78-10077
CR-155731

"Made available under NASA sponsorship
in the interest of early and wide dis-
semination of Earth Resources Survey
Program information and without liability
for any use made thereof."

APPLICATION OF REMOTE SENSING DATA TO SURVEYS OF THE ALASKAN ENVIRONMENT

ANNUAL REPORT
Grant NGL 02-001-092

July 1, 1974 - June 30, 1975

(E78-10077) APPLICATION OF REMOTE SENSING DATA TO SURVEYS OF THE ALASKAN ENVIRONMENT Annual Report, 1 Jul. 1974 - 30 Jun. 1975 (Alaska Univ., Fairbanks.) 224 p HC A10/MF A01 CSCL 08F G3/43

N78-18486

Unclas
00077

MAR 1978
RECEIVED
NASA STI FACILITY

MAR 1978
RECEIVED
NASA STI FACILITY

APPLICATION OF REMOTE SENSING DATA TO SURVEYS OF THE ALASKAN ENVIRONMENT

A cooperative Program of the University of Alaska with User Organizations Including Local, State and Federal Government Agencies

J. M. MILLER and A. E. BELON

Geophysical Institute
University of Alaska
Fairbanks, Alaska 99701

Original photography may be purchased from
EROS Data Center

Sioux Falls, SD

ANNUAL REPORT

Grant NGL 02-001-092

Period Covered

July 1, 1974 - June 30, 1975

Prepared for

National Aeronautics and Space Administration
Office of University Affairs
Washington, DC 20546

INTRODUCTION

Recent events on the national and international economic scene have shifted attention to the location, development, and exploitation of the natural resources in the State of Alaska. There has been rapid growth of petroleum and forest products; and marine and anadromous fisheries are still a mainstay of Alaska's economy. Mineral ore production does not currently share a major role, but extensive exploration is underway and it might regain and surpass its former status as a major industry.

The increasing demands upon the land and environment create critical issues for decision makers who manage Alaska's natural resources. What should be the best distribution of land ownership in Alaska? Where are the resources located, and how can they be developed? How can we enhance the quality of human life while maintaining the quality of the environment? Some of these considerations are amenable to the application of satellite remote-sensing.

The Landsat program provides a means to overcome the formidable logistic and economic costs of preparing environmental surveys of the vast and relatively unexplored regions of Alaska. There is an excellent potential in satellite remote-sensing to benefit federal, state, local and private agencies. Satellite data provides an up-to-date, synoptic data-base which is necessary for the preparation of the needed surveys and the search for solutions to resource and environmental management problems.

Historically, Alaskan problems were first coupled to satellite data by a major program initiated by the University of Alaska and funded by NASA's Goddard Space Flight Center (NAS5-21833). These 12 projects, which were completed in 1974, studied the feasibility of applying Landsat data to the disciplines of ecology, agriculture, hydrology, wildlife management, oceanography, geology, glaciology, volcanology, and archaeology.

Equally important are the activities performed under NASA grant NGL 02-001-092 from the Office of University Affairs. This grant extends the disciplinary concepts entailed in Contract NAS5-21833 plus three follow-up contracts to the operating needs of mission-oriented agencies of the federal, state, and local governments, as well as private industry in some instances. The goal of this grant is to involve the active participation of public and private groups in applying remote-sensing data in such form as may be most appropriate to existing problems in resource management. During the first two annual grant periods, the implementation of this central objective has been effected by encouraging user participation in the program at a variety of levels appropriate to the users' interests. These levels currently include:

1 Observation, coordination and information exchange

2 Training courses and workshops in the interpretation of remote-sensing data

3 Data exchange

4 Consulting services

5 Data processing services

6 Cooperative projects involving operational activities of users

More than two dozen agencies, as listed in Table 1, have participated in the program at one or more of the above levels. As might be expected during the first phase of such a program, the widest agency participation has been at levels 1 to 5. However, recent trends indicate that previously low-level agency participation, together with the positive results of the Landsat projects, are generating substantial interest for the greater involvement represented by level 6. Therefore, it appears that our multi-level approach to Landsat data utilization by operational agencies is effective, and that we are beginning to see the routine and effective use of remote-sensing data by operational agencies of government and industry.

TABLE 1 - Cooperating Agencies

Federal Government Agencies

DOT/Federal Aviation Administration
DOT/Federal Highways Administration
NOAA/Auke Bay Fisheries Laboratory
NOAA/National Weather Service
U. S. Air Force/Alaskan Command
U. S. Army Corps of Engineers
U. S. Coast Guard
USDA/Forest Service
USDA/Soil Conservation Service
USDI/Alaska Power Administration
USDI/Bureau of Indian Affairs
USDI/Bureau of Land Management
USDI/Bureau of Mines
USDI/Fish & Wildlife Service
USDI/National Park Service

State Government Agencies

Department of Highways
Department of Fish & Game
Dept. of Education/State Library
Dept. of Natural Resources/ Geol. Survey
Dept. of Natural Resources/ Div. of Lands
Dept. of Economic Devel./ Indust. Development
Dept. of Public Works/ Div. of Aviation
Dept. of Environmental Conservation
Office of the Governor/ Planning & Research
Joint Federal-State Land Use Planning Commission for Alaska

Regional & Local Government Agencies

City of Nenana
City of Fairbanks
Fairbanks North Star Borough
City and Borough of Juneau
Greater Anchorage Area Borough
Kenai Peninsula Borough
Ketchikan Gateway Borough
Matanuska-Susitna Borough

Other Organizations

Kross & Associates
Woodward, Lundgren & Associates
Alyeska Pipeline Service Company
CH2M/Hill Alaska, Engineers
Lost River Mining Corp., Ltd.
Humble Oil & Refining Company
Woodward-Envicon Inc.
Environment/Alaska
Resource Associates of Alaska Inc.
U. S. Steel Corporation
Marathon Oil Company
Tanana Chiefs Conference
NANA Regional Corporation
Arctic Environmental Information & Data Center
Fisheries Extension Service
Northland Wood Products
Gulf Oil Company
Atlantic-Richfield Company
Shell Oil Company
ESSO Production Research Company
Boston Museum of Science
Union Carbide Corporation
Doyon, Ltd.
Calista Corporation
Alaska Travel Publications, Inc.
INEXCO Mining Company
R & M Eng. & Geol. Consultants
AMAX Coal Company
Enplan Corporation

SUMMARY OF ACTIVITIES

The University's role in providing a functional base for the applications of remote-sensing technology to all bona fide users has become well known. We continued efforts to generate regional support for the utilization of technology that is appropriate to the dichotomous nature of resource management in Alaska. Our objective has been to be involved in cooperative projects which promise beneficial applications of remote-sensing technology, particularly satellite sensing, to agencies with operational problems to solve. Emphasis was given to those projects which had a good likelihood for significant decisions being made which were based upon the results of the grant activities.

While most of our efforts were oriented toward specific projects, performing an operational project successfully requires a certain amount of backup or supporting facilities and capabilities. Included in this category is a general outreach effort which serves to alert us when opportunities for new applications occur, a data center with which to generate the basic products that are required, and processing facilities to manipulate the data into suitable forms for analysis, interpretation and application.

Coordination and Information Exchange

We have maintained a statewide liaison with operational agencies of government and industry to maximize a sharing of appropriate levels of information. We have enjoyed a substantial base of goodwill and rapport with various user groups involved with environmental and resource management problems. We are generally recognized as the best source in

Alaska for information on remote-sensing technology and for suitable data products.

Many agencies have appreciated these activities and are using these capabilities to a growing extent. That there has been an appreciation for the utility of these applications is borne out by the many user-agencies which have borne a major share of the cost of their data applications. When appropriate circumstances prevail, funds from this grant were used to support the demonstration component of cooperative projects with user-agencies. This policy was intended to overcome reluctance by the users to perform what can appear to be research or feasibility studies, when the agency may be constrained to support only operational activities.

Data Center

An important service to the community of users within Alaska is the publishing of information catalogs and listings of available Landsat and aircraft imagery. While all data are available from national data banks, we archive the Alaskan data with low cloud-cover which are most relevant to Alaskan needs. Because the huge geographical extent of the State of Alaska, it is impractical to rely on data searches conducted by national data centers. Users have an immediate need to know what data are available when gathering information for problem-solving. Part of our coordination effort includes the distribution of catalogs which meets the user's need for browsing among available data or searching for some specific regional coverage. An example of our current Landsat catalog appears in Appendix A. As the body of locally stored data grows, maintaining an up-to-date bibliography of the total Alaska library will remain an important part of our activities.

The operation of the Landsat data library frequently involves consulting services of at least four types:

(1) Assisting the user in selecting the data which have the greatest potential of satisfying his needs.

(2) Assisting the user in preparing orders for standard data products from the EROS Data Center. This is particularly appropriate when the need for data is not immediate and standard data products are satisfactory for this purpose.

(3) Assisting the user in preparing a local work order for custom data products (images enhanced for the purpose of the investigation, density-sliced images, etc.).

(4) Advising the user on data analyses and data interpretation facilities available either locally or at major laboratories outside Alaska.

The Landsat data library, browse file, and associated consulting services and facilities remain an essential activity to provide applications assistance to all data users in Alaska. Part of these activities is now supported by a contract with the U. S. Department of the Interior, EROS Program Office, for a librarian. There has been an increasing amount of data purchases ordered through our library, which is indicative of the interest and practical value being placed on remote-sensing data by Alaskan users. Further evidence of a healthy, self-generating flow of applications is that we recorded around 60 "walk-in" visitors per month. This demonstrates that there is a growing community of somewhat self-sufficient data-users which has resulted from our efforts to find new applications for remotely sensed data.

Data Processing Services

An essential aid to new users of remote sensing has been the services of the centralized facilities for processing remote-sensing data at the University. It would be wasteful were each user agency to establish laboratory facilities and technical personnel to perform its own analysis and interpretation. A continuing activity of the University was the processing of remote-sensing data either photographically or digitally to the specifications of the user agencies. These activities were performed on our facilities on a job-order basis parallel to the applied research already under way. In most instances, the user agency bore the costs of such direct services, but selected cases with high benefit/cost potential or demonstration projects were funded from this grant for direct services support.

The ability to provide a variety of processing services for the data is equally important along with the timely access to specific data to produce a satisfied user. This enables the user to receive the data in a format best suited to his particular application, rather than "make do" with those standard data products that are available. Data processing for its own sake has not been supported by the grant, except for those cooperative projects which otherwise qualify for funded support.

Our experience and the published work of others has shown that the more substantial applications involve not only conventional photo interpretation but increasingly use computer-aided digital techniques of analysis and interpretation. Some of our users are tending to move from visual photo interpretation into the application of digital interpretation techniques.

PRECEDING PAGE BLANK NOT FILMED

Applying digital techniques with our present facilities has turned out to be uneconomic except for very small target areas. This results from the original design concept of our digital color display unit which was intended to serve only limited test-areas associated with our early ERTS-1 feasibility investigations. It is now evident that we cannot adequately serve the needs of our community of data users without a greater capability to process larger quantities of digital Landsat data. Several projects have required moderately extensive, computer-aided analysis techniques which were beyond the capability of our in-house services and for which we sought processing services from firms in the contiguous states.

Procurement of outside computer services is an interim solution until we can develop a local capability of performing clustering and maximum likelihood algorithms on a scale suited to users of regional analyses. The awkwardness of interaction and communications with service firms in the lower 48 states, while dealing with complex data handling and processing decisions, greatly extends the time and cost of a given project. In some instances it has meant the untimely end to an opportunity that otherwise deserved our involvement, which is counter-productive to the objective of this grant. Consequently, for projects of larger scope, we must give preference to those which do not demand a short turn-around time.

Training and Workshops

Less emphasis was placed this year upon formal training activities. Efforts in previous years have established a rather broad foundation in the theory and application of remote-sensing techniques. More recently we have tried to concentrate on groups that sought our help in training

PRECEDING PAGE BLANK NOT FILMED

or educational exercises. These included informal indoctrination of individuals from agencies as well as participation in more formally structured course work. One such effort was an introduction to the understanding of basic map skills that was presented in a local elementary school with our assistance. The principal of the school ordered three enlargements of color-infrared photos acquired last summer by the NASA U-2.

A major course in remote-sensing was presented for credit at the University level (see Appendix B for course outline). The class was heavily dependent upon the use of the data products, processing facilities and interpretation instruments associated with the activities of this grant, and periodically conducted laboratory exercises in our data center. This class also stimulated individual interest on the part of the students who came to pursue applications of remote-sensing data for their own purposes.

We have also participated in the preparation of a traveling exhibit explaining the use of satellite data in laymen's terms. This was a project jointly funded with the National Science Foundation, with the goal of enhancement of the public understanding of science. The context of these displays related to the accrued public benefits of Landsat as part of space-related technologies. These exhibits are being transported from place to place throughout the State in order to communicate to schools and the public the areas of active research pertinent to Alaska.

We have also prepared a number of display boards which illustrate applications of Landsat data in various disciplines. These are prominently displayed for maximum public impact in the foyer area of the

PRECEDING PAGE BLANK NOT FILMED

Geophysical Institute. These displays are effective in developing appreciation for Landsat applications with casual visitors as well as providing a frame of reference for interested visitors who approach us with needs and plans that are not yet well defined.

PRECEDING PAGE BLANK NOT FILMED

CURRENT PROJECTS

We emphasized as much as possible those project-oriented activities that have identifiable benefits directly attributable to the application of satellite or aircraft data. Because some degree of "pump-priming" must always be a part of development activities of a cooperative nature, not all of our projects have been as outwardly successful as others. In a world filled with vagaries in political and human value-systems, some projects generated more technical success than operational benefits. Sometimes advance evidence suggested a high probability of early benefits and operational decisions, but subsequent matters related to internal agency concerns inhibited the decision-making process either on a timely basis or permanently.

Not all projects have been conducted solely with funds from this grant. In some instances the work has gone forward in the absence of expected immediate benefits, but with only a trivial amount of grant support. The initial situation sometimes may not be sufficiently clear to warrant a definite commitment of grant support, but the project may have enough merit to justify a start so as to evaluate the probability of benefit to the agency. In those instances that a measurable decision remained too uncertain after such a start, the project was allowed to proceed on a small-scale basis supported only by agency funds.

USDI/Bureau of Indian Affairs

The major project this year was the completion of a regional survey of land resources for land selection and management purposes. Landsat imagery was applied to Native land-selection and management problems of

PRECEDING PAGE BLANK NOT FILMED

Doyon, Ltd., the largest regional corporation established for land management and investment purposes under the Alaska Native Claims Settlement Act of the U. S. Congress. This was a demonstration project with the goal of preparing thematic maps of a wilderness area to emphasize those resources of greatest interest to Doyon. Funds from BIA Contract EOOC 142 01079 were used in conjunction with NASA Grant NGL 02-001-092 in support of this project.

Doyon required resource inventory information upon which to base their land selection decisions before the deadline set by Congress, December 1975. At their request we concentrated the Landsat image analysis upon the two resources of commercial timber and mineral potential. The area surveyed included 250 townships in seven different regions in the interior of Alaska in the vicinity of Kaltag, Purcell Mountains, Tanana, Kuskokwim River, Chandalar-Wiseman, Allakaket, and Ray Mountains. These regions were considered by Doyon to be of high priority for selection decisions.

We endeavored to correlate all existing resource data of the target regions to the best available Landsat imagery in the process of generating a resource base for land-use maps and prospecting area maps. The township and range data were projected onto 1:250,000 scale Landsat images to aid the visual interpretation of the imagery by the land managers.

The objective of the mineralization analysis was to delineate areas for which the interpretation of Landsat images, combined with ground truth, indicated a favorable probability of metallic or non-metallic mineral products that warranted prospecting efforts. The size of the target areas is so great that the cost of doing even a rapid geologic reconnaissance to identify favorable prospecting areas was prohibitive.

A four step process was used to prepare potential mineralization maps. First, all existing geophysical data relating to ore deposits were organized. This delineated the distribution of mineralization regions of similar types and the nature of the geological control prevailing in each region. Next, the existing mining claims and mining districts were located on the Landsat images. Then the images were interpreted to identify distinctive features of the geologic environment, land forms, vegetation and tectonic faults which can be associated with each mineralized province. From this analysis it was determined which combination of features might justify extension of the boundaries of the known mining districts or projection of the trends of known deposits into adjacent areas. Finally, maps of the study area were prepared which indicated the locations of the more favorable prospecting areas.

The land-use maps were prepared as vegetation maps depicting broadly defined vegetation types at a scale of 1:250,000. Land-use maps are of increasing importance owing to the widespread rush into land disposition and resource exploitation. Such maps provide a spatial inventory of selected resources, and they are an important guide for land selection and management in that they aid in planning activities that are compatible with the natural environment and the needs of the owner.

Although the maps prepared from Landsat imagery were small scale and rather coarse botanically, they do provide far more spatial information than any existing maps of the areas. Images were analyzed in optical registration from two seasons of the year. Late winter scenes, printed in black and white, permitted the estimation of vegetation height and cover because the winter snow-cover tends to mask the brush without substantial height. The summer scenes were reconstituted into false color-infrared formats which enabled several floristic distinctions of high-cover species or species groups of particular relevance to commercial timber potential.

The few existing aerial photographs covering part of the regions were used as training aids for visual photo interpretation of the satellite images. As a final check, low-altitude aerial reconnaissance was utilized on a sampling basis to verify the validity of the thematic maps prepared for the project.

The process of identifying potential commercial timber first required that forest vegetation be recognized. Then an estimate was made of the composition and stature of the forest using the spectral and physiographic information interpreted from the satellite imagery. Commercial timber was mapped where there were high probabilities of a number of larger trees suited for lumber production. No attempt was made to determine timber volume.

Based chiefly upon the thematic maps produced from the interpretation of Landsat data, Doyon, Ltd. expects to select some 2 to 4 million acres by the deadline of December 1975 imposed by Congress. The estimated value of these lands ranges from $20 million to $200 million. A conservative assumption is that the application of Landsat data at least doubled the value of the land selected in comparison with the land not selected. The benefits of this application can range between $10 million and $100 million, although the benefits are not quantitatively definable. There are good indications that the benefits exceed the cost of the project by a factor ranging from 250:1 to 2,500:1, not taking into account the cost of development and deployment of the spacecraft or of data acquisition.

A detailed description of the Doyon project is enclosed as an Interim Report in Appendix C.

Description of Other Operational Projects

Our participation in operational projects of user agencies included both simple as well as major projects. Minor projects included products to demonstrate the effectiveness of remote-sensing data for the Soil Conservation Service and for the Bureau of Land Management. There were a number of cooperative projects of varying complexity and degree of operational benefit to the user. It has been difficult upon occasion to reliably predict the potential for operational benefits while evaluating the opportunity for a new cooperative project. We have tried to be guided by the principle that most ideas or concepts merit at least a cursory or preliminary involvement on our part. By thus acting as a catalyst we try to stimulate the project into the kind of maturity that will involve operational decisions or actions. This kind of interaction with the real world leads to involvement with some activities which fail to produce the kind of result we seek. We conclude that the significant number of apparently non-responsive projects should not necessarily be viewed as project failures for the purposes of this grant. The redeeming feature of this group of "underachieving projects" is twofold--the users nearly always are delighted with their use of this new technology, and our level of support with grant funds has been slight.

Many of the operationally oriented projects were unforeseen opportunities which could not have been planned in advance. We feel that it is important to respond to new requests for assistance whether they arise from administrative decisions within an agency, or from unexpected natural events, such as a demonstration of mapping the extent of forest fires.

The projects which have not generated as yet operational decisions, but which possess significant benefits of increased user awareness, are described briefly below:

U. S. Forest Service - Based upon our previous description of Landsat capabilities, the Forest Service decided to obtain complete coverage of the Tongass National Forest (which essentially includes all of Southeast Alaska). In consultation with agency personnel we helped to select 26 black-and-white prints and prepared several color reconstitutions on a custom basis with our laboratory facilities.

Bureau of Land Management - We prepared a poster-board display to illustrate the feasibility of mapping areas burned by forest fires from the use of remote-sensing imagery of various kinds. This included satellite images that were enhanced by means of color density-slicing as well as conventional aerial photos. Our methods were found to be more accurate than the existing methods for estimation of burned acreage, largely because of the synoptic overview of large wildfires and the ability to distinguish unburned "islands" within a large area that had been mostly burned over.

National Oceanic and Atmospheric Administration - Catalogs and maps of available satellite and aircraft data were prepared on a periodic basis for the Alaskan coastal zone. We also provided assistance to investigators working on NOAA's outer continental shelf environmental assessment program in selecting appropriate remote-sensing data.

U. S. Fish & Wildlife Service - Assistance was provided as this agency sought to relate Landsat and U-2 images to studies correlating marine mammal habitat with spring sea-ice conditions. Preliminary results were very encouraging and may enable wildlife managers to inventory this important resource for the first time.

Alaska Division of Lands - Participation in the Delta Planning Project involved the interpretation of Landsat imagery, including digital classification of existing land-uses, of a 1.4 million-acre region in central Alaska which has extensive agricultural and recreational potential, but which also is the focus of development related to construction of the Alaska pipeline.

Alaska Department of Environmental Conservation - This work sought to study digital classification of coastal terrain along four coastal areas to determine any apparent physiological indicators of coastal climatic effects.

U. S. Soil Conservation Service - As a demonstration project to illustrate the utility of the false-color infrared format of Landsat, we prepared a 1:250,000 scale Landsat enlargement of the Delta area for the Delta Planning Team, a land-use study group. This joint project addressed the problem of mapping from Landsat data areas prone to flood hazards. Field work is to be performed by agency personnel during the following summer. This project was an outgrowth of the work performed for the Delta Planning Team in conjunction with the Alaska Division of Lands.

Most of the projects described above fall into the category of demonstration projects. While they may have fallen short of the operational impact that we consistently seek, they did serve the critical purpose of making initial inroads in routine agency affairs for the use of Landsat products. Such "pump-priming" activities cannot be overlooked, but they should not be allowed to predominate in the overall scope of our work. We have attempted, with some success, to achieve a balance between work which is purely a demonstration project and work that is mostly operational. We would, of course, like to generate more of the latter type, but there was a fair representation of both types of projects involved with this year's activities under this grant.

Conferences and Meetings Attended

In January Professor Belon and K. Martz visited the U. S. Department of the Interior's EROS Data Center in Sioux Falls, South Dakota at no cost to this project. This visit served to introduce our personnel to the functions and operations of the EROS Data Center which is the national distribution center for NASA Landsat data products and high-altitude aerial photographs. Briefings on the operation of Users Services and the Data Reference Facility were designed to aid us in preparing data searches and data orders for the products required for users in Alaska.

Professor Belon also visited the National Space Technology Laboratory in Bay St. Louis, Mississippi, and the USGS Applications Assistance Facility in Menlo Park, California. These installations serve needs that are related to the activities of this grant, and presented a good opportunity to observe methods and functions that serve the community of users in areas other than Alaska. The exchange of ideas was helpful in reviewing facilities and training programs which might be useful with our activities.

The visit at the EROS Data Center also served to introduce us to the development of training aids in the sound-and-slide format for orientation of individuals or small groups.

Dr. W. J. Stringer attended the 11th Alaska Surveying and Mapping Convention in Anchorage in February. He presented a paper entitled, "Remote Sensing Activities at the Arctic Environmental Information and Data Center".

In June, J. M. Miller attended a symposium on "Machine processing of remotely sensed data" at Purdue University, and the following week presented two papers at the Earth Resources Survey Symposium, Houston, Texas, that were based upon the activities of this grant. They were titled, "Environmental Assessment of Resource Development in the Alaskan Coastal Zone Based on Landsat Imagery" and "Applications of Satellite Remote-Sensing to Land Selection and Management". See Appendix D for complete bibliographic citations.

CONCLUSIONS AND RECOMMENDATIONS

We have continued to develop applications of remote-sensing data to meet the growing needs in Alaska as more issues are addressed which relate to the shortage of raw materials, energy exploration and development, and social problems such as the settlement of the land claims of Alaskan Natives. We have introduced a growing cross-section of public and private agencies in Alaska to the use of remote-sensing data, both satellite and aircraft. We have engaged in cooperative projects which involved the performance of operational activities, and we have provided assistance upon request for data processing, enhancement and interpretation using facilities at the Geophysical Institute.

There is a continuing opportunity to work with new agencies and personnel to introduce the operational benefits of remote sensing and to upgrade existing users into more extensive and intensive use of these data and state-of-the-art techniques that are available through research activities of the University. With the continuing support from the Office of University Affairs, we expect during the coming year to provide additional assistance with remote-sensing technology to the operational agencies of government and industry at a variety of levels. These include:

1 - Observation, coordination and information exchange
2 - Training courses and workshops
3 - Data exchange
4 - Consulting services
5 - Data processing services
6 - Cooperative projects

This broad-based approach should continue to be effective in meeting the goals of this Grant. It addresses the initial reticence of new users to become deeply involved in a new technology which they only partially understand, but the greatest emphasis should be on activities at level 6. It is only as we become involved with cooperative projects which result in significant decisions or actions that we can thoroughly justify the program functions at levels 1 through 5. While important as supporting roles, they more properly are viewed as supporting elements of cooperative projects.

Appendix A

Catalog of Landsat Data of Alaska

with

Low Cloud Cover

July 1972 - June 1975

Prepared by:

Landsat Library
Geophysical Institute
University of Alaska
Fairbanks, Alaska 99701
Telephone 907-479-7487

with support from:

National Aeronautics & Space Administration
Office of University Affairs
Grant NGL 02-001-092

and

U. S. Geological Survey
EROS Program
Contract 14-08-0001-14857

LANDSAT DATA

The characteristics of the Landsat system are summarized in the attached table.

The data coverage maps locate the scene identification number of all Landsat images which are currently available in the remote-sensing archives in the following formats:

- 70mm positive transparencies of MSS spectral bands 4,5,6 and 7
- 70mm negative transparencies of MSS spectral band 5
- 9½" print of MSS spectral band 7

The more detailed catalog listings give the date of acquisition, approximate cloud cover, geographic center point of the image and the sun elevation and azimuth. A general map description is also included in the listing.

Other formats up to 40"x40" prints (1:250,000 scale) and simulated color-infrared composites can be ordered from the Geophysical Institute photo lab or the EROS Data Center, Sioux Falls, South Dakota. Landsat images in digital magnetic tape format must be ordered from the EROS Data Center.

