were collected, dried and tested again under more controlled conditions. Following the advice of Wing, sample sites were evaluated, as opposed to single samples; that is, multiple samples were taken at a given locality. Also, active sediments were sampled as well as bank or flood-plain deposits. Both Wing (1961, p. 56) and Hawkes and Webb (1962, p. 268), point out that bank samples will carry slightly higher concentrations of anomalous metal than active samples from the same locality. This phenomenon is attributed to finer grain size of the sediment and higher percentage of organic material. This fact is emphasized in the sample/value distribution shown in Table 1.

<table>
<thead>
<tr>
<th>TABLE 1. Distribution of heavy metal values, active vs. bank samples (463 actives; 454 bank samples).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>------------------</td>
</tr>
<tr>
<td>Active cxHM</td>
</tr>
<tr>
<td>83.8%</td>
</tr>
<tr>
<td>Bank cxHM</td>
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<td>64.2%</td>
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(0-7 ppm = background; 8-14 ppm = threshold range; 15 ppm = anomalous.)

Because of the large area involved, no attempt is made in this report to show the locations of the more than 400 sample sites. This information is on "open file" at the Maine Geological Survey, Augusta. Comments are made on a number of the quadrangles which contain a large number of sample localities or significant geochemical anomalies.

Cherryfield 7½’ Quad: 57 sample localities; numerous anomalous values, all attributed to culture; the Cherryfield Mine may be “found” by the very high values in sediments from the stream flowing southwest from the prospect (Plate 3B).

Petit Manan 7½’ Quad: a single station at the south end of the inland heath on Petit Manan Point (Plate 11B) gave values in the “high-anomalous” class (34A/27B); the samples were unusually high in organics; the entire HM content may be a contribution of the known mineralized zone, some 4500 feet distant.
Pebble-bearing, purple tuff, unit "d," northwest shore, Denbow Point Prospect.

Wesley 15' Quad: 27 sample localities; no sample collected yielded threshold values.

Columbia Falls 15' Quad: 42 sample localities; the small brook immediately north of Lower Eastside School, Addison Twp., showed consistently high bank values (17-20 ppm), but low (3 ppm) actives.

Gardner Lake 15' Quad: 21 sample localities; bank samples collected from the outlet of Patrick Lake gave "high threshold" to "low anomalous" values (10-20 ppm).

Machias 15' Quad: 26 sample localities; the small stream in East Machias Twp., flowing into Shipyard Cove gave low anomaly values (17A/14B); an unusually high number of samples provided threshold values.

Calais 15' Quad: 51 sample localities; an unusually large number of threshold values were recorded for this area:

(a) Conant Hill, lying astride the Meddybemps-Charlotte town line, provided at least threshold values at six sample sites around the periphery of the hill, with a maximum value of 24 ppm recorded at two places.

(b) Because of some insight into the local geology, the anomalous HM values measured around Alexander (Plate 20B) should prove of special interest. All of the 13 sample sets taken in the immediate area (6 on the Frost grid) showed at least one element of not less than threshold significance. Some of the values measured on the Frost grid (Plate 26) are in the high anomalous range (more than 22 ppm). Particular emphasis is placed on the fact that the short streams flowing south off Kendall Mountain carry sediments with HM values in the threshold to high anomaly range (14A/10B; 27A/27B). This fact, coupled with the previously mentioned concentration of sulfide-bearing gabbro boulders, makes the area to the immediate northwest high priority prospecting ground.

(c) High values (10A/17B, 7A/20B, 10A/14B) were measured for sediments in the southeast drainage of Rye Hill, Baileyville Twp.

Robinson 15' Quad: 31 sample localities; no true anomalies; four sample sites (bank only) in the Trimble Mountain area, Robinson 15' Twp., provided low threshold analyses.

Eastport 15' Quad: 110 sample localities; a statistical evaluation of sample data in this particular eastern Maine area indicates that background should be 30-40% higher, occupying the range 0-10 ppm. This is especially true of bank samples. This higher threshold level is probably the manifestation of a higher metal content of the basic igneous rocks prevailing in this general area.

(a) Several sample sites on the Smelt Brook drainage of the Porcupine Mountain area, Perry Twp., contained anomalous concentrations of heavy metals (10/14; 7/17; 24/14). Although no thorough examination was made, there is no obvious contamination in a 0.4 mile stretch upstream from the road.

(b) The West Pembroke-to-Ayers Junction area constitutes what is certainly the most impressive geochemical anomaly mapped in southern Washington County. The presence of outcropping sulfides on and near Big Hill is a matter of long standing record, but the apparent distribution of HM values cannot be totally explained by the known sulfide distribution (Plate 53).