PRECEDING PAGE BLANK NOT FILMED

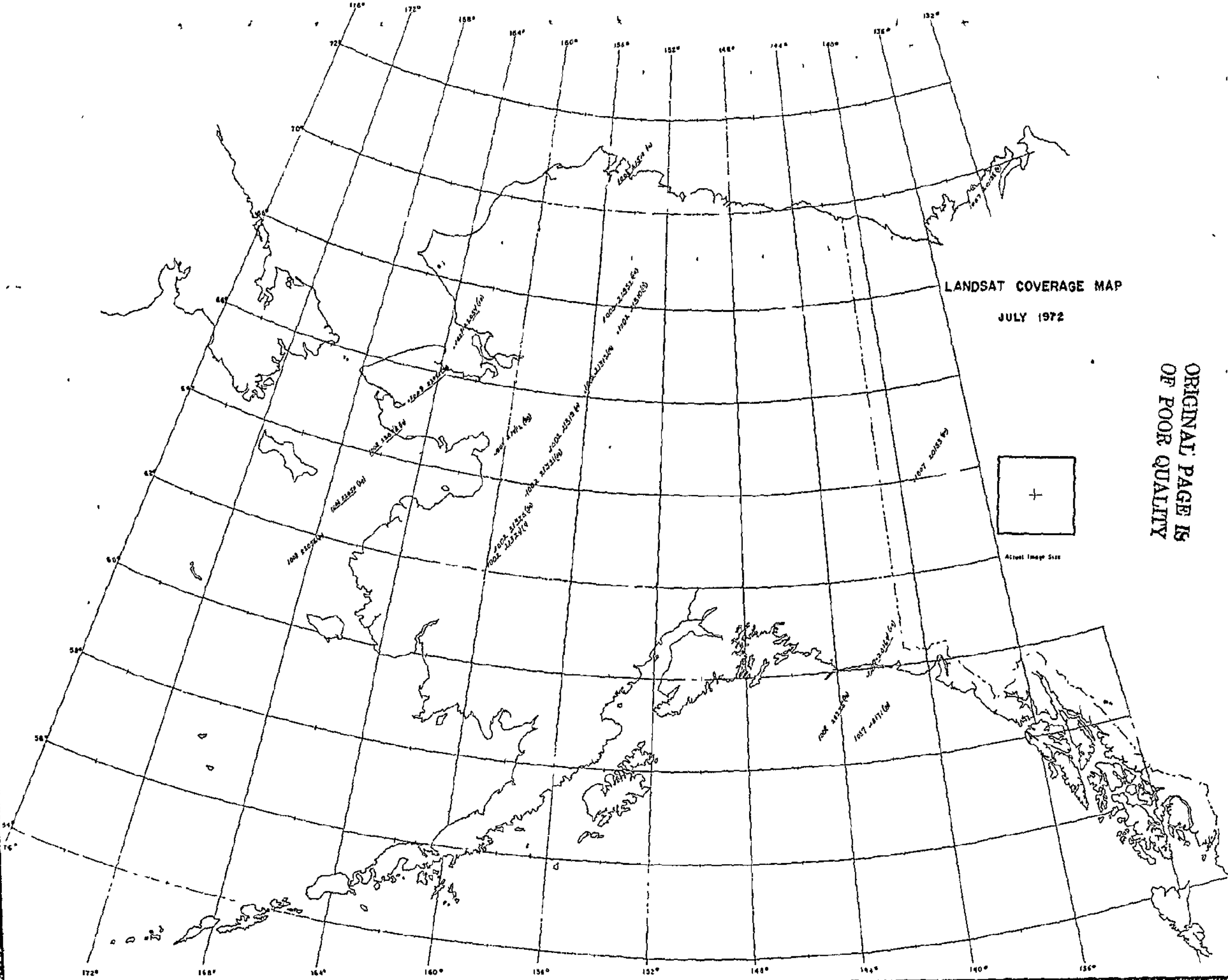
LANDSAT SYSTEM CHARACTERISTICS

Altitude of Satellite	915 km (570 miles)
Type of orbit	circular, sun-synchronous, 99^{o} inclination
Orbital period	103 minutes
Orbits per day	14 orbits
Coverage cycle	18 days
Time of observation	approx. 1050 AM at 60^{o} to 70^{o} north latitude
Size of area imaged	185 x 185 km (115 x 115 st. mi. or 100 x 100 naut. mi.)
Field of view	11.56 x 11.56 degrees
Sidelap	approximately 67% at 62^{o} north latitude
Overlap along orbit	10%
Instrument	Multispectral scanner
Image distorition	2%
Ground resoltuion	less than 80 to 120 meters
Positional accuracy (meters	900 meters
Scene registration (meters	160 meters

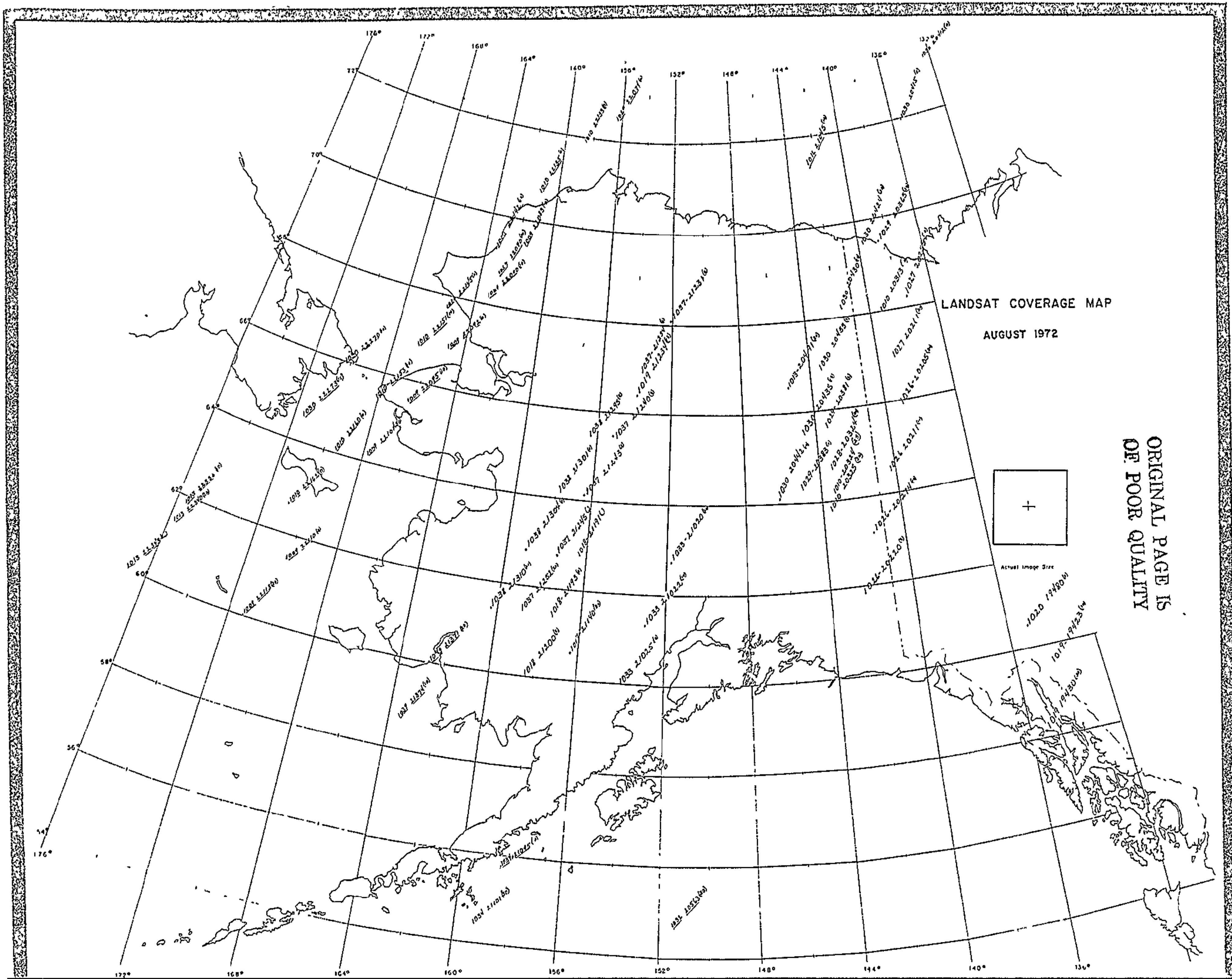
Spectral Band	4	5	6	7
Spectral bandwidth (microns)	0.5-0.6	0.6-0.7	0.7-0.8	0.8-1.1
Nominal color	Green	Red	Far Red	Near IR

LANDSAT COVERAGE MAP

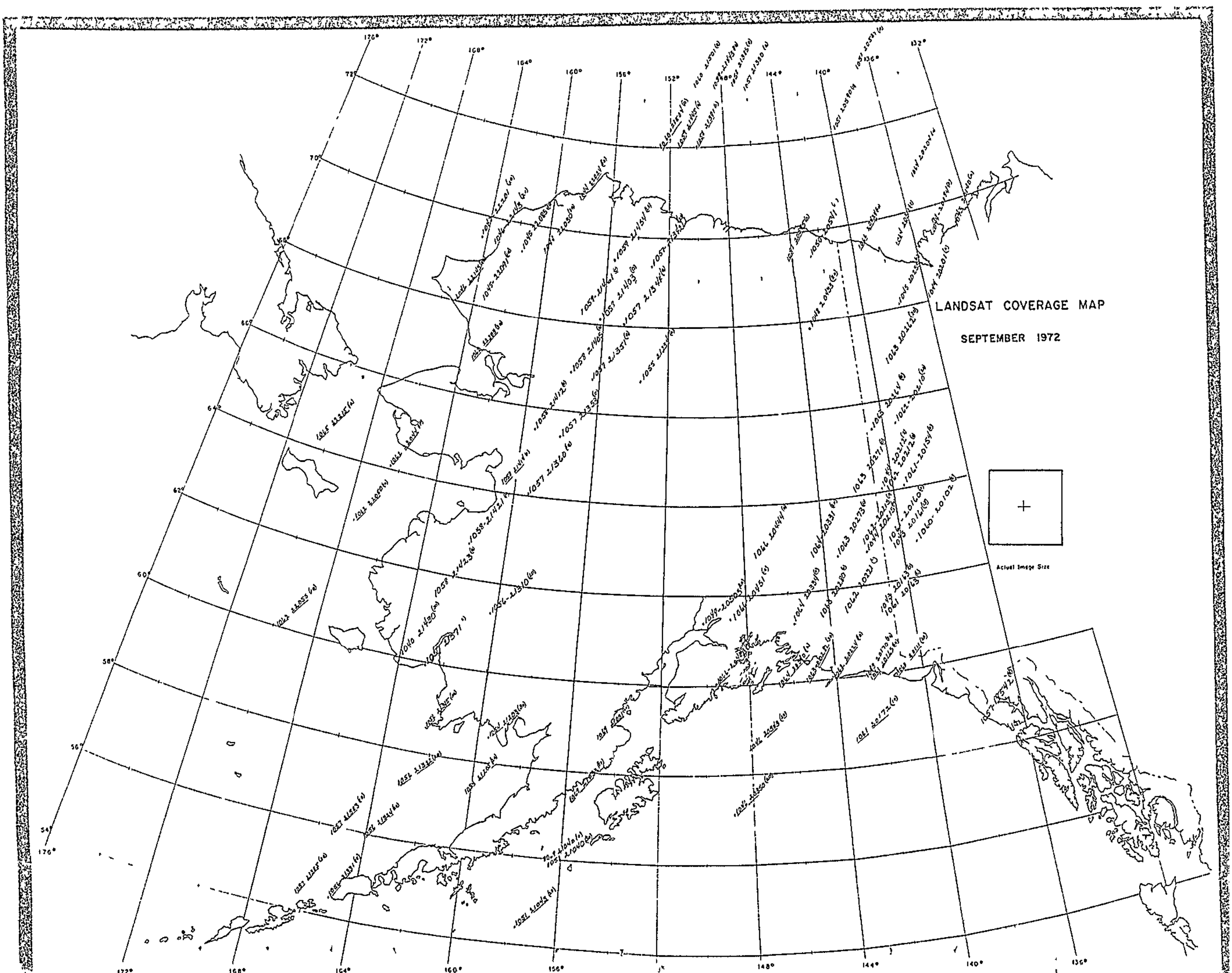
JULY 1972

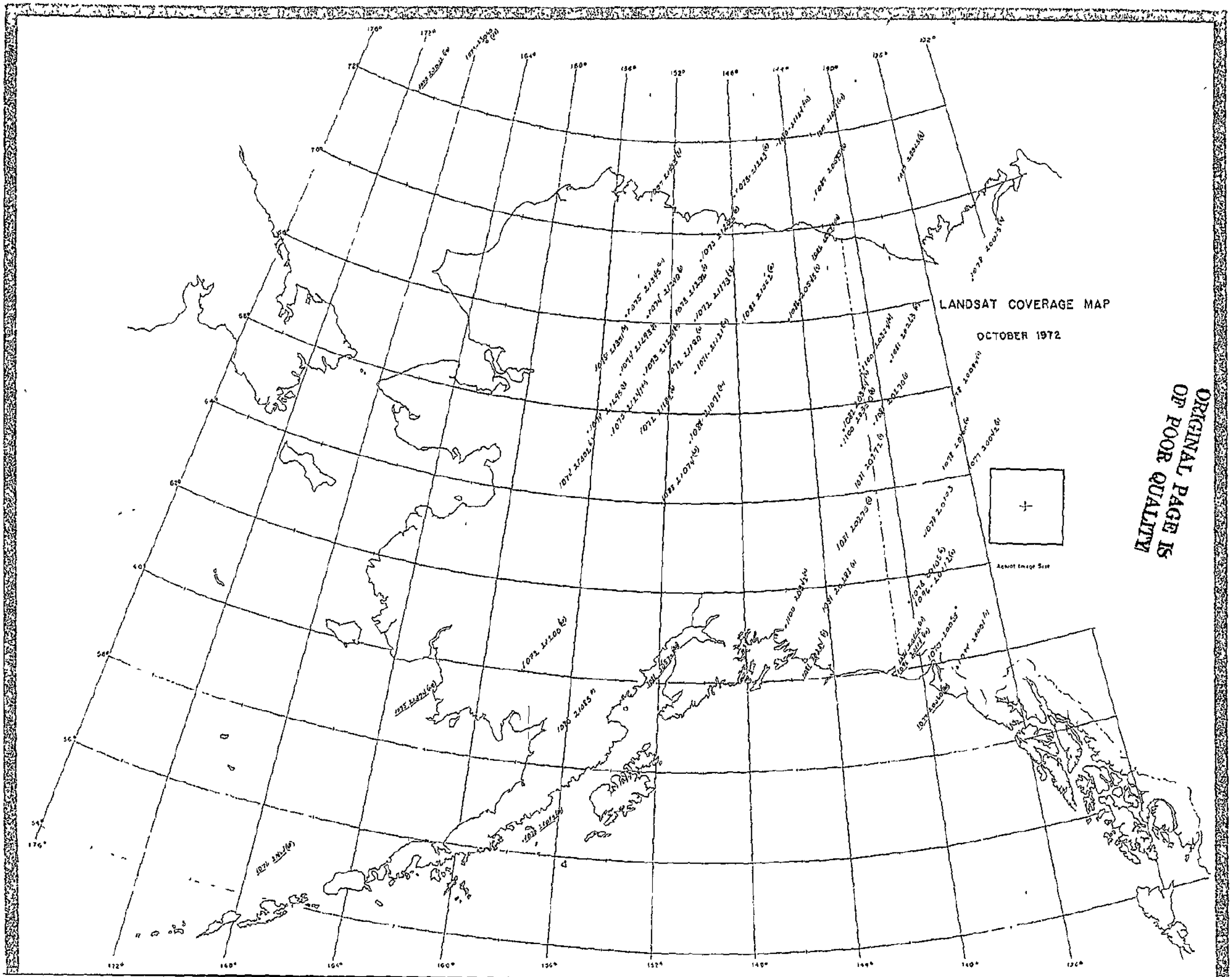


ORIGINAL PAGE IS
OF POOR QUALITY

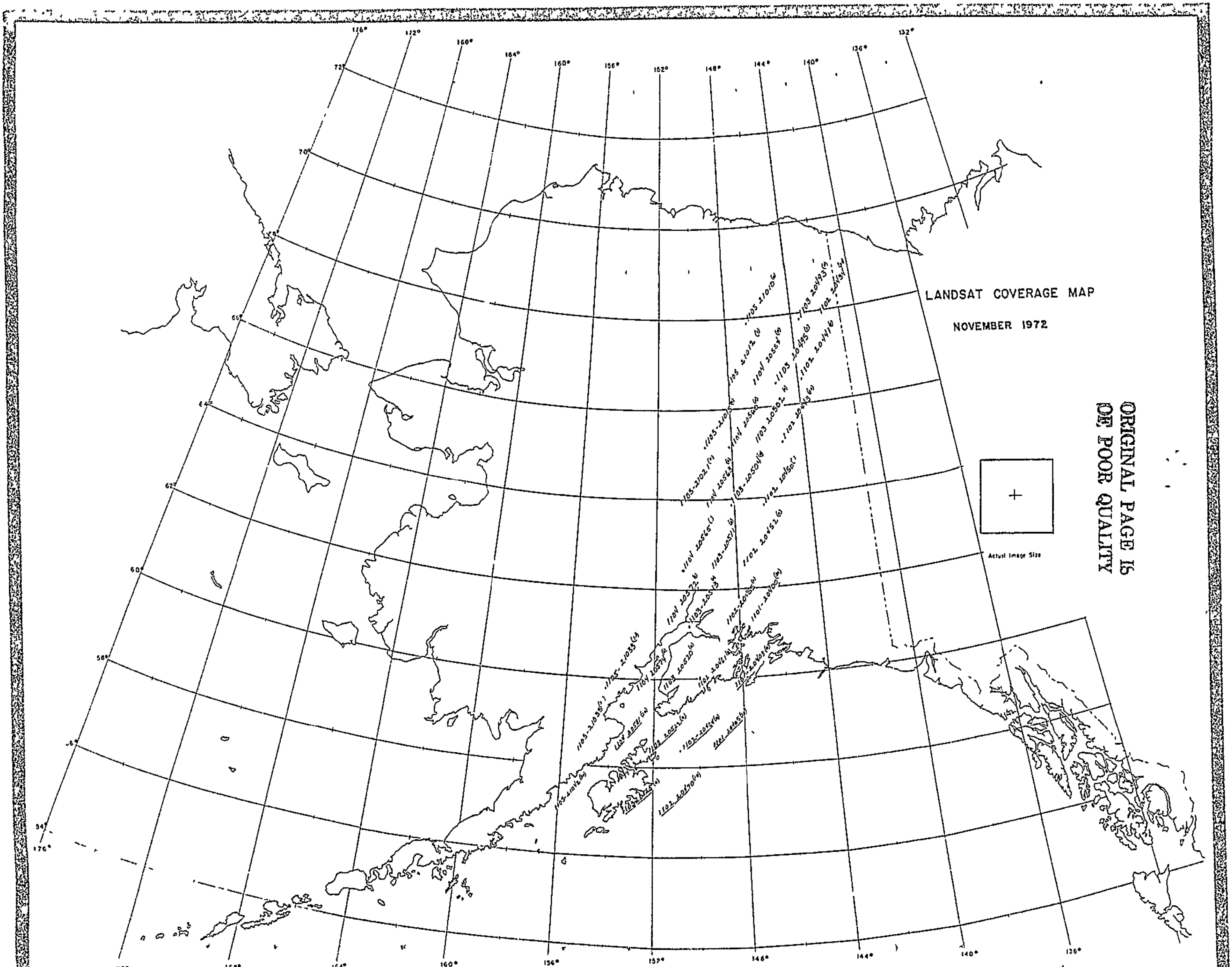


ORIGINAL PAGE IS
OF POOR QUALITY

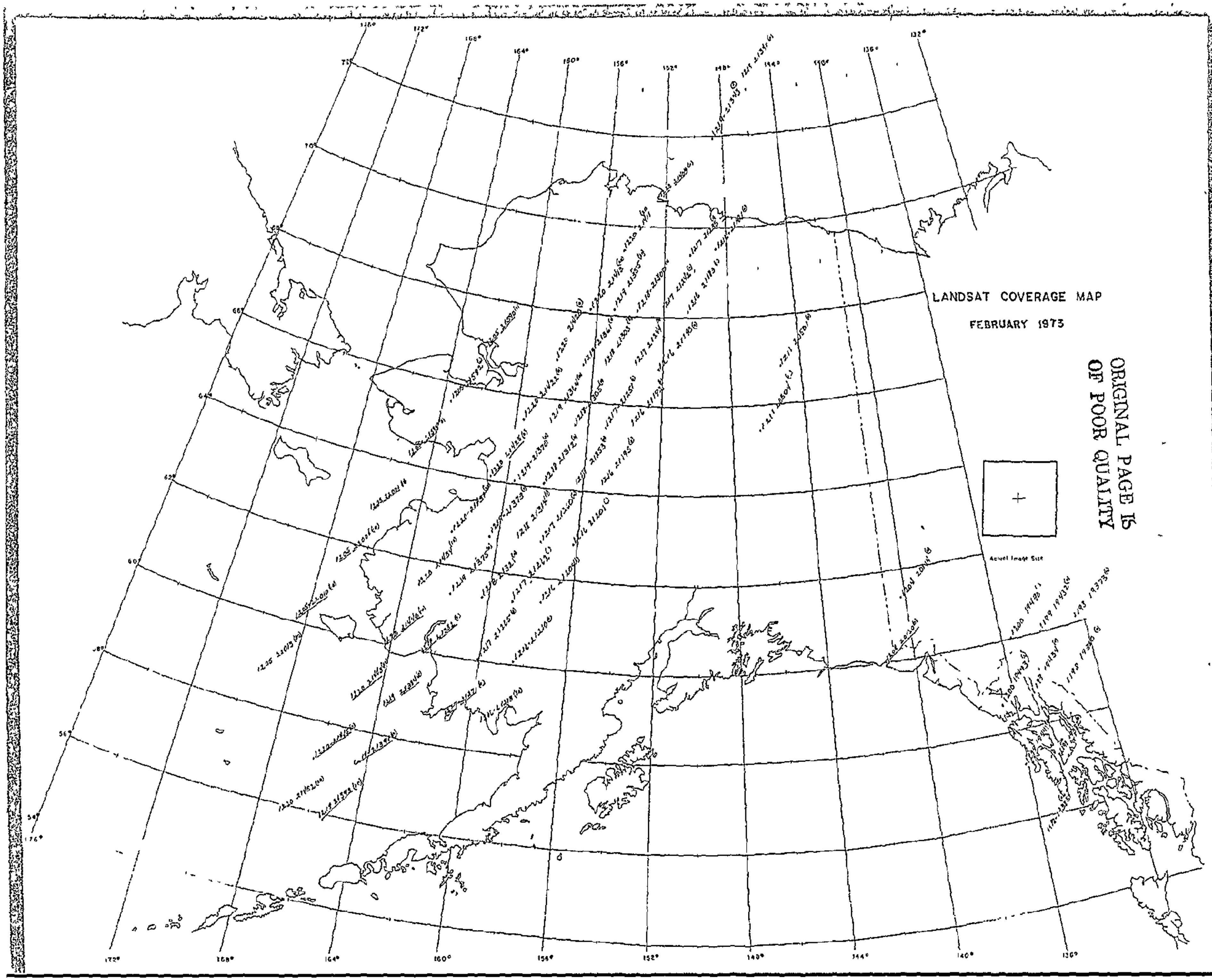

LANDSAT COVERAGE MAP
SEPTEMBER 1972
Actual Image Size



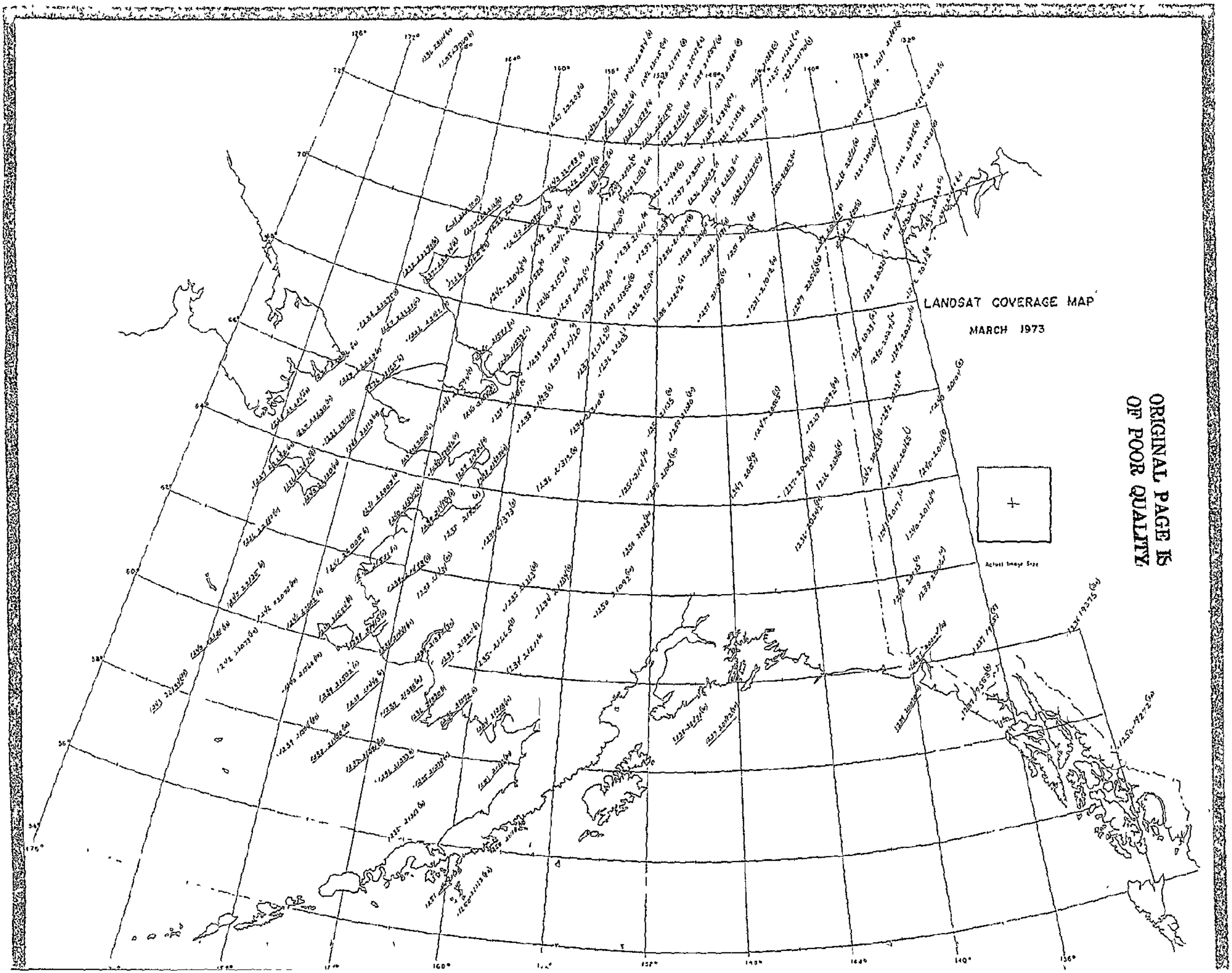
ORIGINAL PAGE IS OF POOR QUALITY



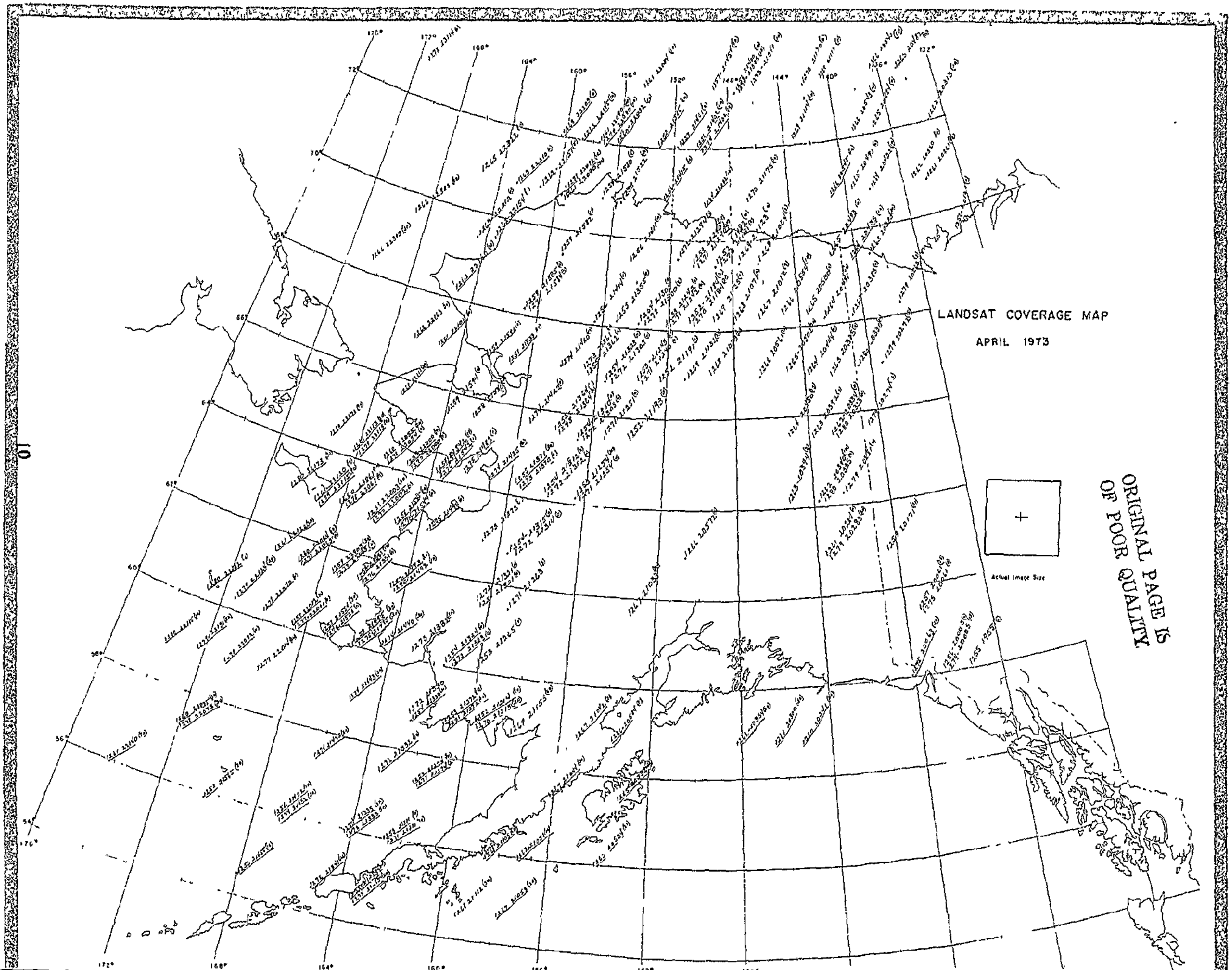
ORIGINAL PAGE IS
OF POOR QUALITY



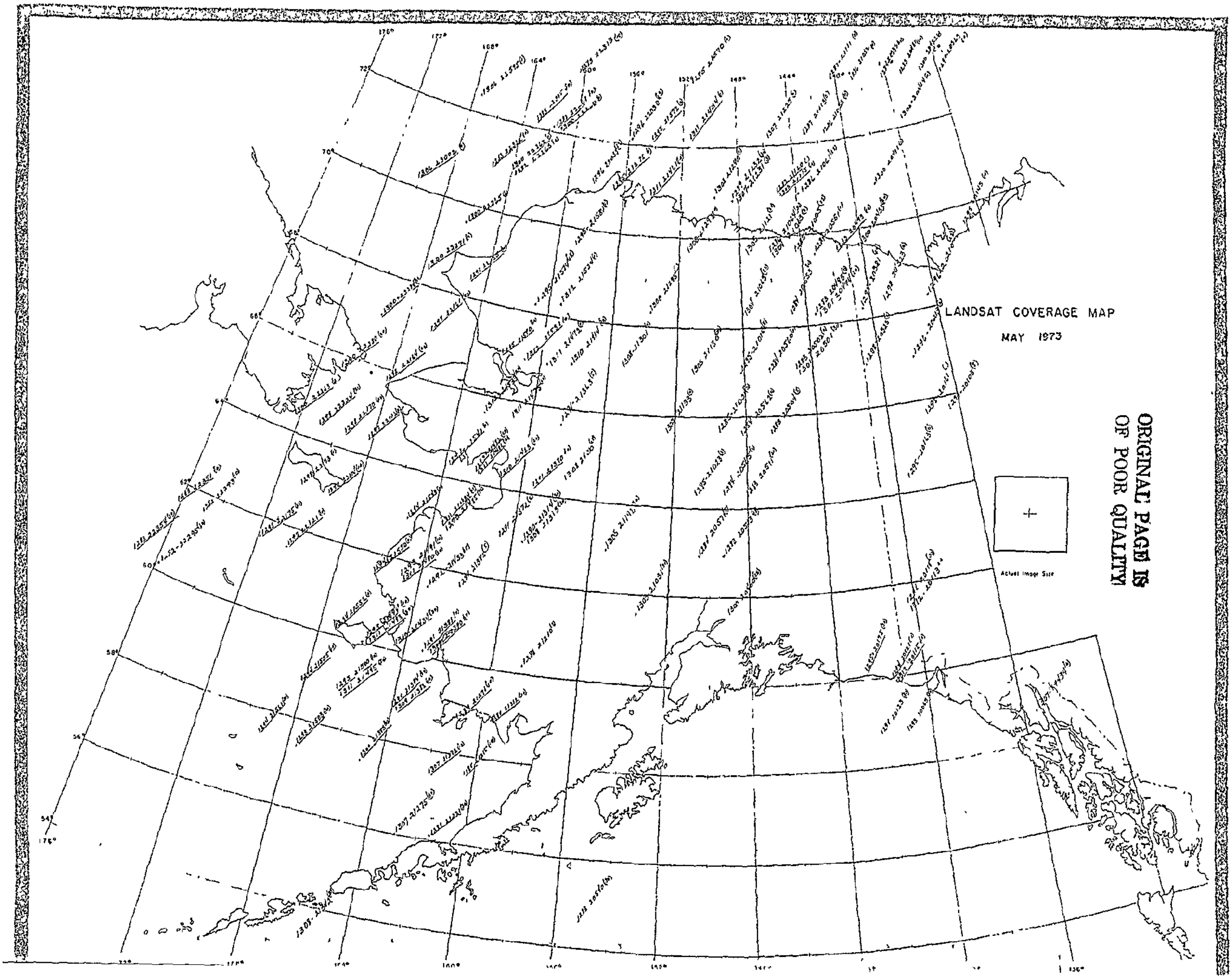
ORIGINAL PAGE IS
OF POOR QUALITY

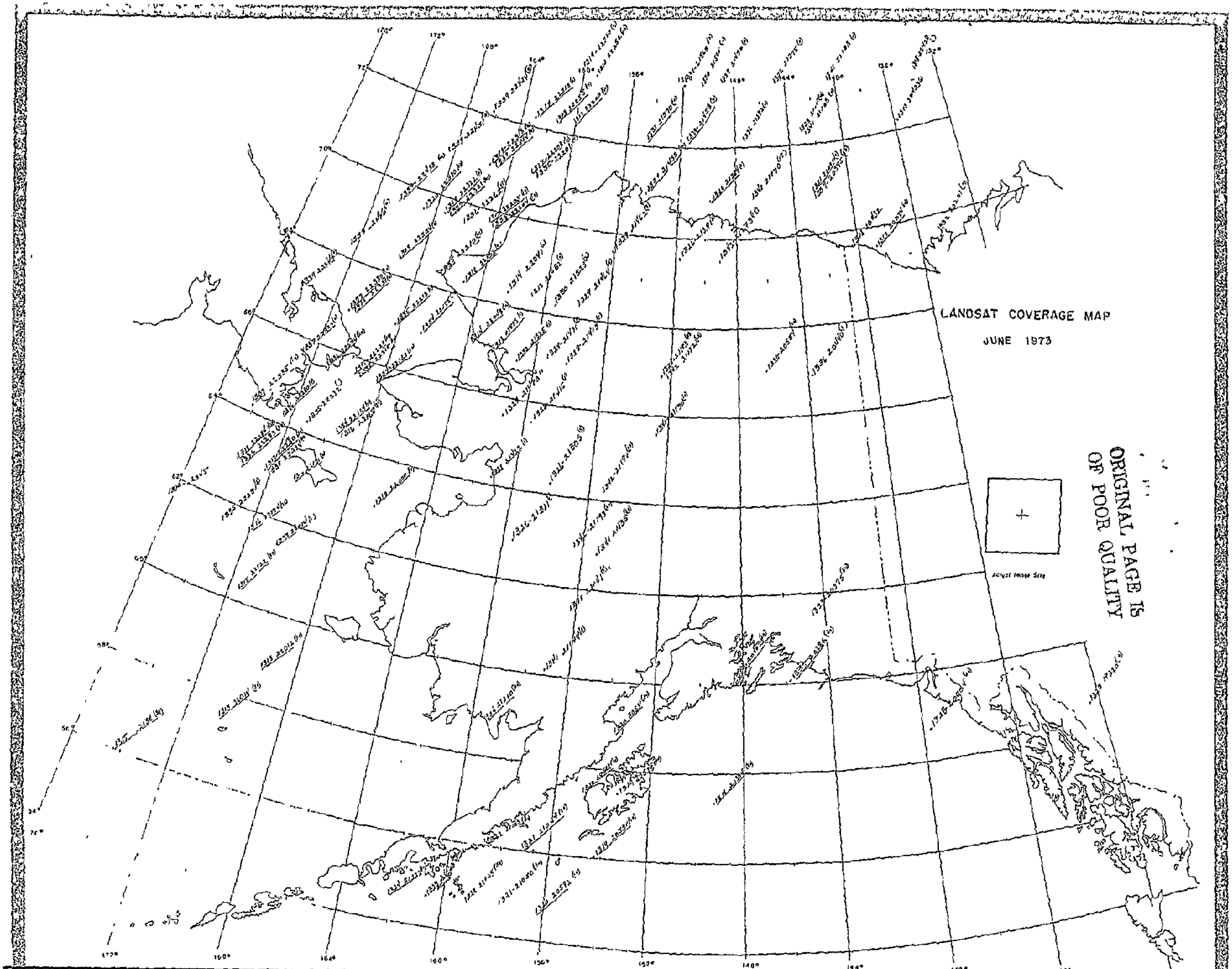


ORIGINAL PAGE IS OF POOR QUALITY

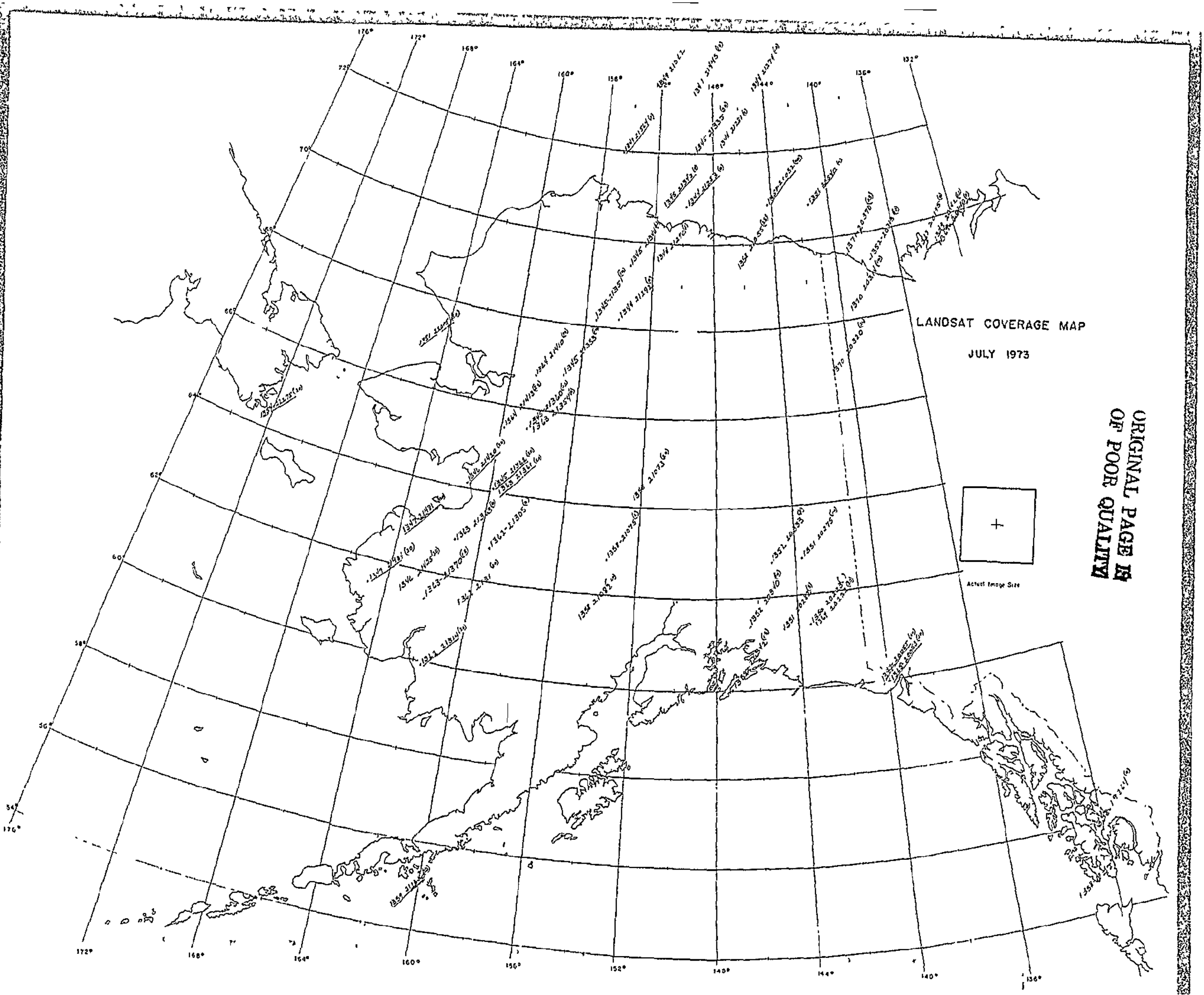


ORIGINAL PAGE IS
OF POOR QUALITY

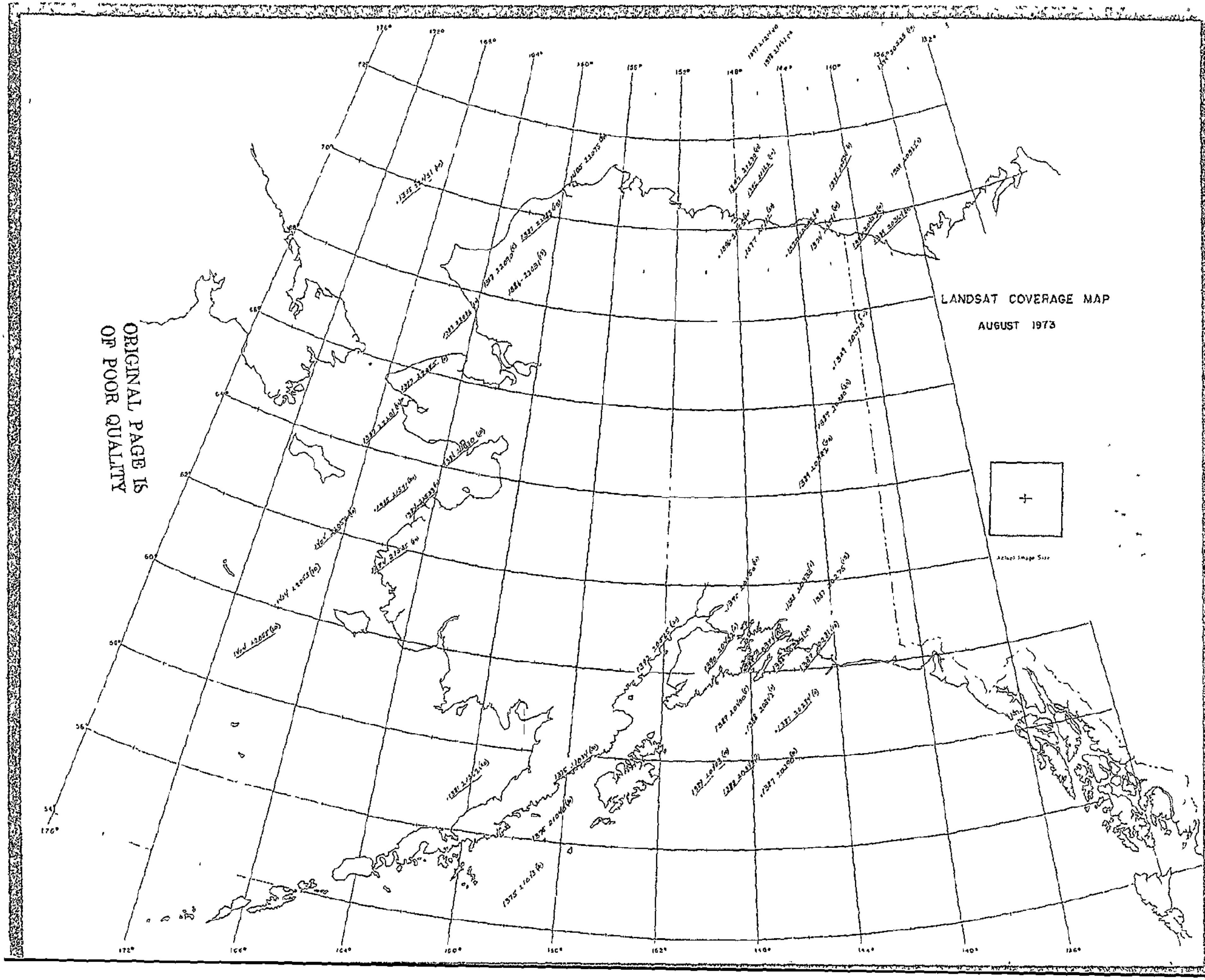