The Eastman Hill drainage anomaly, although displaying relatively low values, is somewhat constant and is in a basin separate from the the Big Hill-Barrett occurrences.

Sample localities on Meadow Brook, principal drainage from the Big Hill Prospects area, reflect in more or less straightforward fashion the known mineralized area. The drop-off rate appears to be relatively low, however, and there may be a minor, unknown contribution in the area between Meadow Mountain and the Old County Road.

The streams which were sampled on the logging trail between the Barrett (Sinclair Farm) Prospects and Rt. 214 contain concentrations of cHxH which are difficult to interpret in the light of known geology. It should be pointed out that water samples from one of the active brooks contained a concentration of approximately 100 times background. The area between the access trail and the north-facing slope of Big Hill is devoid of outcrops. The very high HM values suggest that there may be a significant sulfide body, probably sphalerite, in the low, swampy ground between the Barrett Prospect and Big Hill. The mobility of the sulfides is attested to by the 170 ppm in the active sample where the Barrett Brook crosses the road; of course, there is the possibility of another, un-
known sulfide zone contribution in the area north of the known Barrett pits.

c) A third geochemical anomaly occurs in the Chandler Brook-to-Ohio Brook area, west of Ayers Junction. Samples taken from Chandler Brook and three other smaller, parallel streams all yielded threshold or higher HM values; a high of 68 ppm in one active sample was recorded. This local zone should be studied in close detail.

Cutler 15' Quad: 19 sample localities; no anomalies detected.

RECOMMENDATIONS AND CONCLUSIONS

Results of the 1962 exploration program show that southern Washington County possesses sulfide mineral potentials which apparently have not been thoroughly evaluated by commercial organizations. Although one modern exploration effort, covering a relatively large area, is known to have been completed, methods of approach and detail of examination are not known. The potential economic targets range from narrow, high-grade vein deposits, which may be silver-rich (Cherryfield Mine), to apparently much larger, replacement or segregation deposits, which contain interesting copper-nickel values (Frost Prospect). The iron ore prospect in the Town of Trescott also deserves more attention. Evidence indicates that deposits of the Blue Hill type, copper and zinc-bearing replacement bodies near granite contacts, are not likely to be found in this region.

Specific recommendations for additional work in the general area fall logically into the three basic groups: geological, geophysical, and geochemical anomalies. In some cases, there is a great deal of overlap between types, but one type of anomaly does not necessarily constitute another.

Geological Anomalies: In this category, there are two outstanding areas, the vicinity of the Lubec Lead "Mine" and the tract between Ayers Junction and West Pembroke. Except with the possibility of using induced polarization, the mineralized zone at the Lubec Mine is not likely to offer geophysical expression. The prospect environs should be mapped in extreme detail in order to ascertain the nature and extent of the over-all fault zone into which the sulfide minerals were emplaced. The fact that the "best" sulfide veins known outcrop on the shore emphasizes the importance of the State-owned mineral rights under South Bay.

The West Pembroke-Ayers Junction area constitutes much the same problem; that is, solving the structural control of sulfide zones which may not be detected geophysically. Much less is known of the mineral deposits here than at the Lubec Mine, principally because of sparse outcrop. Nonetheless, detailed geologic mapping should delimit areas within which there is a greater likelihood of sulfide deposits, as well as shedding light on local geochemical anomalies.

Investigations along basic geologic lines, field mapping and laboratory procedures, will probably continue to be the most satisfactory methods to prospect for molybdenite occurrences such as those known in eastern Maine.

Geophysical Anomalies: There are few areas or, more properly, prospects which constitute valid geophysical anomalies. The two of greatest apparent promise are Frost and Wesley. The Barrett, Marion & Gardner, and Smith Prospects present interesting aspects, and all should be accorded further attention.

Because of the nickel-cobalt-copper content of pyrrhotite zone(s) which appear to be responsible for the anomalous magnetism and conductivity recorded, the Frost Prospect and immediate vicinity is a prime exploration area. Local geochemical anomalies and concentrations of sulfide-bearing basic boulders enhance the importance of the geophysical response.

The Wesley anomalies are "blind"; there are no outcrops over the geophysical trends. The correlation between methods is good, and, despite the fact that values cannot be demonstrated, an attempt should definitely be made to resolve the anomaly cause. It should be noted that sulfide minerals in the form which crop out nearby, sphalerite-pyrite-arsenopyrite in vein quartz, could not give rise to geophysical responses such as those recorded.