LANDSAT COVERAGE MAP
MAY 1973
Actual Image Size
ORIGINAL PAGE IS
OF POOR QUALITY



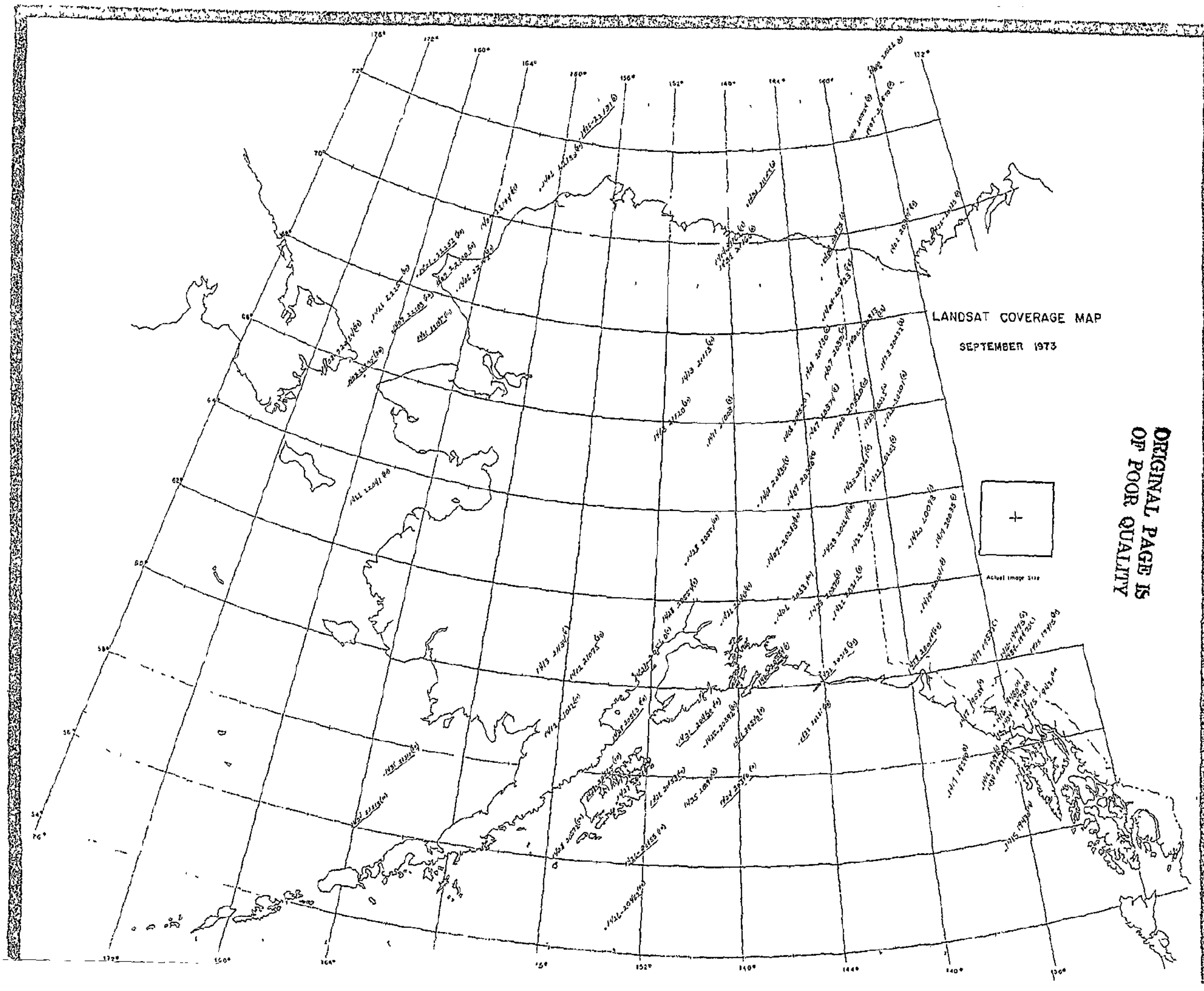
ORIGINAL PAGE IS
OF POOR QUALITY



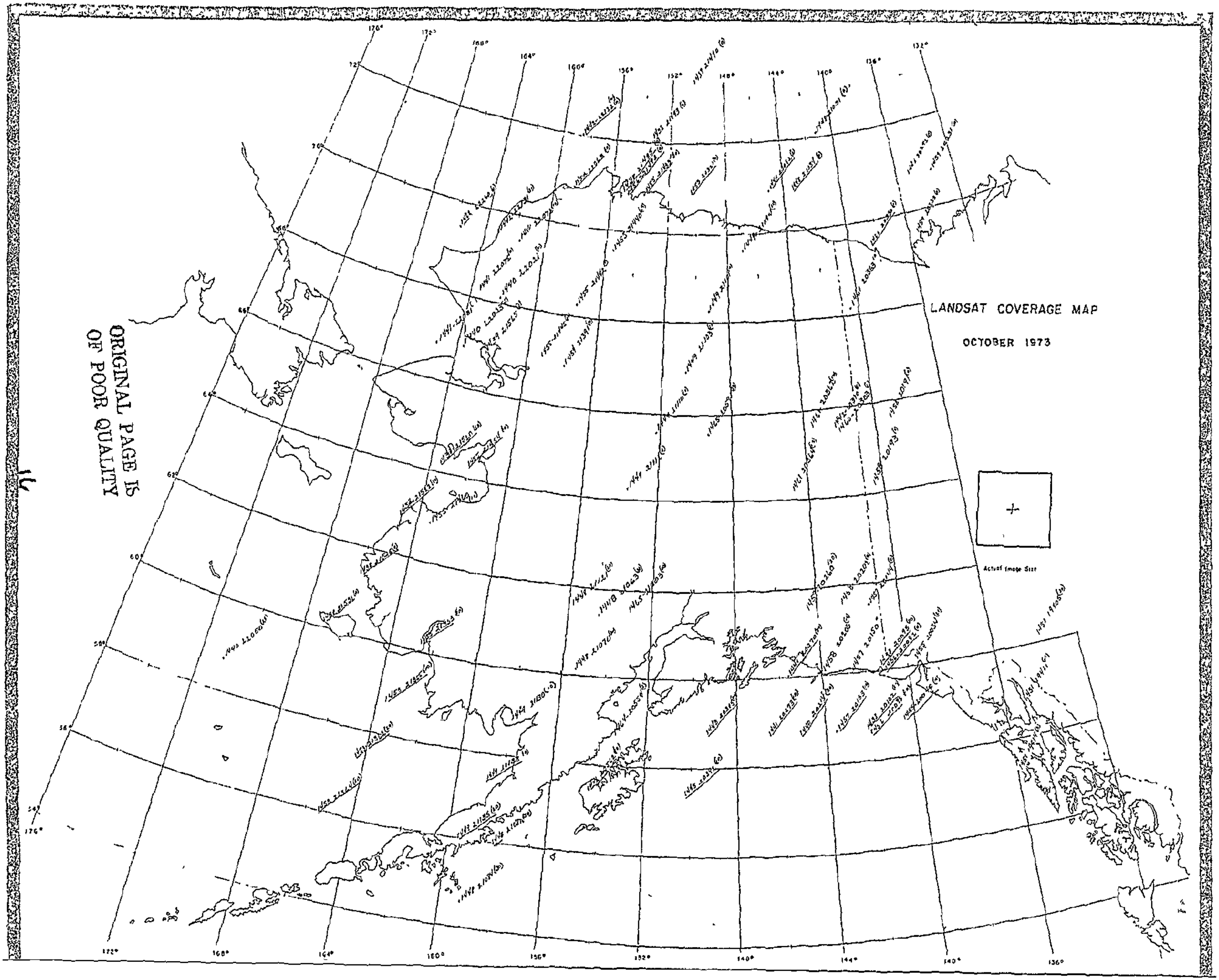
ORIGINAL PAGE IS OF POOR QUALITY



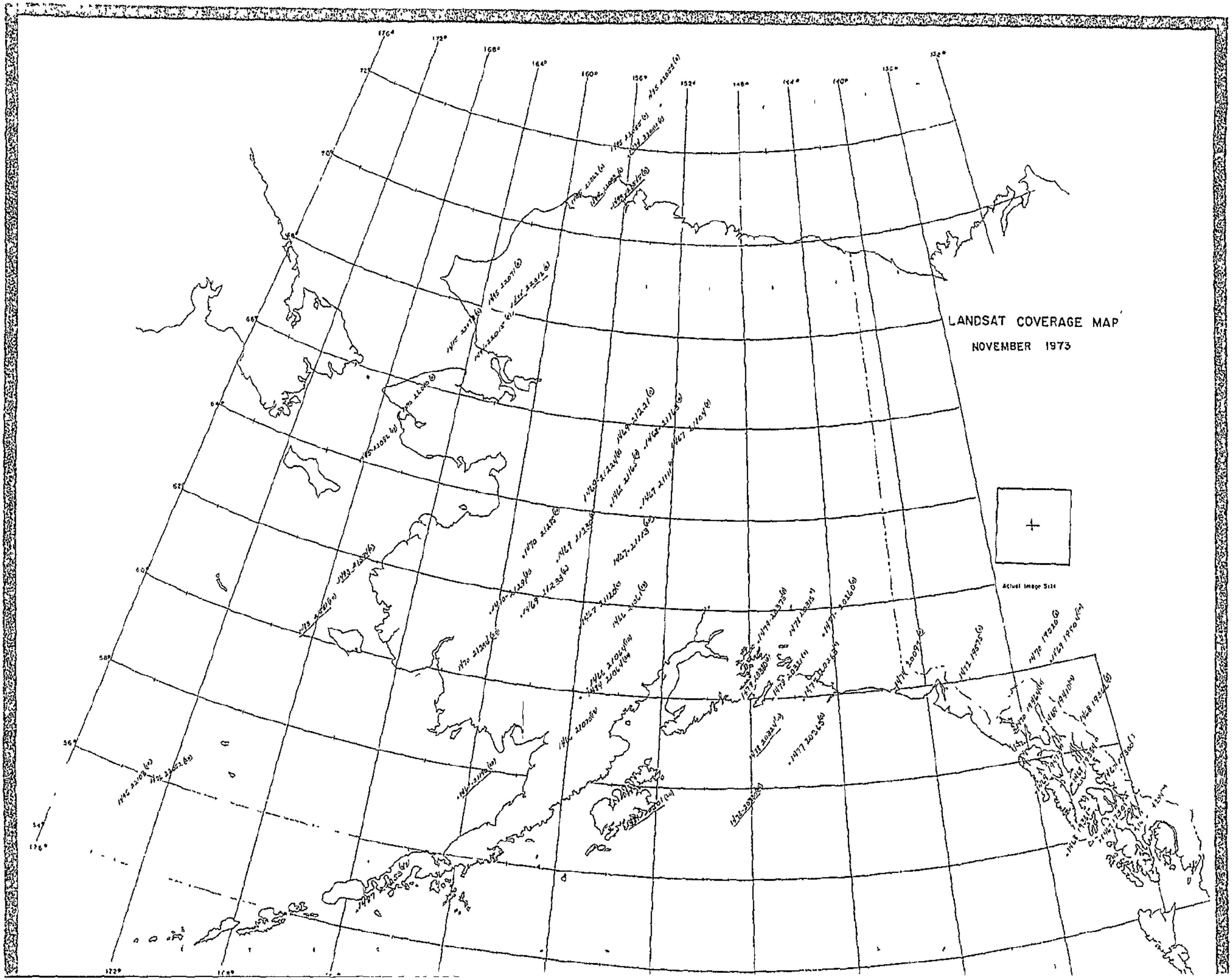
ORIGINAL PAGE IS
OF POOR QUALITY

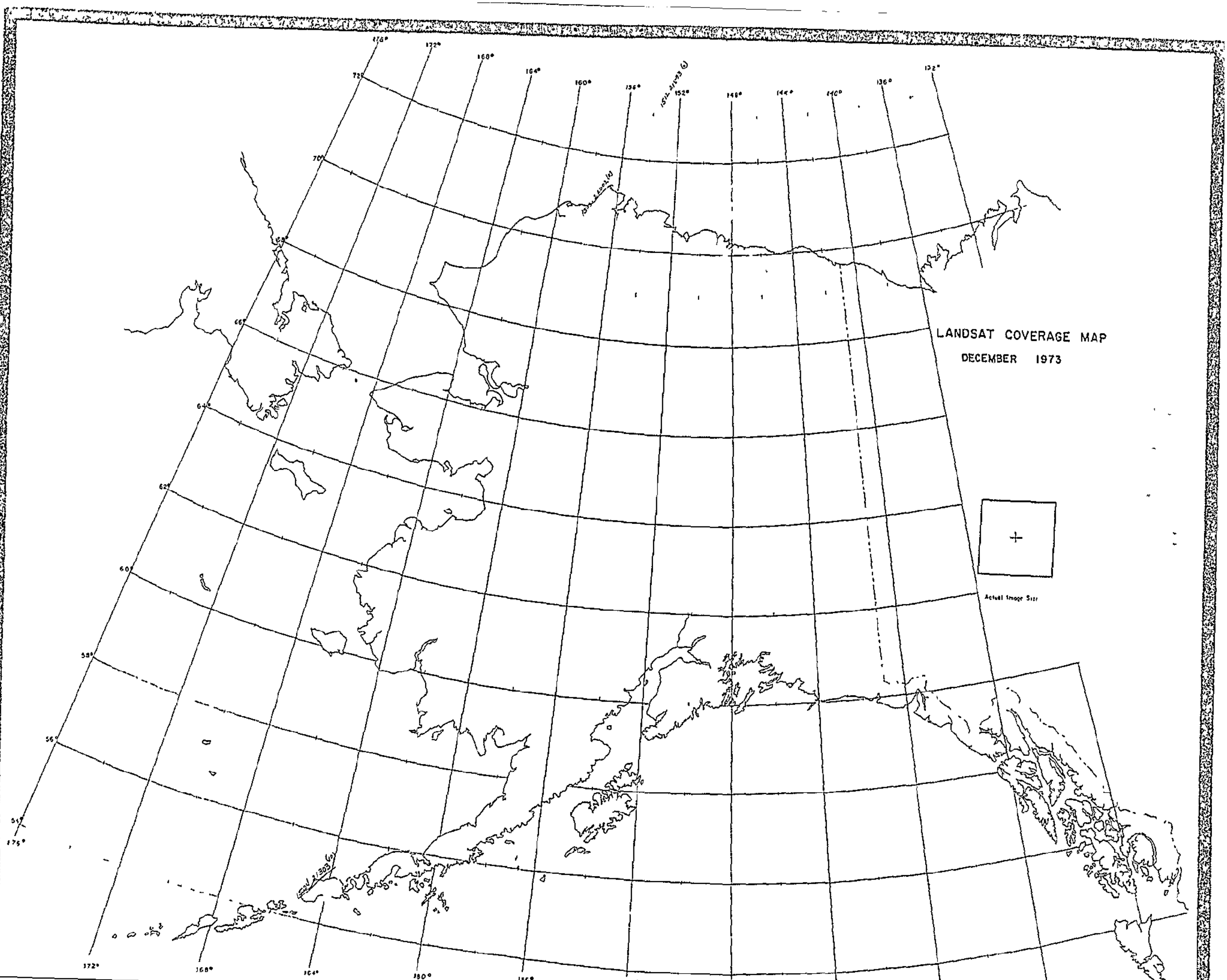


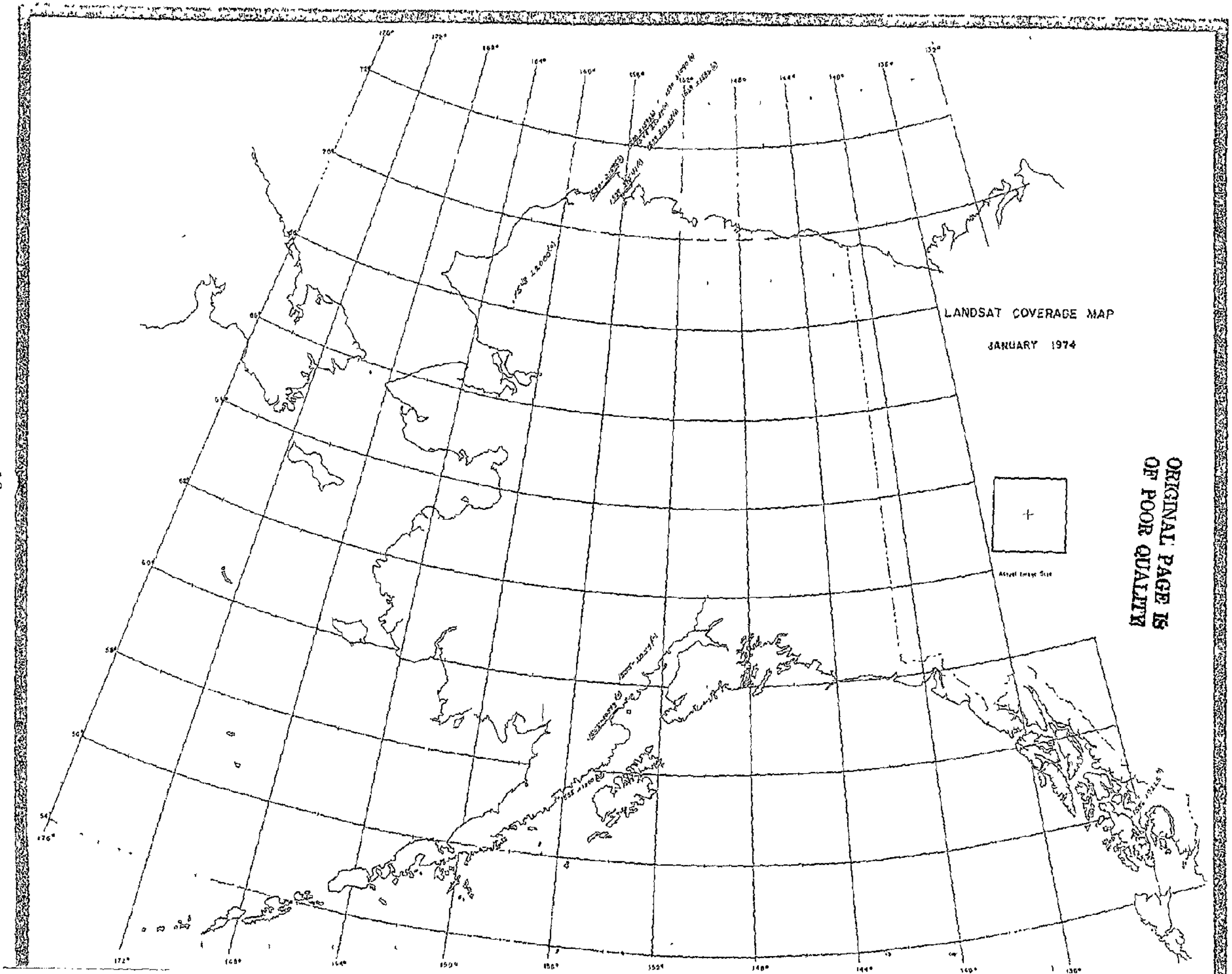
ORIGINAL PAGE IS
OF POOR QUALITY



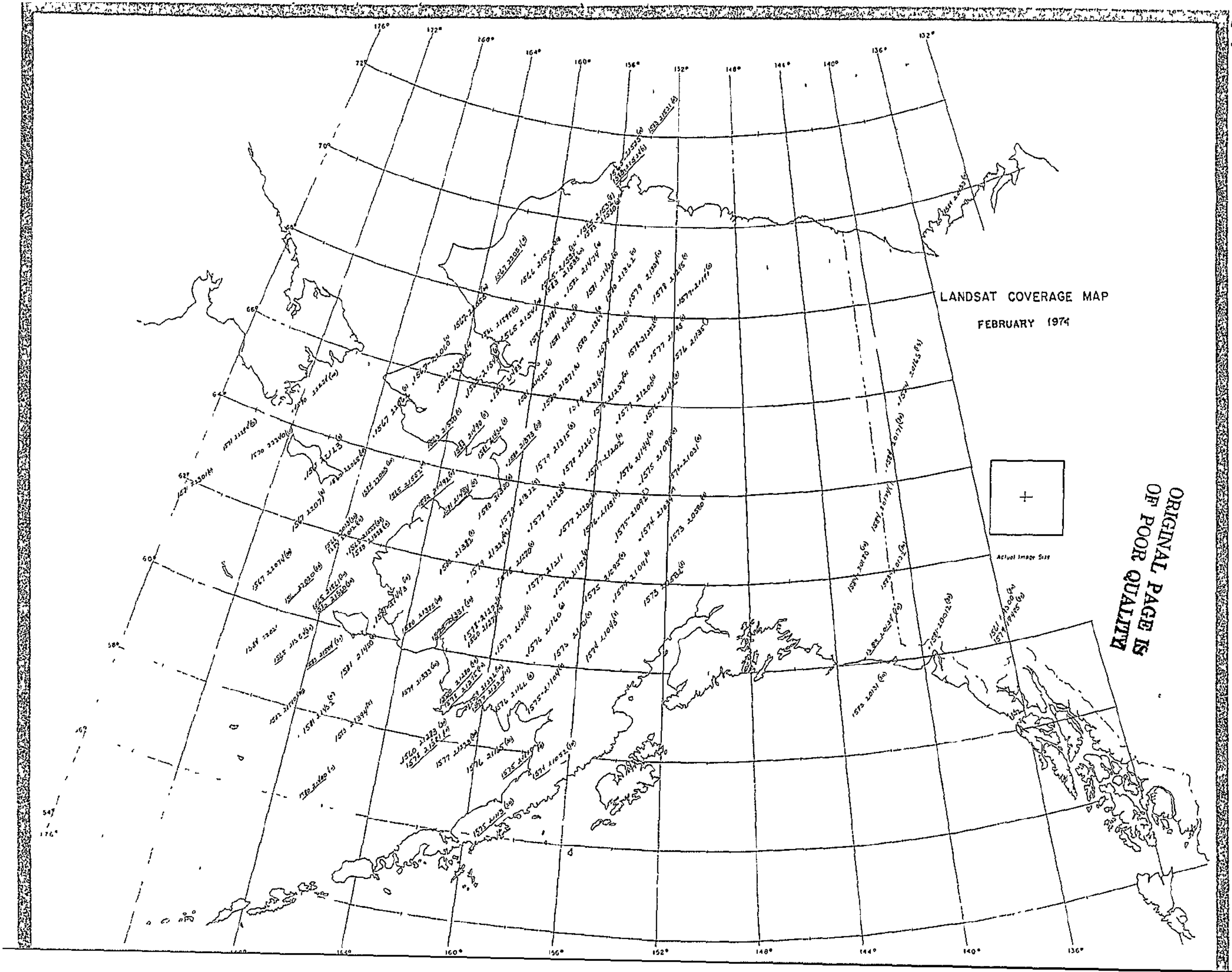
ORIGINAL PAGE IS OF POOR QUALITY


LANDSAT COVERAGE MAP
NOVEMBER 1973
Actual Image Size

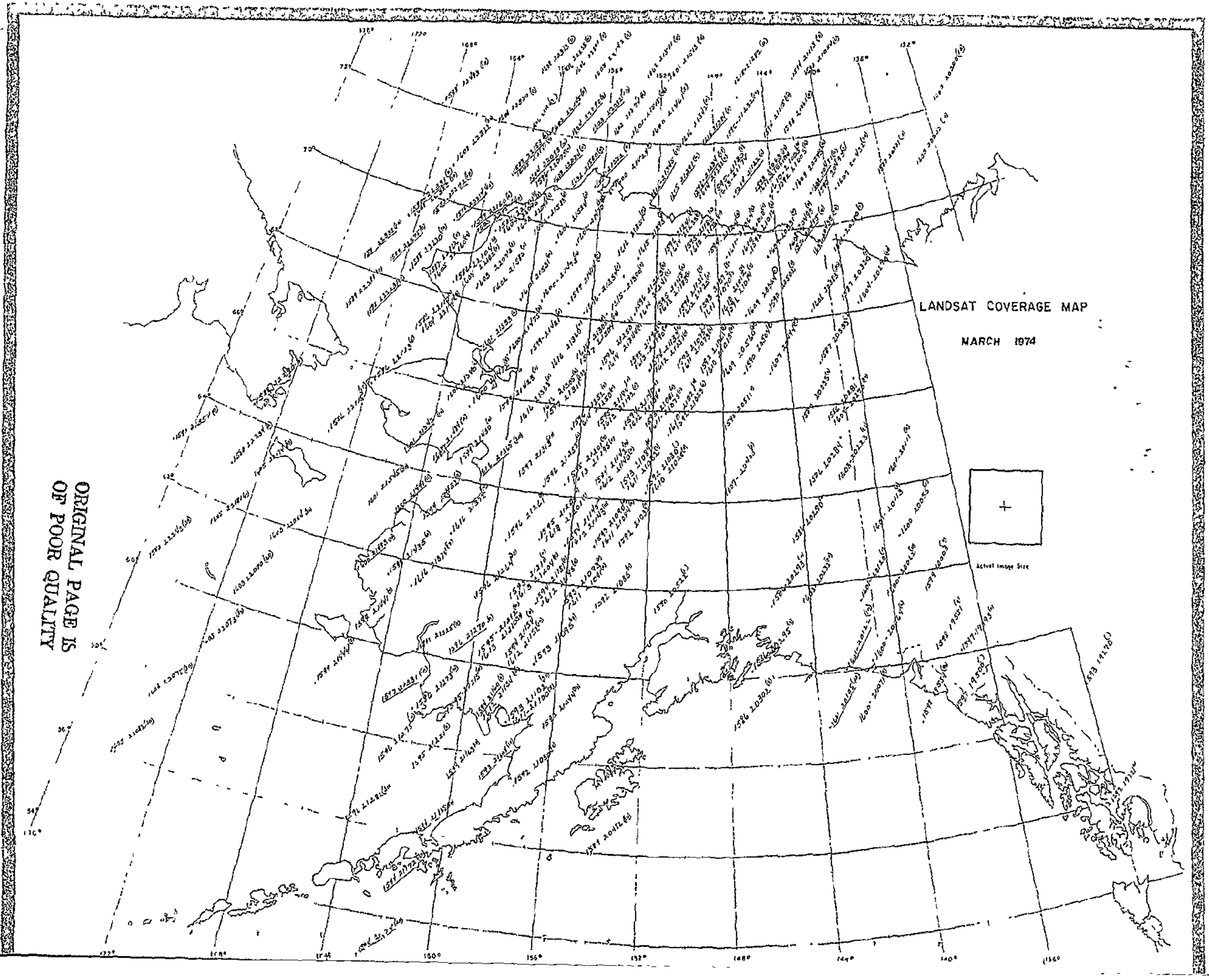

LANDSAT COVERAGE MAP
DECEMBER 1973
Actual Image Size
72°
70°
68°
66°
64°
62°
60°
58°
56°
176°
172°
168°
164°
160°
156°
152°
148°
144°
140°
136°
132°
180°



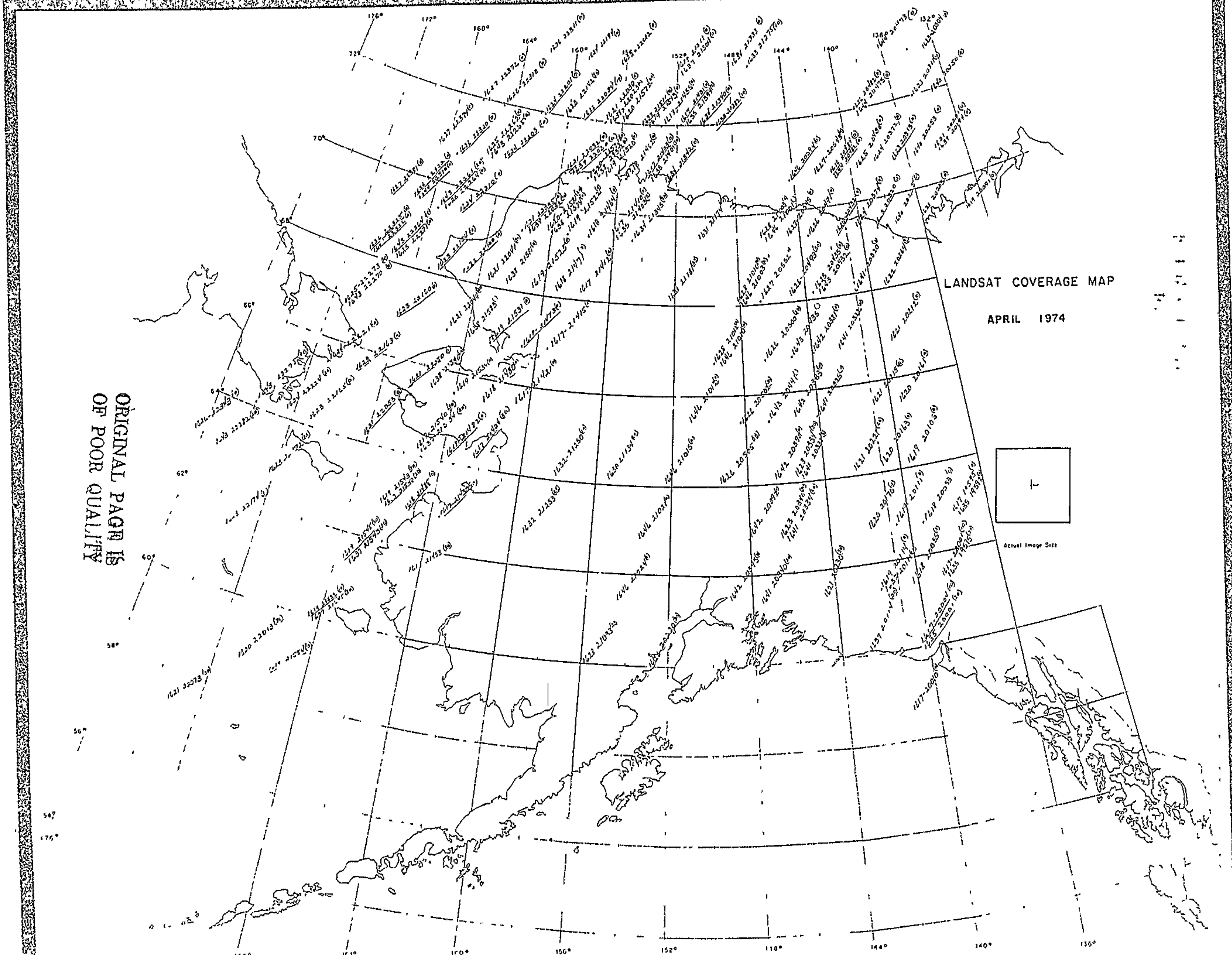
ORIGINAL PAGE IS OF POOR QUALITY



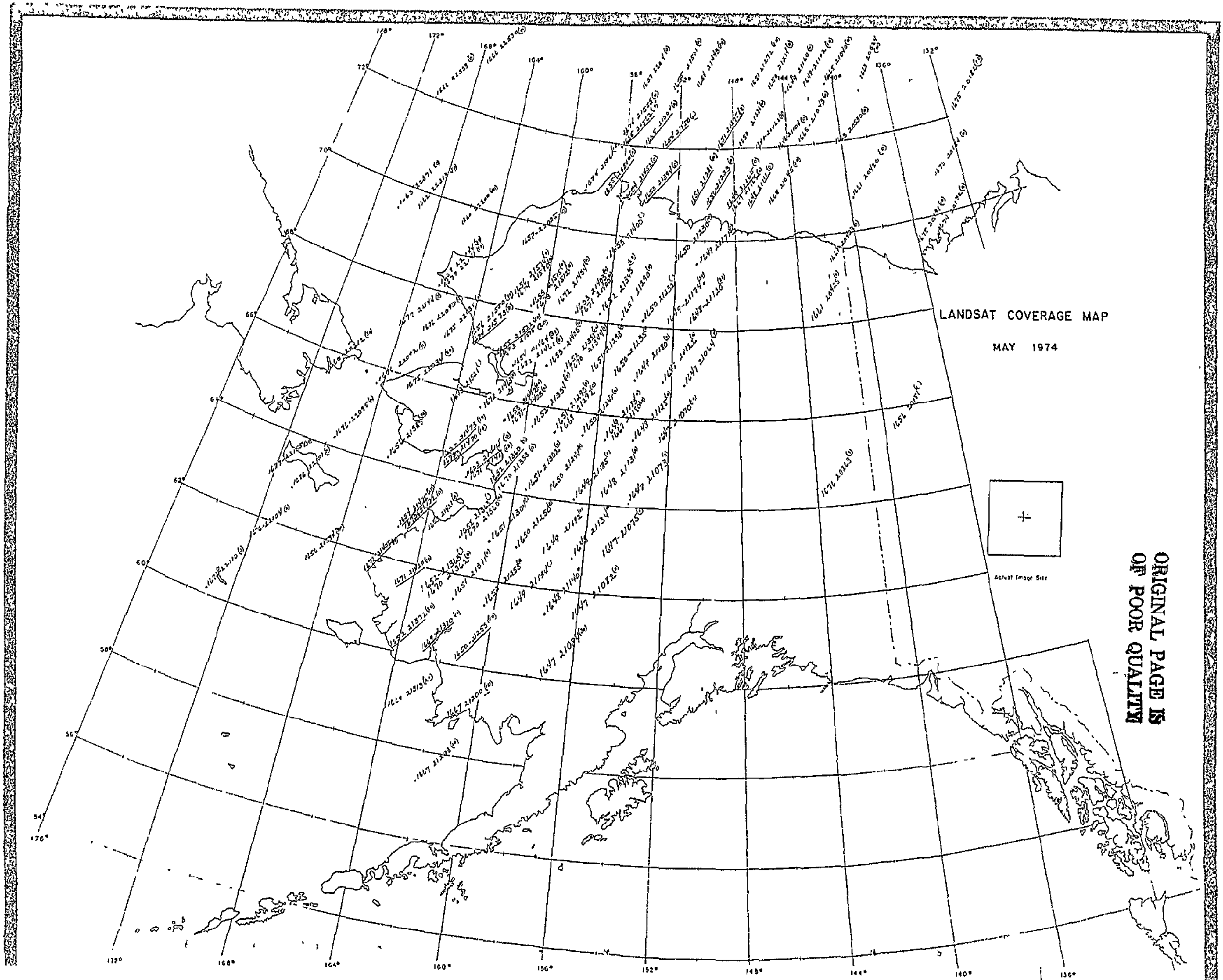
ORIGINAL PAGE IS OF POOR QUALITY



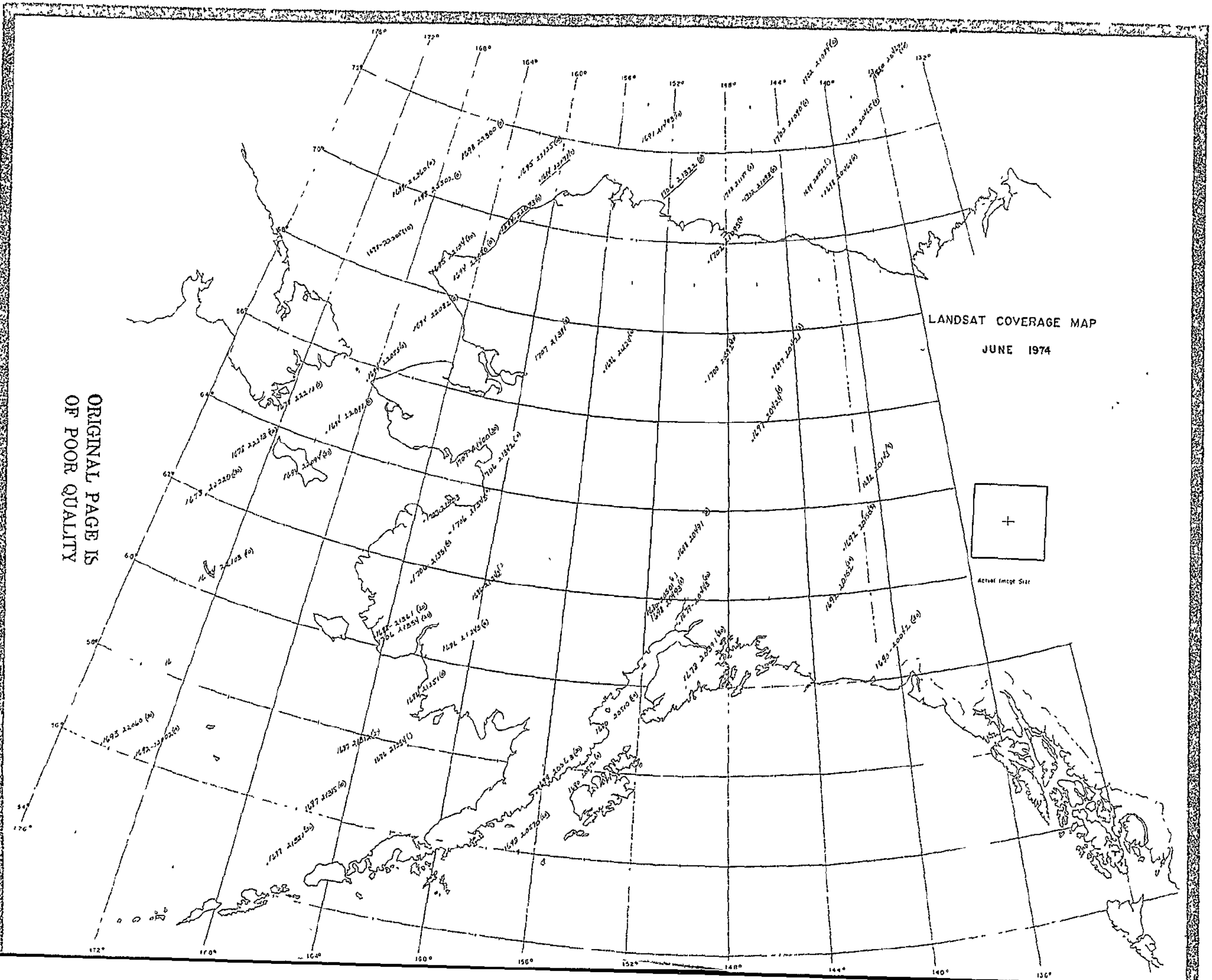
ORIGINAL PAGE IS
OF POOR QUALITY



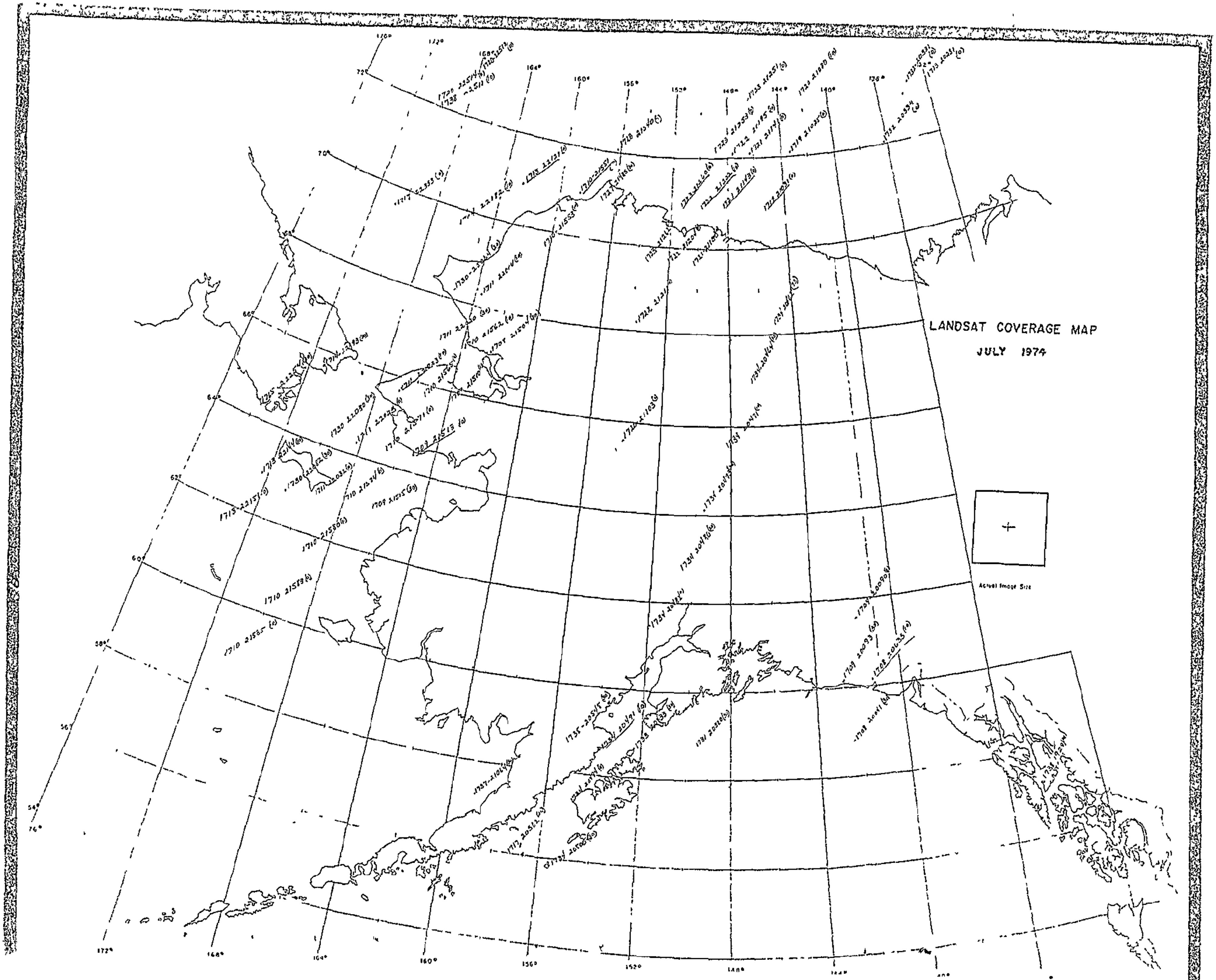
ORIGINAL PAGE IS OF POOR QUALITY

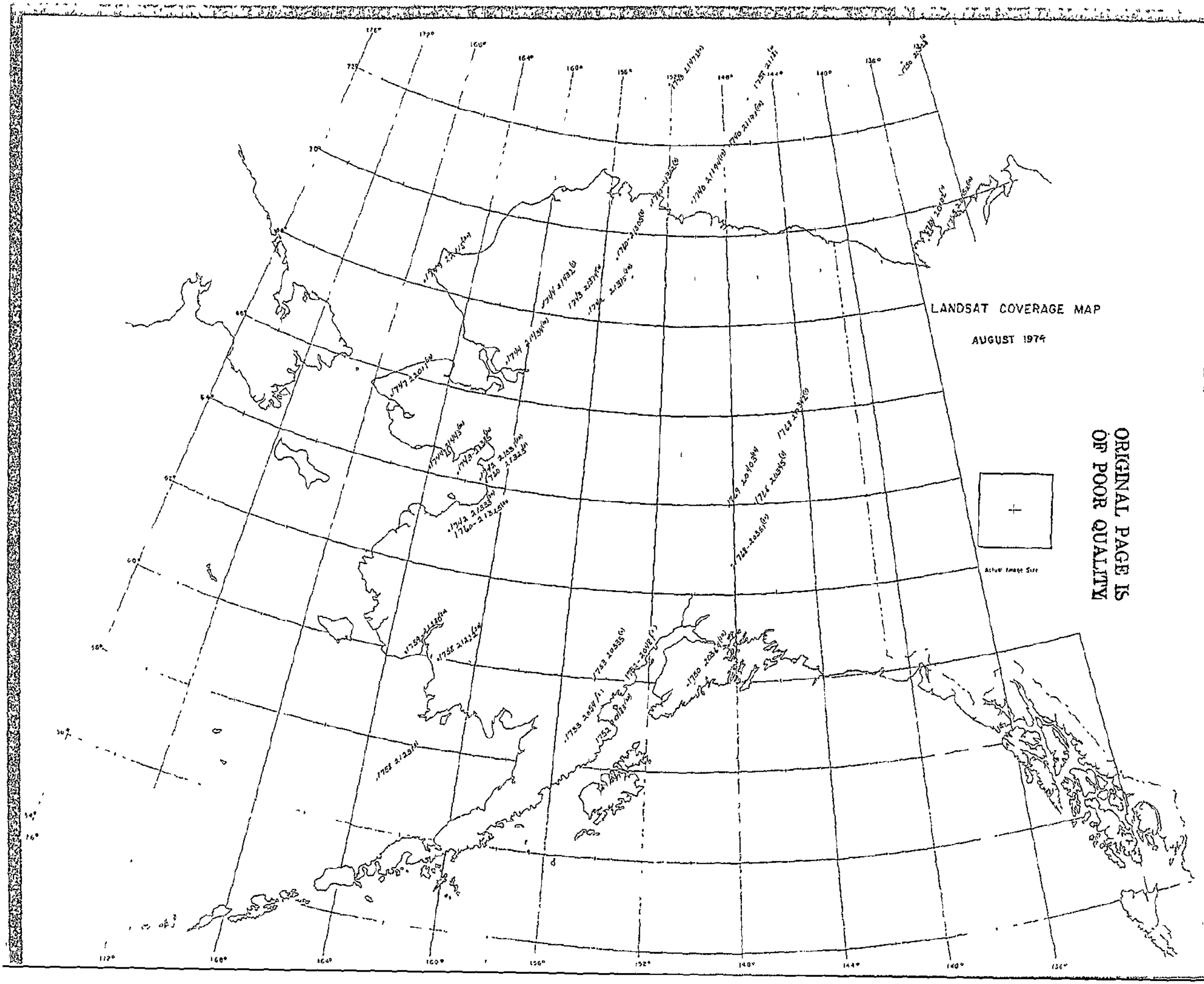


ORIGINAL PAGE IS OF POOR QUALITY

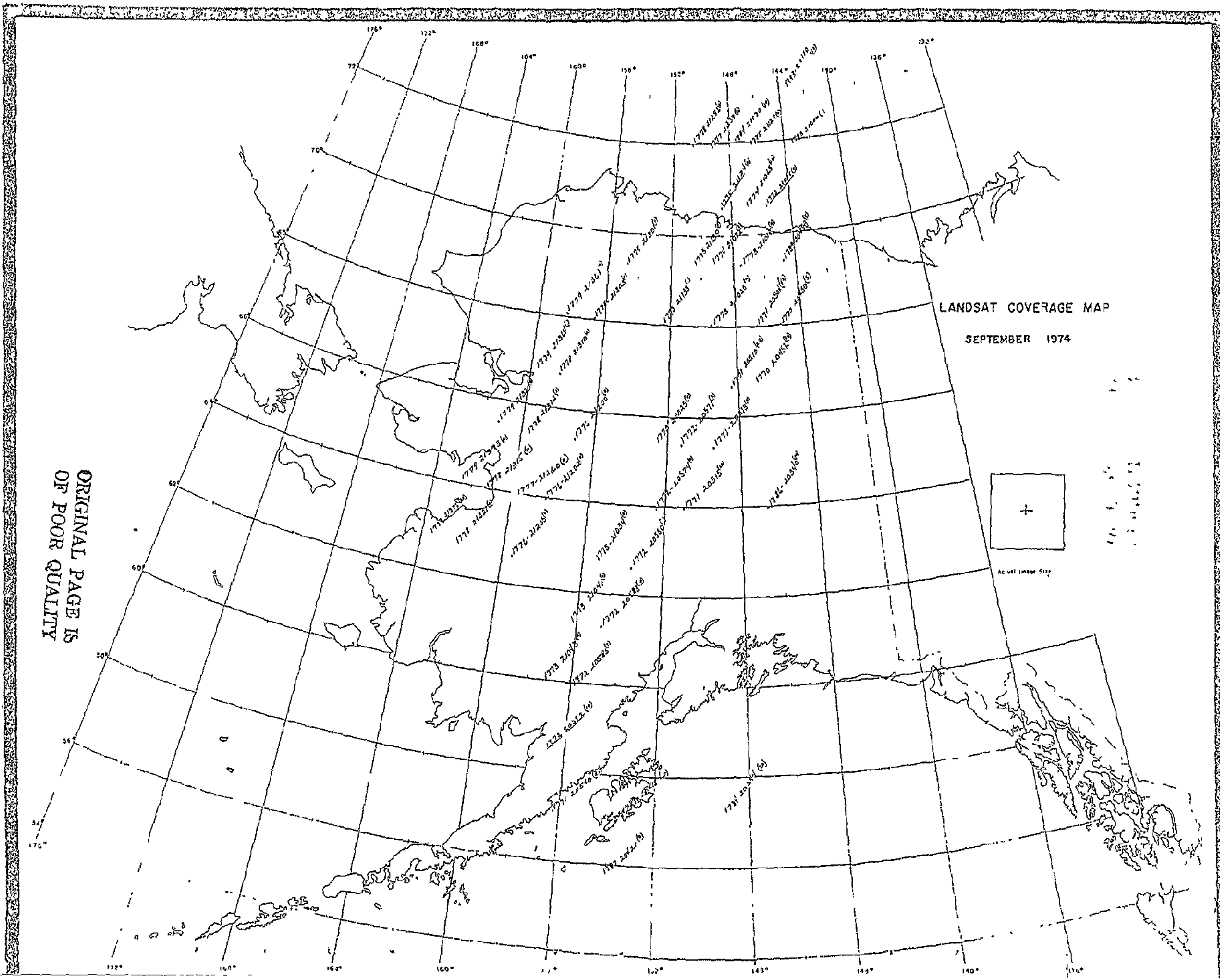


ORIGINAL PAGE IS
OF POOR QUALITY

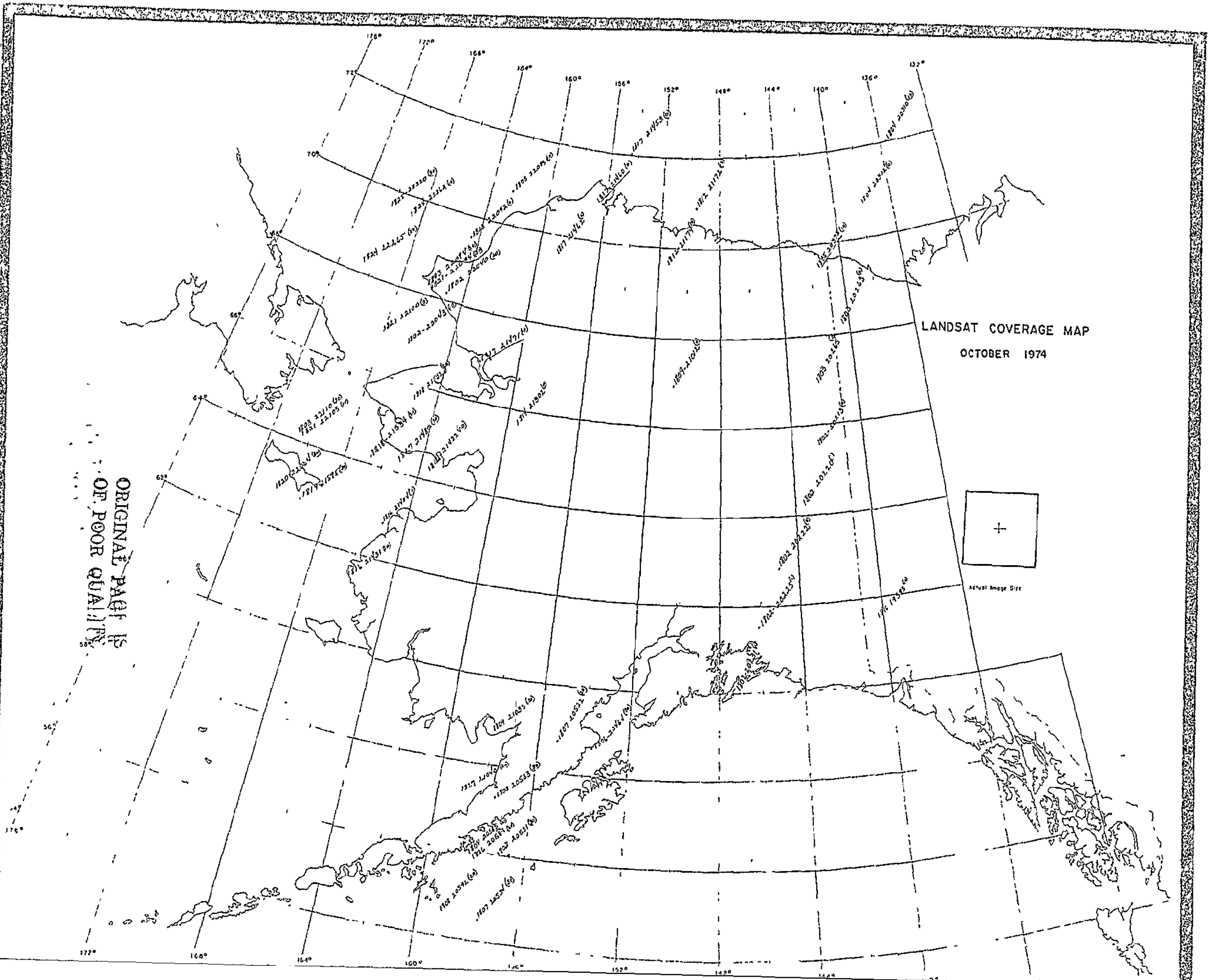

LANDSAT COVERAGE MAP
JULY 1974
Actual Image Size



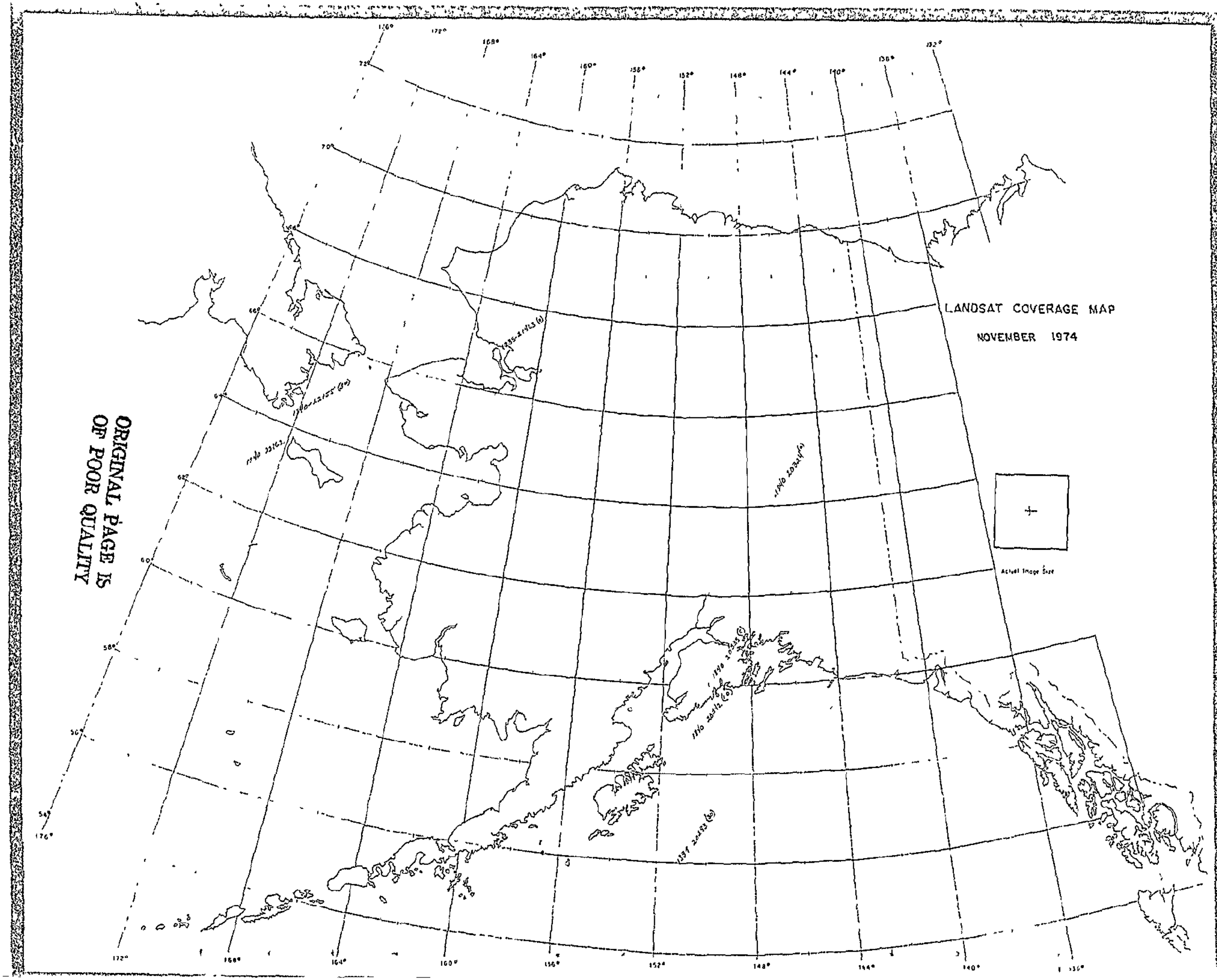
ORIGINAL PAGE IS
OF POOR QUALITY



ORIGINAL PAGE IS
OF POOR QUALITY

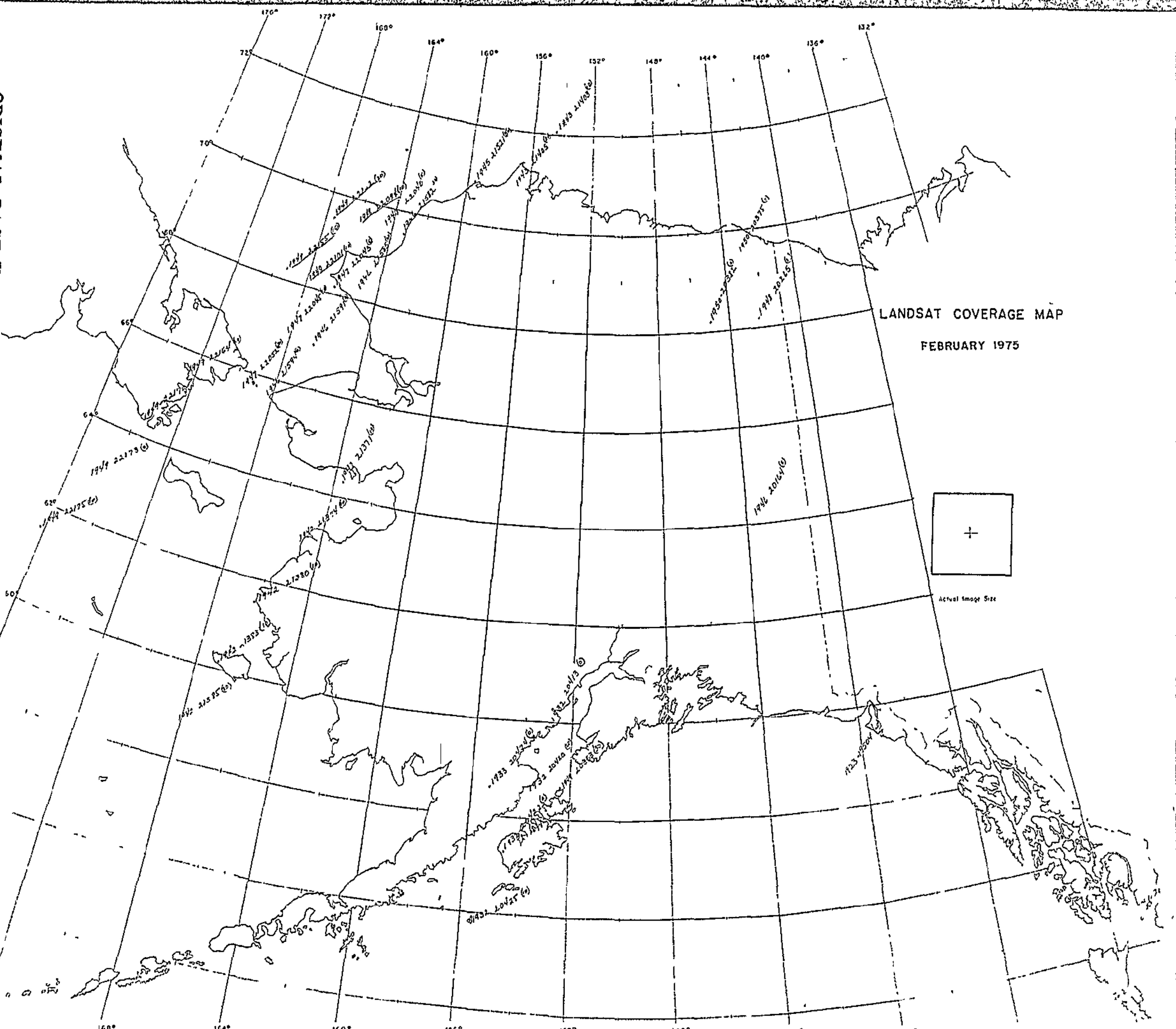


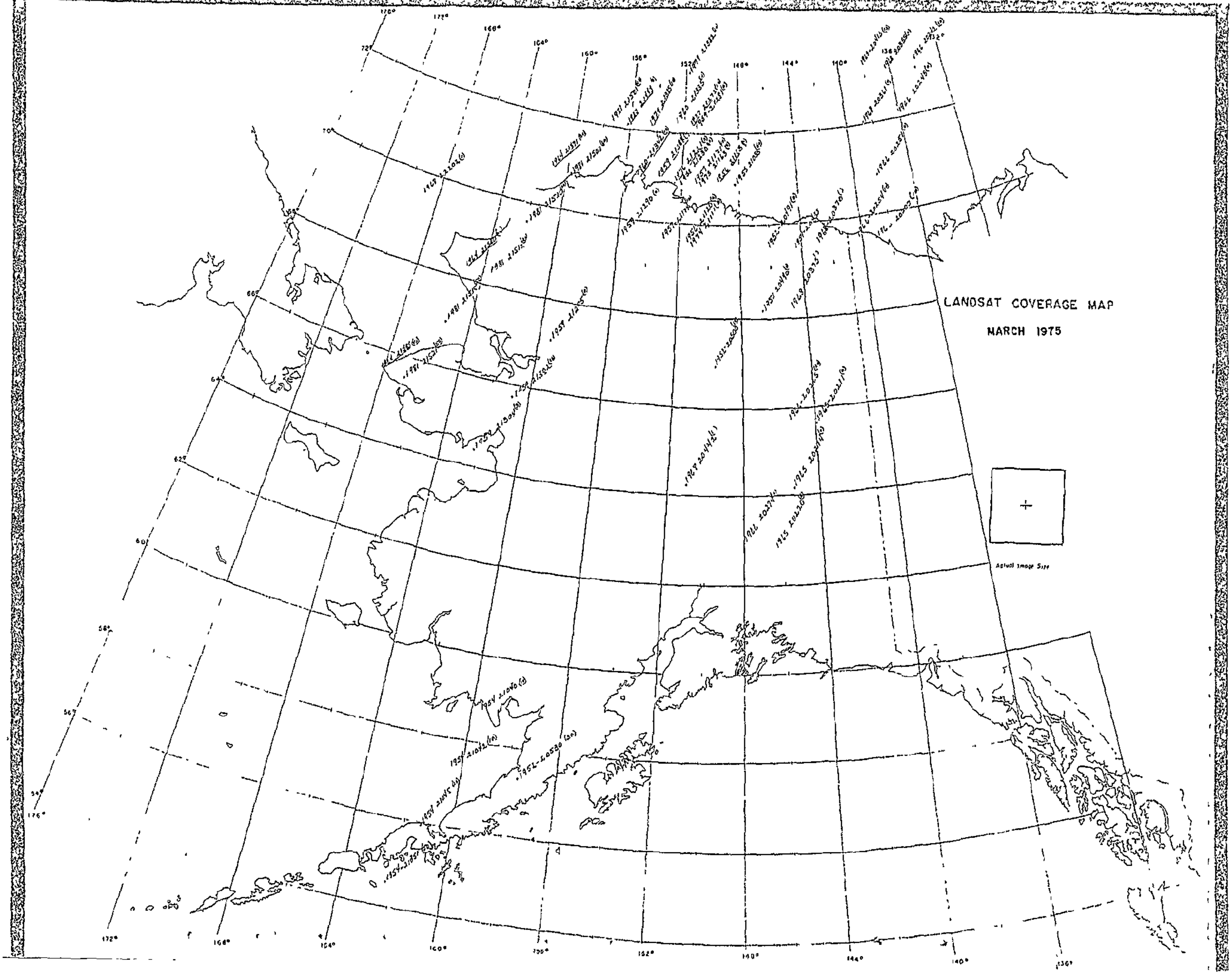
ORIGINAL PAGE IS
OF POOR QUALITY

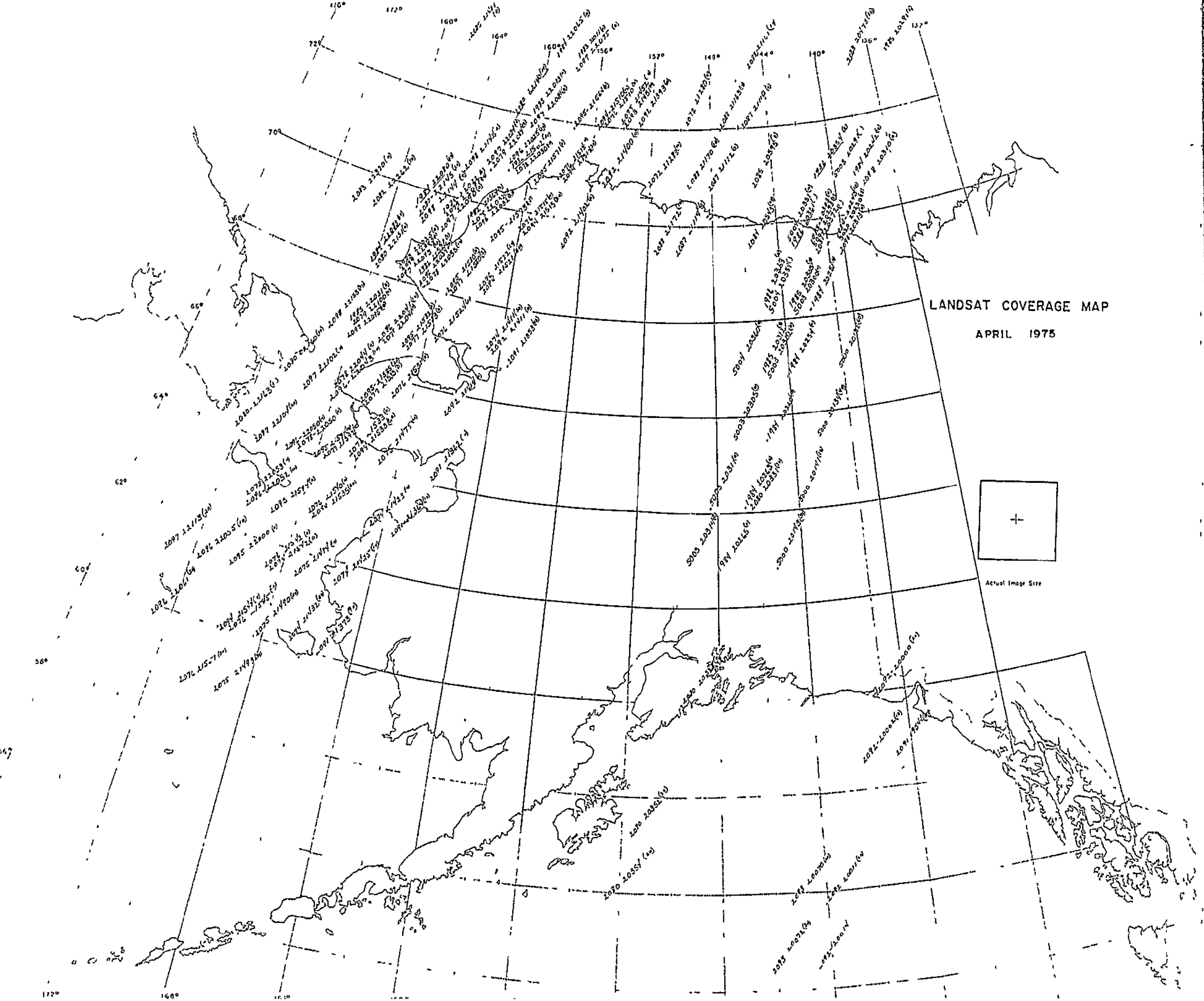


ORIGINAL PAGE IS
OF POOR QUALITY

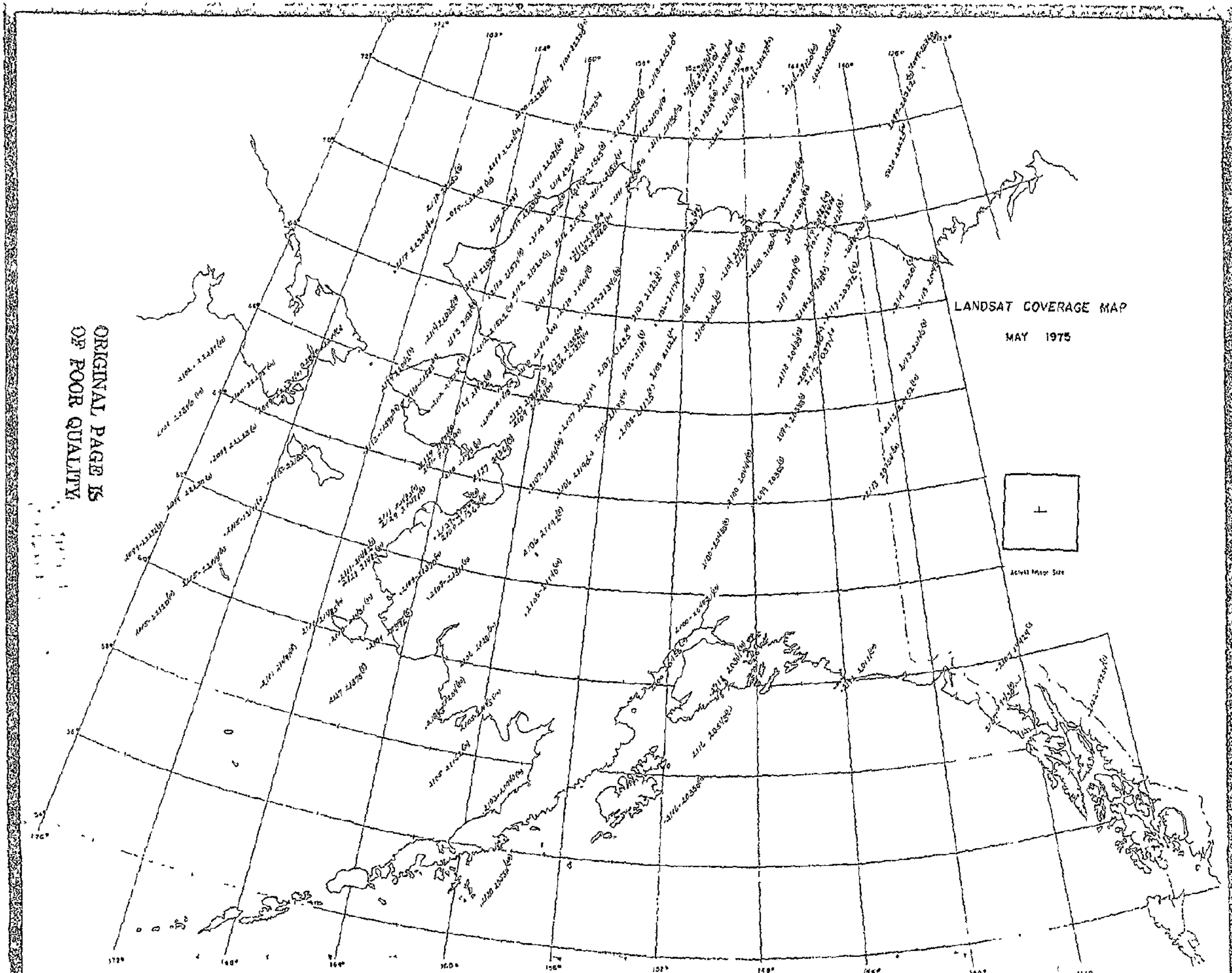
ORIGINAL PAGE IS
OF POOR QUALITY



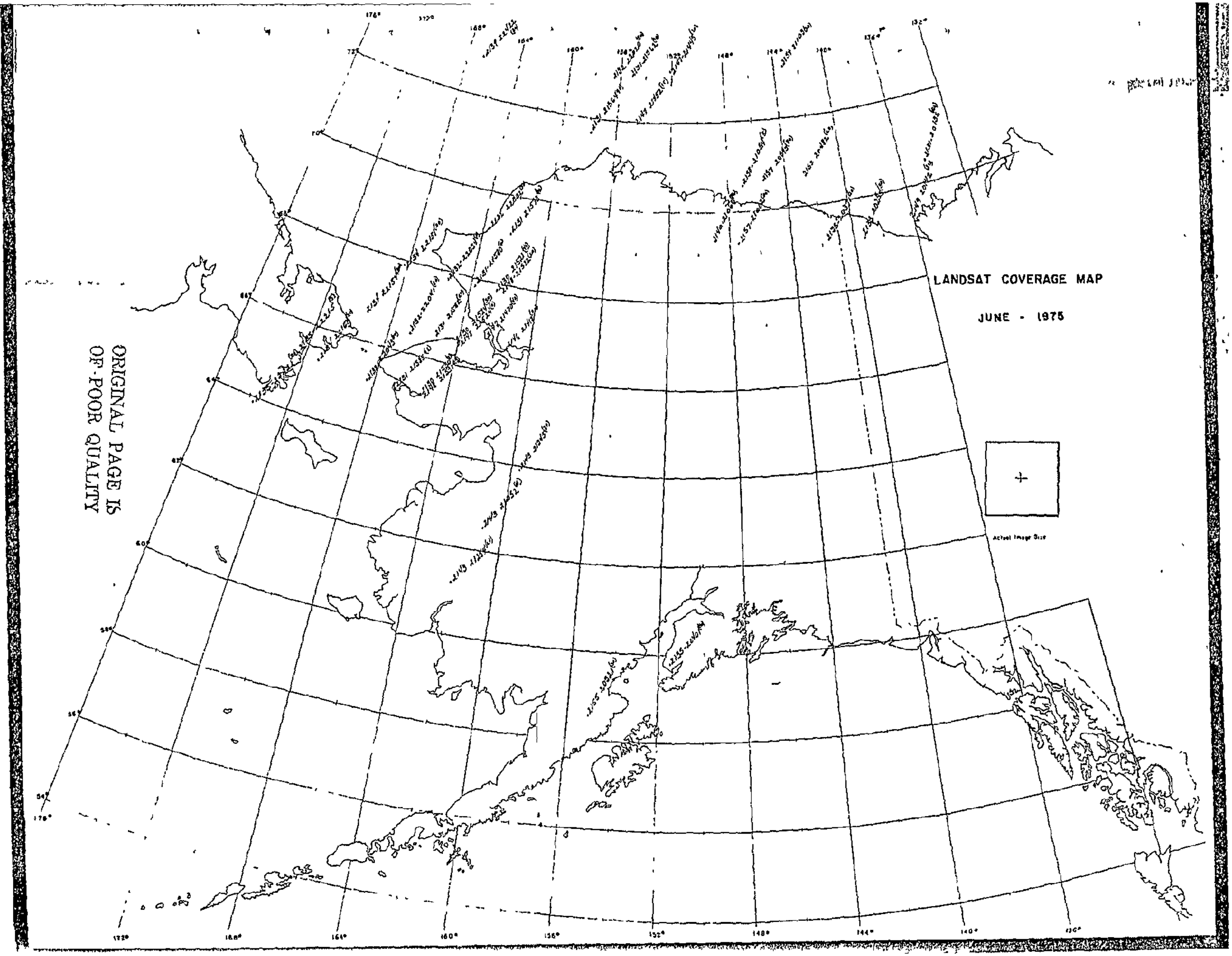

LANDSAT COVERAGE MAP
MARCH 1975
Actual Image Size



ORIGINAL PAGE IS
OF POOR QUALITY



ORIGINAL PAGE IS
OF POOR QUALITY



ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS OF POOR QUALITY

ERTS SCENES WITH LOW CLOUD COVER
JULY - NOVEMBER 1972

Scene ID No.	Date	Cloud Cover	Lat (Center Pt)	Long. (Center Pt)	Sun El	Sun Az	Map Description	Color = C Digital Tape=D
1002-21310	July 25, 1972	15	67 25N	154.43W	41	162	Walker Lake	D + C
1002-21312	July 25, 1972	15	66.06N	156 16W	42	160	Hughes	D
1002-21315	July 25, 1972	10	64 45N	157 42W	43	158	Nulato	C + D
1002-21324	July 25, 1972	15	62 02N	160 09W	45	154	Holy Cross	C
1006-21510	July 29, 1972	5	60.32N	155 26W	37	168	Barrow	
1009-22083	August 1, 1972	5	69.25N	161.30W	37	166	Point Lay	
1009-22090	August 1, 1972	2	68 07N	163.21W	39	164	Point Hope	C
1009-22092	August 1, 1972	0	66.48N	165 00W	40	162	Kotzebue	C
1009-22095	August 1, 1972	0	65 27N	166.30W	41	160	Seward Peninsula	C + D
1009-22101	August 1, 1972	20	64 07N	167.51W	42	158	Nome	
1009-22110	August 1, 1972	10	61 23N	170.14W	44	154	Bering Sea	
1010-20313	August 2, 1972	10	67.56N	139 29W	39	164	Old Crow	
1010-22133	August 2, 1972	10	71.53N	159 04W	35	171	Sea Ice Off Barrow	
1010-22135	August 2, 1972	0	70.37N	161.21W	36	169	Wainwright, Point Lay	C
1010-22142	August 2, 1972	2	69 20N	163.22W	37	166	Point Lay	
1010-22144	August 2, 1972	2	68 02N	165 09W	38	164	Point Hope	C + D
1010-22145	August 2, 1972	5	67.37N	165 26W	39	163	Point Hope	C
1010-22151	August 2, 1972	5	66.42N	166.47W	40	162	Shishmaref	
1010-22153	August 2, 1972	2	65.21N	168.19W	41	160	Teller	
1010-22160	August 2, 1972	0	64.01N	169.39W	42	158	St. Lawrence Island	C
1010-22162	August 2, 1972	10	62.39N	170 53W	43	156	St. Lawrence Island	
1016-21045	August 8, 1972	10	71.20N	142.35W	34	171	Arctic Ocean, sea ice	
1018-21191	August 10, 1972	5	62.40N	156.24W	41	157	Iditarod	C + D
1018-21193	August 10, 1972	0	61.19N	157.32W	42	155	Sleetmute	
1018-21200	August 10, 1972	5	59.57N	158.36W	43	153	Dillingham	C
1019-19423	August 11, 1972	20	59.30N	134 23W	43	153	Atlin	
1019-19430	August 11, 1972	20	58 07N	135.20W	44	151	Juneau	C
1019-21234	August 11, 1972	15	66.24N	153.59W	37	162	Hughes, Bettles	C
1020-19480	August 12, 1972	0	60 32N	135.04W	42	154	Whitehorse	C
1026-20211	August 18, 1972	10	64.28N	140 25W	37	160	Eagle	C
1026-20214	August 18, 1972	10	63.06N	141.40W	38	158	Tanacross	C
1026-20220	August 18, 1972	5	61.45N	142.50W	39	156	McCarthy	C
1027-20255	August 19, 1972	10	68.14N	137.29W	33	166	East of Table Mts	C
1027-20261	August 19, 1972	20	66.55N	139 08W	34	164	East of BlackRiver	C
1027-22074	August 19, 1972	5	72.26N	156 23W	30	174	Sea Ice north of Barrow	
1028-20324	August 20, 1972	20	64.37N	143 08W	36	160	Eagle	
1029-20365	August 21, 1972	20	69.32N	138.38W	32	168	Herschel Island	
1029-20381	August 21, 1972	2	65.33N	143 38W	35	162	Charlie River	D
1029-20383	August 21, 1972	0	64.12N	145 00W	36	160	Big Delta	C + D
1030-20424	August 22, 1972	20	69.27N	139.54W	31	168	Demarcation Point	C
1030-20430	August 22, 1972	10	68.09N	141 45W	32	166	Table Mountains	
1030-20433	August 22, 1972	5	66.50N	143 24W	34	164	Black River	C
1030-20435	August 22, 1972	15	65.29N	144.55W	35	162	Circle	
1030-20442	August 22, 1972	10	64.08N	146 17W	36	160	Fairbanks, Delta	C
1030-22270	August 22, 1972	15	65.52N	170 20W	34	162	Cnukotsk Penn ,Siberia	C
1030-22273	August 22, 1972	20	64.31N	171 44W	35	161	Siberia, St Lawrence Is.	
1033-21020	August 25, 1972	20	62.43N	151 52W	36	159	McKinley	C + D
1033-21022	August 25, 1972	10	61 20N	153.01W	37	157	Lime Hills, Tyonek	
1033-21025	August 25, 1972	10	59.57N	154.01	38	156	Lake Clark, Illiamna	C
1034-21095	August 26, 1972	10	55.46N	158 28W	41	151	Stepovak Bay	C
1037-21231	August 29, 1972	5	68.08N	152 01W	30	167	Chandler Lake, Wiseman	C + D
1037-21234	August 29, 1972	2	66.49N	153 40W	31	165	Hughes, Bettles	C + D
1037-21240	August 29, 1972	5	65.28N	155.09W	32	163	Melozitna	C + D
1037-21243	August 29, 1972	5	64.07N	156 30W	33	161	Nulato, Ruby	
1037-21245	August 29, 1972	5	62 45N	157 44W	35	159	Ophir, Iditarod	
1037-21252	August 29, 1972	20	61 23N	158.53W	36	158	Russian Mission, Sleetmute	C
1038-21295	August 30, 1972	5	65.29N	156 35W	32	163	Kateel River	
1038-21301	August 30, 1972	0	64.08N	157 57W	33	161	Nulato	C + D
1038-21304	August 30, 1972	0	62 46N	159 11W	34	160	Holy Cross, Iditarod	C + D
1038-21310	August 30, 1972	20	61.24N	160 19W	35	158	Russian Mission	D
1039-21371	August 31, 1972	10	60.00N	162 18W	36	157	Kuskokwim Bay	
1039-21371	August 31, 1972	5	58.37N	163 48W	37	155	Kuskokwim Bay	
1043-20161	September 4, 1972	15	62.42N	110.31W	33	160	Nabesna & east	C
1043-20163	September 4, 1972	0	61.19N	111.42W	34	159	McCarthy	C
1044-20201	September 5 1972	2	68 05N	136 15W	28	167	Aklavik, NWT	
1044-20212	September 5, 1972	2	64 04N	110 14W	31	162	Eagle, Tanacross	C
1044-20215	September 5, 1972	10	62.12N	111 57W	32	161	Tanacross, Nabesna	