Geochemical Anomalies: Areas recommended for further geochemical surveying have been specifically outlined (see Geochemical Surveys). Those which constitute first order exploration targets are: (1) the Frost Prospect area, (2) the
GEOLOGY - CULTURE: BARRETT PROSPECT
TOWN OF PEMBROKE
PEMBROKE 7½' QUAD.
West Pembroke-Ayers Junction tract, and (3) Conant Hill in Meddybemps Township. In all of these areas, as well as the less conspicuous but nonetheless important geochemical anomalies, stream-sediment analysis appears to be the preferred method of investigation.

The 1962 exploration program was an unqualified success in attaining both primary and secondary objectives. A large number of significant deposits of sulfide ore minerals exist in southern Washington County, and it may be inferred that there is an equally large number which are not exposed at the surface. Most of the deposits can be detected by at least one geophysical method or geochemically, and many constitute multiple-method anomalies. Thus, it is feasible to prospect in the subject area using modern geophysical-geochemical procedures, with a relatively high anticipated discovery rate. As was demonstrated in Hancock County during the 1961 project, electromagnetic techniques and spontaneous polarization measurements appear most valuable. Geochemical prospecting, especially stream-sediment analysis, is indispensable.

<table>
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<th>Index</th>
<th>Prospect</th>
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<th>Silver (oz./ton)</th>
<th>Lead (%)</th>
<th>Copper (%)</th>
<th>Zinc (%)</th>
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11 Gold (oz./ton) 0.005 (a) (b)
Silver (oz./ton) 0.8
Lead (%) none
Copper (%) 0.655 0.894
Zinc (%) 0.2
Nickel (%) 0.305 0.353
Cobalt (%) 0.103 0.088
Platinum Group trace
Iron (%) 21.2
Sulphur (%) 10.67

2M Molybdenum (%) 0.106

PLATE 55

Shattered and mineralized porphyritic andesite; main trench, Barrett Prospect.
BARRETT PROSPECT, TOWN OF PEMBROKE
SELF-POTENTIAL SURVEY

CONTOUR INTERVAL = 50 millivolts
S-P Datum: Local
Plate 57

GEOLOGY - CULTURE:
BIG HILL PROSPECT, TOWN OF PEMBROKE
PEMBROKE 7 1/2 QUAD.

outcrops are undifferentiated diabase, andesite, dacite.
A. Shale/mineralized diabase contact; south end of main pit, Big Hill Prospect.

B. Fault contact of diabase and dacite; main pit, Big Hill Prospect.

Alteration (white areas) associated with sulfide zones in andesite; Big Spruce Pit, Big Hill Prospect.
BIG HILL PROSPECT, TOWN OF PEMBROKE
MAGNETIC SURVEY: VARIATIONS IN VERTICAL MAGNETIC INTENSITY
Contour Interval: 100 gammas
Magnetic Datum: Arbitrary
Plate 61

A. Cross Island Prospect, Index #22; Cross Island 7½' Quad.

B. Mitchell Point Vein; Pembroke 7½' Quad.

Plate 62

A. Catherine Hill Prospect, Index #1M; Tunk Lake 15' Quad.

B. Cooper Prospect, Index #2M; Gardner Lake 15' Quad.

C. Burke Hill Prospect, Index #3M; Cherryfield 7½' Quad.
MINERALIZED FRACTURE
APLITE DIKE
ALL OUTCROPS PINK TO GRAY GRANITE
B. Aplite dike in granite, Catherine Hill Prospect.

A. Surface expression of a mineralized fracture (joint), Catherine Hill Prospect.

Mineralized fracture (joint) in Pit Area #2, Catherine Hill; note oxidized molybdenite grains on exposed joint face.
CATHERINE HILL MOLYBDENUM PROSPECT
THIRD, HANCOCK COUNTY
SELF-POTENTIAL SURVEY
S-P Datum: Local
All Contour Values Negative, Interval: 50 millivolts
PLATE 67

GEOLOGY - CULTURE:
COOPER MOLYBDENUM PROSPECT
TOWN OF COOPER
GARDNER LAKE 15' QUAD.

all outcrops granite
A. Horizontal sheeting in granite; main pit, Cooper Molybdenite Mine.

B. Jointing in granite which carried disseminated molybdenite; main pit, Cooper Molybdenite Mine.
COOPER MOLYBDENUM PROSPECT, TOWN OF COOPER
SELF-POTENTIAL SURVEY
Contour Interval: 25 millivolts
S-P Datum: Local
REFERENCES CITED