1044-22024	September 5, 1972	0	70 10N	158.09W	25	172	Meade River	C
1045-20255	September 6, 1972	0	68 05N	137 39W	27	168	East of Table Mountains	C
1045-22091	September 6 1972	10	68 05N	163 30W	27	168	Noatak	C
1046-20313	September 7, 1972	5	58 31N	118 01W	35	156	Gulf of Alaska	
1046-20351	September 7, 1972	10	57 08N	118 58W	36	155	Pacific Ocean	
1046-22113	September 7 1972	20	69 20N	163.12W	26	170	Point Lay	C

PRECEDING PAGE BLANK NOT FILMED

1046-22145	September 7, 1972	10	68 01N	165 02W	27	168	Point Hope	C
1047-22201	September 8, 1972	20	69 30N	164.20W	25	170	Point Lay	
1049-20505	September 10, 1972	20	61 24N	150 16W	31	160	Anchorage, Cook Inlet	D
1050-20541	September 11, 1972	10	69.28N	142 55W	24	170	Demarcation Point	C + D
1054-21205	September 15, 1972	10	57 12N	160 22W	33	157	Bristol Bay	
1055-21234	September 16, 1972	0	66 45N	153 39W	25	167	Hughes, Bettles	
1056-21310	September 17, 1972	20	61 20N	160 18W	29	161	Russian Mission	
1056-21324	September 17, 1972	40	55 47N	164 04W	33	156	Cold Bay	
1056-21331	September 17, 1972	20	54 24N	164 52W	35	155	Unimak, False Pass	C
1057=19542	September 18, 1972	0	58 31N	137 59W	31	159	Mt Fairweather	C
1057-21342	September 18, 1972	20	69.31N	153 05W	22	171	Teshekpuk	C
1057-21344	September 18, 1972	0	68 03N	154 55W	23	169	Killik River, Walker Lake	C
1057-21351	September 18, 1972	0	66 44N	156.35W	24	167	Shungnak, Hughes	C
1057-21353	September 18, 1972	0	65 23N	158.04W	25	166	Kateel River, Nulato	C
1057-21360	September 18, 1972	10	64 03N	159 25W	26	164	Norton Bay, Nulato	
1057-21371	September 18, 1972	5	59 55N	162 49W	30	160	Baird Inlet, Kuskokwim Bay	
1058-21403	September 19, 1972	0	68 09N	156 14W	22	169	Howard Pass, Killik River	C
1058-21405	September 19, 1972	0	66.50N	157 52W	23	168	Shungnak	
1058-21412	September 19, 1972	0	65.29N	159.22W	25	166	Candle, Kateel	
1058-21414	September 19, 1972	0	64.08N	160 44W	26	164	Norton Bay, Unalakleet	
1058-21421	September 19, 1972	0	62 46N	161.48W	27	163	St. Michael, Kwiguk	
1058-21423	September 19, 1972	0	61 23N	163.07W	28	162	Marshall	
1059-21445	September 20, 1972	0	72.01N	151 21W	18	176	Arctic Ocean	
1059-21454	September 20, 1972	25	69 28N	155.47W	21	171	Ikpikpuk River	C
1059-21461	September 20, 1972	0	68.10N	157.39W	22	170	Howard Pass	C
1060-20102	September 21, 1972	5	62 44N	139 03W	26	163	Wellesley Lake, Dawson	
1061-20154	September 22, 1972	0	64.04N	139 13W	25	165	Dawson	
1061-20160	September 22, 1972	0	62 43N	140.28W	26	163	E. of Nabesna	
1061-20163	September 22, 1972	0	61.21N	141.36W	27	162	McCarthy & East	C
1061-20165	September 22, 1972	0	59 58N	142 39W	28	161	Icy Bay	C
1061-20172	September 22, 1972	10	58 35N	143 38W	29	159	Pacific Ocean	
1062-20210	September 23, 1972	20	65 26N	139.18W	23	166	Charley River	
1062-20212	September 23, 1972	0	64 05N	140.39W	24	165	Eagle	
1062-20215	September 23, 1972	0	62 43N	141.53W	26	163	Nabesna	
1062-20221	September 23, 1972	0	61.21N	143.01W	27	162	McCarthy	C + D
1063-20262	September 24, 1972	20	66.46N	139 16W	22	168	E of Black River	
1063-20264	September 24, 1972	0	65.26N	140 46W	23	167	Charley River	C
1063-20271	September 24, 1972	0	64.04N	142 06W	24	165	Eagle - Tanacross	
1063-20273	September 24, 1972	0	62 42N	143.20W	25	164	Nabesna	
1063-20280	September 24, 1972	0	61.20N	144.28W	26	162	Chitina	
1063-20282	September 24, 1972	40	59.58N	145.31W	28	161	Valdez, clouds are over ocean	
1064-20331	September 25, 1972	20	62.42N	144 46W	25	164	Gulkana, Nabesna	
1064-20334	September 25, 1972	0	61.19N	145 55W	26	162	Valdez, Cordova	
1066-20424	September 27, 1972	0	69.29N	139 56W	18	172	Demarcation Point	
1066-20444	September 27, 1972	0	62.47N	147.35W	24	164	Mt. Hayes	C
1066-20451	September 27, 1972	10	61.25N	148 43W	25	163	Anchorage, cloud over city	D-C
1066-20453	September 27, 1972	20	60 02N	149.46W	26	162	Seward, Kenai	D-C
1070-21085	October 1, 1972	0	58 43N	156.24W	26	161	Karluk, Mt. Katmai	C
1072-21173	October 3, 1972	5	68 07N	150 26W	17	171	Philip Smith Mountains, Chandalar	C
1072-21180	October 3, 1972	0	66.48N	152 06W	18	169	Bettles, Tanana	C
1072-21182	October 3, 1972	0	65.28N	153 36W	19	168	Tanana, Ruby	C
1072-21200	October 3, 1972	20	60.01N	158 23W	24	162	Taylor Mts., Dillingham	C
1073-21223	October 4, 1972	0	70.46N	147 55W	14	175	Beechey Point	C
1073-21225	October 4, 1972	0	69.28N	150.01W	15	173	Umiat, Sagavanirktok	D
1073-21232	October 4, 1972	0	68 09N	151 52W	17	171	Chandler Lake, Wiseman	D
1073-21241	October 4, 1972	20	65.29N	155 00W	19	168	Melozitna, Ruby	
1074-21290	October 5, 1972	0	68.08N	153 18W	16	171	Killik River, Chandler Lake	
1074-21293	October 5, 1972	5	66.48N	154 57W	17	170	Hughes	
1074-21295	October 5, 1972	5	65.28N	156.23W	19	168	Kateel River, Nulato	
1074-21302	October 5, 1972	20	64.07N	157 48W	20	167	Ophir, Nulato	
1075-21345	October 6, 1972	10	68 05N	154 46W	16	171	Killik R., Survey Pass	
1075-21351	October 6, 1972	0	66 46N	156 25W	17	170	Shungnak, Kateel River	
1076-21444	October 7, 1972	0	54 28N	167 42W	27	159	Unalaska, Dutch Harbor	
1077-20033	October 8, 1972	0	66 50N	133 21W	16	170	Canada	
1077-20035	October 8, 1972	10	65 30N	134.52W	17	168	Canada	
1077-20042	October 8, 1972	5	64 09N	136 15W	19	167	Mayo Lake	
1077-20053	October 8, 1972	0	60 03N	139.43W	22	163	Yakutat	C
1077-21453	October 8, 1972	5	70 42N	153 43W	13	175	Teshekpuk, Harrison Bay	D
1078-20085	October 9, 1972	0	68 11N	133 10W	15	172	Sitidgie Lake, Canada	
1078-20091	October 9, 1972	0	66 52N	134 50W	16	170	Canada	
1078-20094	October 9, 1972	0	65 32N	136.20W	17	168	Canada	
1078-20100	October 9, 1972	0	64 10N	137 42W	18	167	Dawson	
1078-20103	October 9, 1972	0	62 49N	138 57W	19	166	Dawson	C
1078-20105	October 9, 1972	00	61 27N	140 06W	21	165	Mt St Elias	
1078-20112	October 9, 1972	5	60 05N	141 10W	22	163	Icy Bay, Yakutat	C
1081-20263	October 12, 1972	5	66 18N	139 13W	15	170	E of Black River	
1081-20270	October 12, 1972	0	65 28N	140.13W	16	169	E of Charlie River	

ORIGINAL PAGE IS
OF POOR QUALITY

1081-2027?	October 12, 1972	0	64.06N	142.04W	17	167	Eagle	C
1081-20275	October 12, 1972	0	62 45N	143.19W	18	166	Nabesna	C.
1081-20281	October 12, 1972	0	61.22N	141 28W	20	165	Cordova, McCarthy	C-D
1081-20281	October 12, 1972	0	60.00N	145 31W	21	164	Cordova	C
1082-20324	October 13, 1972	0	65 28N	142 06W	16	169	Eagle, Charley River	C
1084-19042	October 15, 1972	0	54 22N	127 36W	25	160	Smithers - Canada	
1085-19094	October 16, 1972	0	55 47N	128 15W	23	161	E of Ketchikan	
1085-19100	October 16, 1972	0	54.23N	129.03W	24	160	Kitimat, S.E.	
1086-19152	October 17, 1972	0	55.45N	129 41W	23	161	Woodcock, S.E.	
1086-20543	October 17, 1972	5	69 20N	143 00W	11	174	Demarcation Point	C
1086-20545	October 17, 1972	5	68 01N	144 50W	12	172	Christian, Table Mountains	D
1087-20595	October 18, 1972	0	70.38N	142.23W	9	176	Barter Island	
1087-21004	October 18, 1972	0	68.03N	146.17W	11	172	Philip Smith Mountains	D
1088-21062	October 19, 1972	0	68 01N	147 47W	11	172	Philip Smith Mountains	D + C
1088-21071	October 19, 1972	20	65 22N	150 54W	14	169	Tanana, Livengood	
1088-21074	October 19, 1972	20	64 00N	152 15W	15	168	Kantishna River	
1091-19414	October 22, 1972	0	64 00N	138 42W	14	168	Dawson	
1094-19581	October 25, 1972	5	66 37N	132 11W	10	171	Canada	
1094-19583	October 25, 1972	15	65 17N	133 43W	12	169	Canada	
1094-19590	October 25, 1972	0	63 56N	135.05W	13	168	Mayo Lake, Canada	
1094-19595	October 25, 1972	0	61 12N	137 27W	15	166	Kluane Lake, Canada	
1094-20001	October 25, 1972	0	59.50N	138 29W	16	165	Mt Fairweather	
1096-20112	October 27, 1972	0	61 14N	140.18W	15	166	McCarthy, Mt. St. Elias	
1096-20114	October 27, 1972	0	59.51N	141 20W	16	165	Yakutat	
1100-20315	October 31, 1972	50	69.14N	137.31W	06	174	Herschel Island, land clear	
1100-20324	October 31, 1972	0	66.36N	140.58W	08	171	Black River	
1100-20330	October 31, 1972	5	65.16N	142 26W	10	170	Charley River	
1100-20342	October 31, 1972	0	61.12N	146 07W	13	166	Valdez	
1101-20403	November 1, 1972	0	59 48N	148.31W	14	165	Blying Sound	
1102-20434	November 2, 1972	20	67.51N	142 13W	07	173	Coleen	D
1102-20441	November 2, 1972	0	66.31N	143.50W	08	171	Black River, Charlie River	D-C
1102-20443	November 2, 1972	20	65.11N	145.19W	09	170	Circle	
1102-20450	November 2, 1972	0	63.50N	146.39W	10	168	Mt. Hayes	C
1102-20452	November 2, 1972	0	62 29N	147 52W	11	167	Talkeetna Mtns	
1102-20455	November 2, 1972	0	61.06N	148 59W	13	166	Anchorage, Cook Inlet	C
1102-20461	November 2, 1972	0	59.44N	150 01W	14	165	Seldovia	C
1102-20464	November 2, 1972	0	58 21N	150.58W	15	164	Pacific Ocean	
1102-20470	November 2, 1972	0	56 59N	151.52W	16	163	Kaguyak	
1103-20493	November 3, 1972	0	67.50N	143.39W	06	173	Coleen, Black River	D
1103-20495	November 3, 1972	0	66.31N	145.17W	07	171	Ft. Yukon, Circle	C + D
1103-20502	November 3, 1972	0	65.11N	146.45W	09	170	Fairbanks	D
1103-20504	November 3, 1972	0	63.50N	148.05W	10	168	Healy, Talkeetna Mts.	C
1103-20511	November 3, 1972	0	62.28N	149.19W	11	167	Talkeetna Mts , Anchorage	D + C
1103-20513	November 3, 1972	0	61.06N	150.27W	12	166	Anchorage, Cook Inlet	D
1103-20520	November 3, 1972	0	59.44N	151.30W	14	165	Kenai Peninsula	D
1103-20522	November 3, 1972	0	58 21N	152.28W	15	164	Kodiak, Afognak	
1104-20554	November 4, 1972	0	66.30N	146 45W	07	171	Fort Yukon	D-C
1104-20560	November 4, 1972	0	65.10N	148.12W	08	170	Fairbanks	D
1104-20563	November 4, 1972	0	63.49N	149 31W	10	169	McKinley	C
1104-20565	November 4, 1972	0	62.28N	150.44W	11	167	Talkeetna	C + D
1104-20572	November 4, 1972	0	61.06N	151.15W	12	166	Cook Inlet, Tyonek	C + D
1104-21574	November 4, 1972	0	59 44N	152.53W	13	165	Iliamna, Seldovia	C
1105-21010	November 5, 1972	0	67.50N	146.32W	06	173	Christian, Fort Yukon	C + D
1105-21012	November 5, 1972	0	66.30N	148 09W	07	171	Beaver	C
1105-21015	November 5, 1972	0	65.10N	149 38W	08	170	Minto	C
1105-21021	November 5, 1972	0	63.50N	150 50W	09	169	Mt. McKinley	C
1105-21033	November 5, 1972	20	59.44N	154.18W	13	165	Iliamna, Mt. Katmai	C
1105-21035	November 5, 1972	20	58.21N	155 16W	14	164	Karluk, Mt. Katmai	C

ORIGINAL PAGE IS
OF POOR QUALITY

FRIS SCENES WITH 20% OR LESS CLOUD COVER
1973

Scene I D	Date	Cloud Cover	Lat Center Pt	Long.	Sun El	Sun Az	Map Description	Color = C Digital Tape=D
1198-19373	February 6, 1973	0	60 06N	132 38W	12	158	Atlin	
1198-19380	February 6, 1973	0	58 43N	133.37W	13	157	Juneau	C
1198-19382	February 6, 1973	5	57 19N	134 32W	14	156	Sitka - Sumdum	
1198-19385	February 6, 1973	0	55 56N	135 23W	15	155	Port Alexander	C
1199-19432	February 7, 1973	0	60 03N	134 07W	12	158	Atlin	
1199-19434	February 7, 1973	0	58 40N	135 06W	13	157	Juneau	C
1199-19441	February 7, 1973	0	57 17N	136 01W	15	156	Sitka	
1200-19490	February 8, 1973	0	60.00N	135 37W	13	158	Skagway	C
1200-19493	February 8, 1973	2	58.37N	136 35W	14	157	Mt. Fairweather	C
1204-20114	February 12, 1973	0	61.23N	140 18W	13	159	East of McCarthy	
1204-20120	February 12, 1973	2	60.00N	141 21W	14	158	Bering Glacier	
1205-21590	February 13, 1973	0	66 51N	162 17W	09	164	Kotzebue	
1205-21592	February 13, 1973	0	65 31N	163 46W	10	162	Bendleben	
1205-21595	February 13, 1973	0	64 10N	165 08W	11	161	Nome - Soloman	
1205-22001	February 13, 1973	5	62 49N	166 23W	12	160	Black	
1205-22004	February 13, 1973	5	61 27N	167.32W	13	159	Hooper Bay	
1211-20501	February 19, 1973	0	66.50N	145.05W	11	164	Fort Yukon	C
1211-20504	February 19, 1973	50	65 29N	146 35W	12	162	Livengood-Circle, Top half of scene clear	
1216-21181	February 24, 1973	0	69.27N	148 47W	10	167	Sagavanirktok - Philip Smith Mtns	
1216-21183	February 24, 1973	0	68 08N	150.37W	11	165	Chandler Lake, Philip Smith Mtns.	
1216-21190	February 24, 1973	0	66 49N	152.11W	13	164	Bettles	
1216-21192	February 24, 1973	0	65 29N	153 46W	14	162	Melozitna - Tanana	
1216-21195	February 24, 1973	0	64 08N	155.07W	15	161	Ruby	
1216-21201	February 24, 1973	0	62.47N	156 21W	16	159	Iditarod, McGrath	
1216-21204	February 24, 1973	0	61.25N	157.30W	17	158	Sleetmute	
1216-21210	February 24, 1973	0	60 03N	158 33W	18	157	Taylor Mtns	
1217-21235	February 25, 1973	0	59 26N	150.13W	11	167	Umiat, Sagavanirktok	
1217-21242	February 25, 1973	0	68 08N	152.04W	12	165	Chandler Lake	
1217-21244	February 25, 1973	0	66.48N	153 44W	13	164	Hughes, Bettles	
1217-21251	February 25, 1973	0	65.28N	155.14W	14	162	Melozitna	
1217-21253	February 25, 1973	0	64 07N	156 36W	15	161	Nulato - Ophir	
1217-21260	February 25, 1973	0	62 45N	157 58W	16	159	Iditarod	
1217-21262	February 25, 1973	0	61 24N	158 58W	17	158	Russian Mission - Sleetmute	
1217-21265	February 25, 1973	0	60.01N	160.02W	19	157	Bethel - Taylor Mts	
1217-21271	February 25, 1973	5	58 39N	161.01W	20	156	Hagemeister Island	
1218-21300	February 26, 1973	0	68.07N	153 33W	12	165	Chandler Lake	
1218-21303	February 26, 1973	15	66 47N	155.13W	13	163	Hughes	
1218-21305	February 26, 1973	0	65.28N	156.42W	14	162	Kateel River, Melozitna	
1218-21312	February 26, 1973	0	64 07N	158 03W	16	161	Nulato	
1218-21314	February 26, 1973	0	62.45N	159 17W	17	159	Holy Cross, Iditarod	
1218-21321	February 26, 1973	0	61.23N	160 25W	19	158	Russian Mission	
1219-21343	February 27, 1973	5	71.58N	148.47W	09	171	N. of Beechey Point	
1219-21361	February 27, 1973	0	66.47N	156.39W	14	163	Shungnak - Hughes	
1219-21364	February 27, 1973	0	65.26N	158.08W	15	162	Kateel River	
1219-21370	February 27, 1973	0	64 05N	159.29W	16	161	Norton Bay, Nulato	
1219-21373	February 27, 1973	0	62.44N	160.44W	17	159	Holy Cross	
1219-21375	February 27, 1973	0	61.22N	161.52W	18	158	Russian Mission	
1219-21382	February 27, 1973	0	59.59N	162 55W	19	157	Baird Inlet	
1219-21384	February 27, 1973	0	58 36N	163.54W	20	156	Bristol Bay - mostly ice	
1219-21391	February 27, 1973	0	57 14N	164.50W	21	155	Bristol Bay, shows edge of ice	
1220-21413	February 28, 1973	20	68.05N	156 27W	13	165	Howard Pass, Ambler River	
1220-21420	February 28, 1973	0	66 46N	158.05W	14	163	Shungnak	
1220-2142[illegible]	February 28, 1973	0	65.26N	159.34W	15	162	Candle, Kateel River	
1220-21425	February 28, 1973	0	64.05N	160 55W	16	161	Norton Bay	
1220-21431	February 28, 1973	20	62.44N	162.10W	18	159	Kwiguk	
1220-21434	February 28, 1973	15	61.22N	163 18W	19	158	Marshall	
1220-21440	February 28, 1973	5	59.59N	164.21W	20	157	Baird Inlet, Nunivak Island	
1220-21443	February 28, 1973	25	58.36N	165 20W	21	156	Bristol Bay, sea ice	
1220-21445	February 28, 1973	05	57 13N	166 15W	22	155	Bristol Bay, edge of ice	
1226-20322	March 6, 1973	0	69 29N	137 30W	14	167	Herschel Island	
1226-20324	March 6, 1973	0	68 10N	139 10W	15	165	East of Table Mountains	
1226-20331	March 6, 1973	5	66 50N	140.48W	16	164	East of Black River	
1226-20340	March 6, 1973	5	64 09N	143 39W	19	161	Eagle	
1226-22153	March 6, 1973	0	69 27N	163 11W	14	167	Chukchi Sea off Point Lay	
1226-22160	March 6, 1973	0	68 09N	165 00W	15	165	Point Hope	
1226-22162	March 6, 1973	0	66 50N	166 39W	16	164	Shishmaref	
1226-22165	March 6, 1973	0	65 30N	168 08W	18	162	Seward Peninsula	
1226-22171	March 6, 1973	0	64.09N	169 30W	19	161	St Lawrence Island	
1226-22174	March 6, 1973	0	62 48N	170 45W	20	159	St Lawrence Island	
1227-20394	March 7, 1973	10	64 07N	145 10W	19	161	Big Delta, very bottom of image cloudy	D
1227-22203	March 7, 1973	0	72 00N	160 17W	12	172	N of Wainwright	
1227-22212	March 7, 1973	0	69 27N	161 40W	15	167	Point Lay	
1227-22214	March 7, 1973	0	68 08N	166 31W	16	165	Point Hope	
1227-22221	March 7, 1973	0	66 49N	168 10W	17	164	Bering Straits, Chukchi Sea	
1227-22223	March 7, 1973	0	63 29N	169 33W	18	162	Bering Straits	
1227-22230	March 7, 1973	0	64 08N	171 00W	19	161	St Lawrence Island	
1227-22232	March 7, 1973	10	62 46N	172 11W	20	159	Bering Sea - Ice	

ORIGINAL PAGE IS
OF POOR QUALITY

1228-20135	March 8, 1973	0	69 28N	140 17W	15	167	Herschel Island	
1228-22270	March 8, 1973	0	69.27N	166 02W	15	167	Point Hope	
1228-22273	March 8, 1973	0	68 08N	167.53W	16	165	Point Hope	
1228-22275	March 8, 1973	0	66 49N	169.32W	17	164	Siberia, Chukchi Sea	
1231-21012	March 11, 1973	10	68 07N	146.15W	17	165	Arctic	
1234-21175	March 14, 1973	0	70 38N	146.59W	16	169	Flaxman Island	
1234-21181	March 14, 1973	15	69 21N	149 01W	17	167	Sagavanirktok	
1234-21204	March 14, 1973	2	61.19N	157 39W	24	158	Sleetmute	
1234-21211	March 14, 1973	0	59.57N	158 42W	25	157	Dillingham	
1234-21213	March 14, 1973	10	58.34N	159 40W	26	155	Nushagak Bay	
1235-21233	March 15, 1973	0	70 39N	148 22W	17	169	Beechey Point	
1235-21240	March 15, 1973	0	69 22N	150 25W	18	167	Umiat, Sagavanirktok	
1235-21242	March 15, 1973	2	68 04N	152.14W	19	165	Chandler Lake	
1235-21263	March 15, 1973	20	61 21N	129 04W	25	158	Russian Mission, Sleetmute	
1235-21265	March 15, 1973	3	59 58N	160.06W	26	157	Goodnews	
1235-21272	March 15, 1973	5	58 35N	161 04W	27	155	Hagemeister Island	
1235-21274	March 15, 1973	10	57 12N	161.58W	28	154	Bristol Bay	
1236-21292	March 16, 1973	0	70.39N	149 53W	17	169	Beechey Point	
1236-21294	March 16, 1973	0	69.21N	151.55W	18	167	Umiat	D
1236-21301	March 16, 1973	0	68 03N	153.44W	19	165	Killik River, Chandler Lake	D
1236-21303	March 16, 1973	0	66 44N	155.23W	20	164	Hughes	
1236-21310	March 16, 1973	0	65.23N	156 52W	22	162	Kateel River	
1236-21312	March 16, 1973	0	64.02N	158.12W	23	161	Nulato	
1236-21324	March 16, 1973	0	59 56N	161 36W	26	157	Goodnews	
1236-21330	March 16, 1973	0	58.33N	162 34W	27	155	Hagemeister Island	
1236-21333	March 16, 1973	0	57.11N	163 29W	28	154	Bristol Bay	
1237-19551	March 17, 1973	5	59.59N	137 13W	26	157	Skagway	
1237-19553	March 17, 1973	20	58.36N	138.12W	27	155	Mt Fairweather	
1237-21344	March 17, 1973	0	71.56N	148.58W	16	172	N. of Beechey Point	
1237-21350	March 17, 1973	0	70.39N	151.15W	17	170	Harrison Bay, Beechey Point'	
1237-21353	March 17, 1973	0	69.22N	153 17W	19	167	Ikpikpuk River , Umiat	
1237-21355	March 17, 1973	0	68 04N	155 05W	20	166	Killik River, Survey Pass	
1237-21362	March 17, 1973	5	66.45N	156 43W	21	164	Shungnak	
1237-21373	March 17, 1973	0	62.42N	160.47W	24	159	Holy Cross	
1237-21385	March 17, 1973	0	58.36N	163.57W	27	155	Bristol Bay--ice	
1237-21391	March 17, 1973	0	57.13N	164.51W	29	154	Bristol Bay, edge of ice	
1238-21402	March 18, 1973	0	71.54N	150.26W	17	172	Arctic Ocean, n. of Harrison Bay	
1238-21405	March 18, 1973	0	70.38N	152.45W	18	170	Harrison Bay	
1238-21411	March 18, 1973	0	69.21N	154 48W	19	167	Ikpikpuk River	
1238-21414	March 18, 1973	0	68.02N	156.37W	20	166	Howard Pass, Killik River	
1238-21420	March 18, 1973	0	66.44N	158 18W	21	164	Shungnak	
1238-21423	March 18, 1973	0	65.24N	159.47W	22	162	Candle, Kateel	
1238-21425	March 18, 1973	0	64.02N	161 08W	24	161	Norton Bay	
1238-21432	March 18, 1973	0	62.40N	162 21W	25	159	Kwiguk, Holy Cross	
1238-21434	March 18, 1973	0	61.18N	163.28W	26	158	Marshall	
1238-21441	March 18, 1973	0	59 57N	164 29W	27	156	Nunivak Island	
1238-21443	March 18, 1973	0	58.34N	165.28W	28	155	Bristol Bay	
1239-20061	March 19, 1973	0	61 21N	129.03W	26	158	East of McCarthy	
1239-21461	March 19, 1973	0	71.55N	151 53W	17	172	N. of Teshekpuk	
1239-21463	March 19, 1973	0	70.40N	154.11W	18	170	Teshekpuk	
1239-21470	March 19, 1973	0	69.23N	156 13W	19	168	Lookout Ridge, Ikpikpuk River	
1239-21472	March 19, 1973	0	68 05N	158 03W	21	166	Howard Pass, Ambler River	
1239-21475	March 19, 1973	0	66.45N	159 41W	22	164	Selawik, Shungnak	
1239-21481	March 19, 1973	0	65.25N	161.09W	23	162	Candle	
1239-21484	March 19, 1973	0	64 04N	162 30W	24	161	Solomon, Norton Bay	
1239-21490	March 19, 1973	0	62 43N	163.44W	25	159	Kwiguk	
1239-21493	March 19, 1973	0	61.21N	164.51W	26	158	Marshall	
1239-21495	March 19, 1973	0	59 59N	165 53W	27	157	Cape Mendenhall	
1239-21502	March 19, 1973	0	58.36N	166 51W	28	155	Bristol Bay	
1240-20115	March 20, 1973	0	61.23N	140 27W	26	159	E of McCarthy	
1240-21515	March 20, 1973	0	71.56N	153 12W	18	172	N of Teshekpuk	
1240-21531	March 20, 1973	0	68.06N	159 25W	21	166	Misneguk Mtns, Howard Pass	
1240-21533	March 20, 1973	0	66 47N	161 01W	22	164	Selawik	
1240-21540	March 20, 1973	0	65.26N	162 33W	23	162	Bendleben, Candle	
1240-21542	March 20, 1973	0	64 06N	163 53W	24	161	Solomon	
1240-21545	March 20, 1973	0	62 45N	165 07W	25	159	Black, Kwiguk	
1240-21551	March 20,1973	0	61 22N	166 15W	27	158	dHooper Bay	
1240-21554	March 20, 1973	0	60 00N	167.18W	28	157	Nunival Island	
1241-20165	March 21, 1973	1	64 06N	139 29W	25	161	E of Eagle	
1241-20171	March 21, 1973	0	62 45N	140.43W	26	159	E of Nabesna	
1241-21573	March 21, 1973	0	71.58N	154 38W	18	172	Barrow	
1241-21580	March 21, 1973	0	70 12N	156 57W	19	170	Meade River	
1241-21582	March 21, 1973	0	69 25N	159 00W	20	168	Lookout Ridge, Utukok River	

ORIGINAL PAGE IS OF POOR QUALITY

1241-21585	March 21, 1973	0	68.07N	160.49W	21	166	Misheguk Mtn
1241-21591	March 21, 1973	0	66 48N	162 28W	22	164	Kotzebue, Selawik
1241-21594	March 21, 1973	0	65 28N	163 51W	24	162	Bendleben
1241-22000	March 21, 1973	0	64 07N	165 18W	25	161	Norton Sound, Nome
1241-22003	March 21, 1973	0	62 46N	166 31W	26	159	Black, Bering Sea
1241-22005	March 21, 1973	0	61 24N	167 39W	27	158	Bering Sea, Hooper Bay
1241-22012	March 21, 1973	10	60 02N	168.43W	28	157	Bering Sea, Nunivak Island
1242-20221	March 22, 1973	0	65 25N	139.38W	24	162	E. of Charley River
1242-22032	March 22, 1973	0	71 55N	156 08W	18	172	Barrow
1242-22034	March 22, 1973	0	70.39N	158.26W	19	170	Meade River
1242-22011	March 22, 1973	0	69.22N	160 28W	21	168	Utukok River
1242-22043	March 22, 1973	20	68.04N	162 17W	22	166	Delong Mtns, Misheguk
1243-22090	March 23, 1973	0	71.56N	157.35W	19	172	N. of Barrow
1243-22093	March 23, 1973	0	70 40N	159.52W	20	170	Wainwright, Meade River
1243-22095	March 23, 1973	0	69.24N	161.55W	21	168	Point Lay
1243-22113	March 23, 1973	5	64.66N	168.16W	26	161	Nome
1243-22120	March 23, 1973	10	62.44N	169 30W	27	159	St Lawrence Island
1243-22125	March 23, 1973	0	60.01N	171.41W	29	157	Bering Sea, ice
1243-22131	March 23, 1973	10	58.38N	172.40W	30	155	Bering Sea, ice
1247-20491	March 27, 1973	5	70.41N	139.47W	21	170	E of Barter Island
1247-20493	March 27, 1973	0	69 23N	141.50W	23	168	Demarcation Point
1247-20505	March 27, 1973	15	65 26N	146.49W	26	162	Circle
1247-20511	March 27, 1973	25	64.05N	148.09W	27	161	Fairbanks D+C
1251-21130	March 31, 1973	0	68.09N	149.21W	25	166	Philip Smith Mountains
1251-21132	March 31, 1973	10	66.50N	151.00W	26	164	Bettles
1251-21135	March 31, 1973	0	65.30N	152 30W	28	163	Tanana
1251-21141	March 31, 1973	0	64.10N	153.52W	29	161	Ruby, Kantishna
1252-21175	April 1, 1973	0	70.43N	146 57W	23	170	Flaxman Island
1252-21182	April 1, 1973	0	69.26N	149.01W	25	168	Sagavanirktok
1252-21184	April 1, 1973	20	68.08N	150 51W	26	166	Chandler Lake, Philip Smith Mtns
1252-21191	April 1, 1973	2	66.49N	152 29W	27	164	Bettles
1252-21193	April 1, 1973	2	65.28N	153 59W	28	163	Melozitna, Tanana
1253-21233	April 2, 1973	20	70 43N	148 19W	24	171	Beechey Point
1253-21240	April 2, 1973	20	69.27N	150 21W	25	168	Umiat, Sagavanirktok
1253-21242	April 2, 1973	0	68.09N	152.11W	26	166	Chandler Lake
1253-21245	April 2, 1973	25	66.49N	153.51W	27	164	Hughes, Bettles
1253-21265	April 2, 1973	0	60.04N	160 07W	33	157	Bethel, Goodnews
1253-21272	April 2, 1973	5	58.41N	161.06W	34	155	Hagemeister Island
1253-21274	April 2, 1973	0	57.18N	162.00W	35	154	Bristol Bay
1253-21281	April 2, 1973	10	55 54N	162.52W	36	152	Cold Bay, Port Moller
1253-21283	April 2, 1973	15	54.30N	163.40W	37	151	False Pass
1254-21303	April 3, 1973	0	66.48N	155.25W	28	164	Hughes
1254-21310	April 3, 1973	0	65.28N	156.54W	29	163	Kateel River, Melozitna
1254-21312	April 3, 1973	0	64.07N	158.15W	30	161	Nulato
1254-21315	April 3, 1973	0	62.46N	159.29W	31	159	Holy Cross, Iditarod
1254-21321	April 3, 1973	0	61.24N	160.36W	32	158	Russian Mission
1254-21324	April 3, 1973	0	60.02N	161 39W	33	156	Baird Inlet, Bethel
1255-19551	April 4, 1973	5	60.01N	137 13W	33	156	N. of Skagway
1255-21355	April 4, 1973	0	68.07N	155.12W	27	166	Killik River
1255-21364	April 4, 1973	0	65.28N	158.18W	29	163	Kateel River
1255-21371	April 4, 1973	0	64 08N	159 39W	30	161	Norton Bay, Nulato
1256-21402	April 5, 1973	0	72 00N	150 23W	24	173	N. of Harrison Bay
1256-21405	April 5, 1973	0	70.44N	152.44W	25	171	Harrison Bay
1256-21411	April 5, 1973	0	69.27N	154.48W	26	168	Ikpikpuk River
1256-21414	April 5, 1973	0	68.09N	156 37W	27	166	Howard Pass
1257-21461	April 6, 1973	0	72 01N	151.50W	24	173	N. of Harrison Bay
1258-21515	April 7, 1973	0	72.01N	153.14W	25	173	N. of Teshekpuk
1258-21540	April 7, 1973	10	65.30N	162.35W	30	163	Bendleben, Candle
1258-21542	April 7, 1973	0	64.09N	163.56W	31	161	Solomon
1258-21545	April 7, 1973	0	62 47N	164 59W	32	160	Black, Kwiguk
1258-21551	April 7, 1973	0	61.26N	166 17W	34	158	Hooper Bay
1258-21563	April 7, 1973	60	57 17N	169 14W	37	154	Top cloudy but Pribilof Islands seem clear
1258-21565	April 7, 1973	20	55 54N	170.05W	38	152	Pribilof Islands
1259-21580	April 8, 1973	5	70.45N	156 57W	26	171	Barrow
1259-21582	April 8, 1973	10	69 28N	159 01W	27	169	Utukok River - Lookout Ridge
1259-21585	April 8, 1973	0	68.09N	160 51W	28	167	Misheguk Mtn.
1259-21591	April 8, 1973	2	66 50N	162 30W	29	165	Kotzebue - Selawik
1259-21594	April 8, 1973	0	65 30N	163 59W	31	163	Bendleben
1259-22000	April 8, 1973	5	64.09N	165 20W	32	161	Nome - Soloman
1259-22003	April 8, 1973	20	62 48N	166 35W	33	160	Black
1260-22032	April 9, 1973	0	72 01N	156 01W	25	171	Barrow
1261-20284	April 10, 1973	0	62 48N	143 38W	31	160	Nabesna
1261-22090	April 10 1973	0	72 01N	157 30W	26	174	N Of Barrow
1261-22093	April 10, 1973	10	70 45N	159 45W	27	171	Wainwright, Meade River
1261-22102	April 10, 1973	15	68 09N	163 43W	29	167	Delong Mountains

ORIGINAL PAGE IS OF POOR QUALITY

1261-22120	April 10, 1973	10	62.48N	169 25W	34	160	Bering Sea - [illegible]	
1262-20331	April 11, 1973	0	66 51N	140 59W	31	165	Black River	
1262-20331	April 11, 1973	0	65 31N	142 28W	32	163	Charley River	
1262-20340	April 11, 1973	10	64 10N	143 50W	33	161	Eagle	
1262-22145	April 11, 1973	5	72 02N	159.00W	26	174	N of Wainwright	
1262-22151	April 11, 1973	5	70.46N	161.19W	27	171	Wainwright	
1262-22154	April 11, 1973	10	69.29N	163 21W	28	169	Point Lay	
1262-22160	April 11, 1973	3	68.11N	165 12W	29	167	DeLong Mountains	
1262-22163	April 11, 1973	5	66 52N	166 51W	31	165	Shishmaref	
1263-20383	April 12, 1973	0	68 10N	140.51W	30	167	Table Mtn	D
1263-20385	April 12, 1973	0	66.50N	142 29W	31	165	Black River	D
1263-20392	April 12, 1973	0	65 30N	143 58W	32	163	Charley River	
1263-20394	April 12, 1973	5	64.09N	145 19W	33	161	Big Delta	D
1263-22203	April 12, 1973	0	72 02N	160 23W	26	174	N of Wainwright	
1263-22210	April 12, 1973	0	70 46N	162.43W	28	171	Wainwright	
1263-22212	April 12, 1973	0	69.29N	164 46W	29	169	Point Lay	
1264-19051	April 13, 1973	0	54.31N	129 49W	41	151	Canada, SE of Prince Rupert	
1264-20135	April 13, 1973	20	69 28N	140 21W	29	169	Herschel Is.	
1264-20441	April 13, 1973	10	68 11N	142 11S	30	167	Table Mountains	
1264-20444	April 13, 1973	0	66 51N	143.50W	31	165	Black River	
1265-20500	April 14, 1973	0	68.13N	143.38W	30	167	Table Mrs	
1266-20554	April 15, 1973	10	68.13N	145.03W	31	167	Arctic	
1266-20561	April 15, 1973	20	66.54N	146 42W	32	165	Fort Yukon	
1266-20572	April 16, 1973	0	62 52N	150 47W	35	160	Talkeetna Mtn	D-C
1267-21012	April 16, 1973	5	68.13N	146 27W	31	167	Arctic	D
1267-21051	April 16, 1973	10	55 57N	157 10W	41	152	Sutvik Island	
1268-21064	April 17, 1973	5	69.29N	146 10W	30	169	Mt Michelson	
1268-21071	April 17, 1973	0	68.11N	147.59W	32	167	Philip Smith Mtns	
1268-21073	April 17, 1973	20	66 51N	149.37W	33	165	Beaver	
1269-21123	April 18, 1973	10	69.29N	147 34W	31	169	Sagavanirktok - Mt. Michelson	
1269-21125	April 18, 1973	0	68.10N	149.24W	32	167	Philip Smith Mtns	
1269-21132	April 18, 1973	20	66.51N	151 03W	33	165	Bettles	
1269-21155	April 18, 1973	20	58.42N	158 16W	40	155	Nushagak Bay	
1270-21181	April 19, 1973	5	69.29N	149 00W	31	169	Sagavanirktok	
1271-21240	April 20, 1973	10	69.30N	150 25W	31	169	Umiat - Sagavanirktok	
1271-21242	April 20, 1973	0	68.12N	152.15W	33	167	Chandler Lake	
1271-21245	April 20, 1973	0	66.52N	153.54W	34	165	Hughes - Bettles	
1271-21251	April 20, 1973	0	65.32N	155.23W	35	163	Melozitna	
1271-21254	April 20, 1973	0	64.11N	156.44W	36	161	Nulato, Ruby	
1271-21263	April 20, 1973	5	61.28N	159.07W	38	158	Russian Mission - Sleetmute	
1271-21272	April 20, 1973	15	58 42N	161.09W	40	155	Hagemeister Island	
1272-21294	April 21, 1973	15	69.33N	151 47W	32	169	Umiat	
1272-21300	April 21, 1973	5	68.14N	153.38W	33	167	Killik River, Chandler Lake	
1272-21303	April 21, 1973	0	66.55N	155 18W	34	165	Hughes	
1272-21305	April 21, 1973	0	65.35N	156.47W	35	163	Kateel River, Melozitna	
1272-21312	April 21, 1973	0	64 14N	158 09W	36	161	Nulato	
1272-21314	April 21, 1973	0	62.53N	159 24W	37	160	Holy Cross, Iditarod	
1272-21321	April 21, 1973	0	61.31N	160 33W	39	158	Russian Mission	
1272-21323	April 21, 1973	0	60.08N	161 37W	40	156	Bethel	
1272-21330	April 21, 1973	0	58.46N	162 36W	41	155	Kuskokwim Bay - Hagemeister Is	
1272-21332	April 21, 1973	0	57 22N	163 31W	42	153	Bristol Bay & Ice	
1273-21361	April 22, 1973	10	66.55N	156.44W	34	165	Shungnak - Hughes	
1273=21364	April 22, 1973	0	65 35N	158 14W	36	163	Kateel River	
1273-21370	April 22, 1973	0	64.15N	159 36W	37	161	Norton Bay, Nulato	
1274-20002	April 23, 1973	0	61.31N	137.34W	39	158	N of Skagway	
1274-20005	April 23, 1973	15	60 09N	138.37W	40	156	Yakutat	
1274-21402	April 23, 1973	5	72.06N	150 16W	30	174	N. of Harrison Bay	
1274-21420	April 23, 1973	10	66 56N	158.10W	35	165	Shungnak	
1274-21422	April 23, 1973	0	65 36N	159 40W	36	163	Candle, Kateel R	
1274-21425	April 23, 1973	0	64 15N	161 02W	37	161	Norton Bay	
1275-20061	April 24, 1973	[illegible]	61.31N	139.01W	40	158	North of Mt St Elias	
1275-20063	April 24, 1973	20	60 09N	140.04W	41	156	Mt. St Elias	
1275-21483	April 24, 1973	0	64 14N	162 28W	37	161	Norton Bay	
1276-21542	April 25, 1973	0	61.14N	163 53W	38	161	Soloman	
1276-21544	April 25, 1973	0	62.53N	163 08W	39	160	Black - Kwiguk	
1276-21551	April 25, 1973	0	61 30N	166 16W	40	158	Hooper Bay	
1276-21553	April 25, 1973	10	60 08N	167 20W	41	156	Nunivak Island	
1277-21584	April 26, 1973	0	68.18N	160 48W	35	167	Misnoguk Mtns	
1277-22000	April 26, 1973	0	64 18N	165 19W	38	161	Nome, Soloman	
1277-22002	April 26, 1973	0	62.56N	166 34W	39	160	Black	
1277-22005	April 26, 1973	10	61.31N	167.42W	40	158	Hooper Bay	
1277-22011	April 26, 1973	0	60 11N	168 45W	41	156	Bering Sea	
1279-20265	April 28, 1973	5	68 19N	137 45W	35	167	East of Table Mts	
1279-20272	April 28, 1973	15	67 00N	139.26W	36	165	East of Coleen	
1279-20274	April 28, 1973	15	65 40N	140 56W	37	163	Charley River	
1279-20281	April 28, 1973	0	64 19N	142 18W	39	161	Eagle	

1279-22090	April 28, 1973	0	72 11N	157 18W	32	175	Barrow	
1279-22092	April 28, 1973	5	70 55N	159 39W	33	172	Wainwright, Meade River	
1279-22113	April 28, 1973	5	64 19N	168.10W	39	161	Bering Sea - Ice	
1279-22115	April 28, 1973	10	62.58N	169 25W	40	160	St Lawrence Island - Ice	
1280-20330	April 29, 1973	20	66.59N	140 51W	37	165	East of Black River	C
1280-20333	April 29, 1973	0	65.39N	142 21W	38	163	Charlie River	C
1280-20335	April 29, 1973	0	61 18N	143.43W	39	161	Delta - Eagle	C
1283-20495	May 2, 1973	0	68 16N	143 35W	36	167	Table Mtn	
1283-20502	May 2, 1973	0	66.58N	145 14W	28	165	Ft. Yukon	C
1283-20504	May 2, 1973	5	65.37N	146.44W	39	163	Circle	C
1283-20513	May 2, 1973	15	62.55N	149 22W	41	159	Talkeetna Mtns	C
1284-20551	May 3, 1973	10	69 34N	143.12W	36	170	Demarcation Point	C
1284-20553	May 3, 1973	0	68.15N	145.02W	37	167	Arctic	C
1284-20560	May 3, 1973	0	66 56N	156 41W	38	165	Ft Yukon	C
1284=20562	May 3, 1973	0	65.35N	148.11W	39	163	Livengood	C
1284-20565	May 3, 1973	0	64.15N	159.33W	40	161	McKinley	C
1284-20571	May 3, 1973	25	62.53N	150.47W	41	159	Talkeetna	C
1285-21014	May 4, 1973	20	66 59N	148.02W	38	165	Beaver	C
1285-21021	May 4, 1973	5	65.39N	149 32W	39	163	Livengood	C
1285-21023	May 4, 1973	3	64.18N	150.54W	40	161	Kantishna River	C
1288-21210	May 7, 1973	3	60.12N	158 42W	45	156	Taylor Mtns	
1288-21212	May 7, 1973	1	58.49N	159 41W	46	154	Hagemeister Island, Nushagak Bay	
1291-21363	May 10,1973	5	65.35N	158.15W	41	163	Kateel River	C
1291-21370	May 10, 1973	5	64 14N	159 38W	42	161	Norton Bay, Nulato	C
1291-21372	May 10, 1973	5	62.52N	160.53W	43	159	Kwiguk, Holy Cross	C
1291-21375	May 10, 1973	5	61 30N	162.02W	44	157	Marshall, Russian Mission	C
1291-21381	May 10, 1973	10	60.07N	163.05W	45	155	Kuskokwim	
1293-21482	May 12, 1973	15	64.15N	162.27W	43	161	Norton Bay	
1293-21491	May 12, 1973	10	61.32N	164.50W	45	157	Marshall	
1293-21494	May 12, 1973	10	60 10N	165.53W	46	155	Nunivak Island	
1293-21500	May 12, 1973	10	58.47N	166.51W	47	153	Bering Sea	
1294-20121	May 13, 1973	10	60.08N	141.31W	46	155	Icy Bay	
1294-21541	May 13, 1973	0	64.14N	163.56W	43	161	Soloman	
1294-21543	May 13, 1973	10	62 53N	165.10W	44	159	Black	
1294-21550	May 13, 1973	0	61.31N	166.18W	45	157	Hooper Bay	
1294-21552	May 13, 1973	0	60 08N	167 21W	46	155	Nunivak Island	
1295-20161	May 14, 1973	0	65 38N	138.11W	42	163	East of Charley River	
1295-20163	May 14, 1973	0	64.17N	139.33W	43	161	East of Eagle	
1295-21572	May 14, 1973	0	72.09N	154 34W	36	175	North of Teshekpuk	
1295-21575	May 14, 1973	5	70 53N	156 55W	37	172	Meade River	
1295-21581	May 14, 1973	5	69.35N	158 59W	38	169	Ututok River, Lookout Ridge	
1295-21584	May 14, 1973	15	68.17N	160 50W	40	167	Misheguk Mtn	
1298-20323	May 17, 1973	0	68.19N	139.15W	40	167	East of Table Mtn	C
1298-20325	May 17, 1973	2	67.00N	140.55W	41	165	Coleen, Black River	
1299-22224	May 18, 1973	2	64.18N	171 03W	44	161	Siberia, Bering Straits	
1300-20460	May 19, 1973	25	61.35N	149.01W	46	157	Anchorage	D
1300-22262	May 19, 1973	0	70.56N	164.02W	38	172	Point Lay	
1300-22265	May 19, 1973	0	69.39N	166.07W	40	169	Point Hope	C
1300-22271	May 19, 1973	5	68 28N	167.58W	41	67	Point Hope	C
1300-22274	May 19, 1973	20	67 01N	169.37W	42	165	Chukchi Sea	
1300-22280	May 19, 1973	15	65 41N	171.07W	43	163	Chukotsch Penn.	C
1304-21063	May 23, 1973	2	69 36N	146 04W	40	169	Mt. Michelson	C
1305-21115	May 24, 1973	5	70.52N	145.31W	39	172	Flaxman Is	
1305-21121	May 24, 1973	20	69.35N	147.35W	41	169	Sagavanirktok, Mt Michelson	
1305-21133	May 24, 1973	0	65.36N	152.36W	44	162	Tanana	
1307-19434	May 26, 1973	0	58 46N	135.17W	50	152	Juneau	C
1307-21231	May 26, 1973	3	70 53N	148 15W	40	172	Beechey Point	D+C
1308-21290	May 27, 1973	0	70 55N	149 37W	40	172	Beechey Point	D
1308-21292	May 27, 1973	0	69 38N	151 41W	41	169	Umiat	D
1308-21295	May 27, 1973	5	68 20N	153 32W	42	167	Killik River, Chandler	
1308-21301	May 27, 1973	5	67 00N	155 12W	43	164	Survey Pass, Hughes	
1308-21310	May 27, 1973	15	64.19N	158 05W	46	160	Nulato	
1308-21313	May 27, 1973	20	62.57N	159 21W	47	158	Holy Cross, Iditarod	
1311-21472	May 30, 1973	0	66 57N	159 41W	44	164	Selawik, Shungnak	C
1311-21475	May 30, 1973	20	65 36N	161 10W	45	162	Selawik	C
1311-21481	May 30, 1973	0	64 15N	162 30W	46	160	Soloman, Norton Bay	C
1312-20113	May 31, 1973	20	61 32N	140 28W	48	156	McCarthy & East	C
1312-21521	May 31, 1973	0	68.18N	159 24W	43	166	Misheguk Mtn, Howard Pass	C
1312-21531	May 31, 1973	0	66 58N	161 04W	44	164	Misheguk Mtn	C
1312-21533	May 31, 1973	20	65 37N	162.34W	45	162	Bendelben, Candle	C
1313-21582	June 1, 1973	0	68 16N	160 54W	43	166	Misheguk Mtn	C
1313-21585	June 1, 1973	5	66 57N	162 3[illegible]W	44	164	Kotzebue	C
1314-22011	June 2, 1973	5	68 18N	162 17W	43	166	DeLong Mtn, Misheguk	

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

1314-22013	June 2, 1973	0	66 59N	163.55W	44	164	Kotzebue	C
1317-20374	June 5, 1973	0	69.38N	138 56W	42	168	Canada, Herschel Island	
1317-22203	June 5, 1973	0	70.55N	162 38W	41	171	Wainwright	
1318-20432	June 6, 1973	20	69 38N	140.20W	42	168	Herschel Island	C
1323-19320	June 11, 1973	15	58.49N	132.26W	51	150	Taku River	C
1326-21284	June 14, 1973	0	70.50N	149 51W	42	170	Beechey Point	C + D
1326-21291	June 14, 1973	5	69.32N	151.55W	43	168	Umiat	D
1326-21305	June 14, 1973	5	64 12N	158 14W	47	158	Nulato	
1326-21311	June 14, 1973	5	62 50N	159 28W	48	156	Holy Cross	C
1328-20004	June 16, 1973	20	58.42N	139 38W	52	150	Yakutat	
1328-21413	June 16, 1973	5	66.54N	158 15W	45	163	Shungnak	
1328-21415	June 16, 1973	1	65.33N	159 44W	46	160	Candle - Kateel	
1328-21422	June 16, 1973	0	64 12N	161 05W	47	158	Norton Bay	
1329-21455	June 17, 1973	20	70.51N	154.04W	42	170	Teshekpuk	C
1329-21462	June 17, 1973	3	69.33N	156.08W	43	167	Lookout Ridge	C
1329-21464	June 17, 1973	3	68.15N	157 57W	44	165	Howard Pass	
1329-21471	June 17, 1973	0	66.55N	159 36W	45	163	Selawik	C
1329-21473	June 17, 1973	10	65 35N	161.06W	46	160	Candle	C
1330-21523	June 18, 1973	5	68.13N	159.32W	44	165	Misheguk Mtn, Howard Pass	C
1330-21525	June 18, 1973	0	66 52N	161.13W	45	162	Selawik	C + D
1334-22155	June 22, 1973	5	66.54N	166 52W	45	162	Shishmaref	C
1334-22161	June 22, 1973	0	65 34N	168.22W	46	160	Teller	C
1334-22164	June 22, 1973	0	64 13N	169 44W	47	158	St. Lawrence	C
1335-22201	June 23, 1973	10	70.51N	162 45W	42	170	Wainwright	
1335-22215	June 23, 1973	2	65 34N	169.48W	46	160	Teller, Little & Big Diomede	C
1335-22222	June 23, 1973	2	64.13N	171.09W	47	158	St. Lawrence Island	C
1335-22224	June 23, 1973	0	62.51N	172.23W	48	155	St. Lawrence Island	C
1335-22231	June 23, 1973	5	61.30N	173.31W	50	153	St. Matthews	
1336-20440	June 24, 1973	10	66.51N	143 56W	45	162	Black River	C
1336-22262	June 24, 1973	15	69.29N	166 17W	43	187	Point Hope	
1336-22274	June 24, 1973	1	65.30N	171.13W	46	160	Siberia	
1336-22280	June 24, 1973	0	64.09N	172 34W	47	157	Siberia, St Lawrence	
1337-22330	June 25, 1973	0	66.54N	171 10W	45	162	Siberia	C
1337-22332	June 25, 1973	0	65.34N	172 40W	46	160	Siberia	C
1337-22335	June 25, 1973	0	64.12N	174.02W	47	157	Siberia	C
1339-20595	June 27, 1973	20	70.50N	142 43W	42	169	Barter Island	
1339-22424	June 27, 1973	0	72.06N	166.07W	41	172	Chukchi Sea	
1339-22431	June 27, 1973	0	70.51N	168.27W	42	169	Chukchi Sea	
1339-22433	June 27, 1973	0	69.33N	170.32W	43	167	Chukchi Sea	
1339-22440	June 27, 1973	0	68.15N	172 22W	44	164	Chukchi Sea	
1339-22442	June 27, 1973	0	66.55N	174 01	45	162	Siberia	
1341-21130	June 29, 1973	10	65.33N	152 39W	46	159	Tanana	C
1341-21135	June 29, 1973	20	62.49N	155.14W	48	155	McGrath	C
1341-21141	June 29, 1973	5	61.28N	156.23W	49	153	Sleetmute, Lime Hills	C
1341-21144	June 29, 1973	5	60.03N	157.05W	50	151	Taylor Mts.	
1342-21170	June 30, 1973	15	70.49N	147.01W	42	196	Beechey Pt., Flaxman Is.	C
1342-21173	June 30, 1973	15	69.31N	149 04W	43	166	Sagavanirktok	C + D
1342-21191	June 30, 1973	10	64.11N	155.23W	47	157	Ruby	C
1342-21193	June 30, 1973	20	62.49N	156.37W	48	155	Iditarod, McGrath	C
1344-21283	July 2, 1973	0	70 49N	149 53W	42	169	Beechey Point	C + D
1344-21290	July 2, 1973	2	69.31N	151 57W	43	166	Umiat	C
1344-21292	July 2, 1973	0	68.12N	153 47W	44	164	Chandler Lake	C
1345-21342	July 3, 1973	5	70.44N	151.30W	41	169	Harrison Bay	C
1345-21344	July 3, 1973	20	69 27N	153.33W	43	166	Ikpikpuk River	C
1345-21351	July 3, 1973	10	68.08N	155.22W	44	164	Killik River	C
1345-21353	July 3, 1973	10	66 48N	157 00W	45	161	Shungnak	C
1345-21360	July 3, 1973	15	65.28N	158 28W	46	159	Kateel River	C
1345-21362	July 3, 1973	10	64.07N	159.48W	47	157	Norton Bay, Nulato	C
1346-21420	July 4, 1973	20	64.07N	161.10W	47	157	Norton Bay	
1346-21425	July 4, 1973	20	61.24N	163.31W	49	153	Marshall	C
1349-21564	July 7, 1973	0	71.59N	154 54W	40	172	Barrow	
1350-20223	July 8, 1973	2	61.24N	143.26W	48	153	McCarthy	C
1351-20275	July 9; 1973	10	62.41N	143.48W	47	155	Nabesna	D
1351-20282	July 9, 1973	5	61 19N	144 56W	48	152	Valdez, McCarthy	C + D
1352-20333	July 10, 1973	5	62.41N	145 11W	47	155	Gulkara	C + D
1352-20310	July 10, 1973	10	61.22N	146 21W	48	153	Valdez	
1352-20342	July 10, 1973	15	60 00N	147.23W	49	150	Seward, Cordova	
1354-22275	July 12, 1973	20	64 08N	172.39W	46	157	Siberia, St Lawrence Island	
1356-20540	July 11, 1973	0	70 41N	141.22W	40	168	Barter Island	
1358-19262	July 16, 1973	2	57.11N	131 58W	50	147	East of Sumdum	
1358-19264	July 16 1973	0	55 51N	132 19W	51	145	Craig, Ketchikan	C + D
1358-19271	July 16, 1973	0	54 27N	133.37W	52	142	Dixon Entrance	C
1358-21052	July 16, 1973	20	70 11N	114.18W	40	168	Flaxman Island	

1358-21073	July 16, 1973	20	64.07N	152.32W	45	157	Kantishna River	C
1358-21075	July 16, 1973	2	62.46N	153 45W	46	155	McGrath	C
1358-21082	July 16, 1973	20	61.21N	154 53W	47	153	Lime Hills	
1362-21305	July 20 1973	5	62.43N	159 31W	46	155	Holy Cross, Iditarod	C
1363-21354	July 21, 1973	0	65 25N	158.32W	43	159	Kateel River	C
1363-21363	July 21, 1973	0	62.43N	161.04W	45	155	Holy Cross	C
1363-21370	July 21, 1973	15	61.20N	162.10W	46	153	Russian Mission	C
1365-20051	July 23, 1973	20	61.21N	139 07W	46	153	Burwash Landing	C
1370-20314	July 28, 1973	10	68 07N	139.35W	40	163	E. of Table Mtn	
1374-19150	August 1, 1973	0	55.47N	129 59W	48	146	East of Ketchikan	C
1375-20595	August 2, 1973	10	69.24N	144.57W	37	166	Flaxman Island	D
1375-21002	August 2, 1973	15	68 05N	146 46W	38	164	Arctic	D
1384-21533	August 11, 1973	5	62.39N	165.14W	40	156	Black, Kwiguk	
1386-22031	August 13, 1973	15	68.03N	162.32W	35	164	DeLong Mts.	
1387-20275	August 14, 1973	15	61.20N	144.54W	41	155	Valdez	D
1387-20281	August 14, 1973	0	59 58N	145 56W	42	153	Cordova, Middleton Is.	C + D
1387-20284	August 14, 1973	0	58.35N	146.54W	43	152	Gulf of Alaska	
1387-22090	August 14, 1973	5	68.04N	163 58W	35	165	DeLong Mt.	C
1387-22095	August 14, 1973	20	65.22N	167.05W	37	160	Teller	C
1388-20333	August 15, 1973	2	61.20N	146 18W	40	155	Valdez	C + D
1388-20335	August 15, 1973	3	59.58N	147 20W	41	153	Blying Sound	D
1388-20342	August 15, 1973	0	58.35N	148.18W	42	152	Gulf of Alaska	
1389-20364	August 16, 1973	15	69.23N	139.06W	33	167	Herschel Is.	
1389-20373	August 16, 1973	10	66.45N	142.32W	36	163	Black River	C
1389-20380	August 16, 1973	20	65.25N	144.00W	37	161	Circle	
1389-20394	August 16, 1973	5	59.59N	148.45W	41	154	Seward	D ~ C
1390-20450	August 17, 1973	10	61.22N	149.09W	40	156	Anchorage	C + D
1390-20452	August 17, 1973	0	60.00N	150.12W	41	154	Kenai	C + D
1392-19145	August 19, 1973	5	55.49N	129 59W	43	149	East of Ketchikan	C
1392-19151	August 19 1973	0	54.24N	130 46W	44	148	SE, Prince Rupert	C
1396-21162	August 23, 1973	20	70 41N	147.08W	30	170	Beechey Pt , Flaxman Island	D + C
1396-21165	August 23, 1973	20	69.24N	149.09W	31	168	Sagavanirktok	
1406-20320	September 2, 1973	10	65 29N	142.29W	31	163	Charley River	—
1406-20334	September 2, 1973	3	60.01N	147.15W	35	157	Seward, Cordova	C
1406-20340	September 2, 1973	10	58 38N	148.14W	36	155	Gulf of Alaska	
1406-22131	September 2, 1973	5	72.02N	159.04W	25	174	Arctic Ocean	
1406-22142	September 2, 1973	20	68.09N	165.14W	29	167	Point Hope	
1406-22145	September 2, 1973	5	66.50N	166.53W	30	165	Shishmaref	
1407-20371	September 3, 1973	20	66.49N	142 28W	29	165	Black River	D
1407-20374	September 3, 1973	2	65.28N	143.57W	31	163	Charley River	C + D
1407-20380	September 3, 1973	15	64 07N	145.17W	32	161	Delta	C + D
1407-20383	September 3, 1973	20	62.46N	146.31W	33	160	Gulkana	D
1407-22191	September 3, 1973	60	70.44N	162.44W	26	171	Wainwright, clds over water, land clear	
1407-22194	September 3, 1973	15	69.27N	164.46W	29	169	Point Lay	
1407-22200	Sept 3, 1973	20	68.08N	166.35W	28	167	Point Hope, clds over water, land clear	
1408-20423	Sept. 4, 1973	15	68.08N	142.12W	28	167	Table Mt.	
1408-20430	Sept. 4, 1973	0	66.49N	143 51W	29	165	Black River	C + D
1408-20432	Sept. 4, 1973	20	65.29N	145.20W	30	163	Circle	C
1408-20435	Sept. 4, 1973	5	64.07N	146.42W	31	162	Fairbanks - Delta	C + D
1411-21003	Sept 7, 1973	5	65.28N	149 37W	29	164	Livengood	C + D
1412-21082	Sept. 8, 1973	10	58.38N	156.47W	34	156	Naknek	
1413-21113	Sept. 9, 1973	20	66.49N	151.02W	27	166	Bettles	D
1413-21120	Sept. 9, 1973	20	65 29N	152.31W	28	164	Tanana	C + D
1413-21134	Sept 9, 1973	5	60.02N	157 18W	33	158	Taylor Mts. - Lake Clark	C
1414-21162	Sept 10, 1973	15	69.28N	149.00W	25	170	Sagavanirktok	
1415-19421	Sept 11, 1973	20	58 37N	135 15W	33	157	Juneau	
1415-19424	Sept. 11, 1973	0	57.13N	136.10W	35	156	Sitka	
1416-19473	Sept 12, 1973	0	60.01N	135 49W	32	158	Skagway	
1416-19480	Sept 12, 1973	0	58 36N	136.47W	33	157	Mt. Fairweather	C
1416-19482	Sept. 12, 1973	5	57.11N	137.41W	34	156	Sitka, Gulf of Alaska	
1417-19525	Sept 13, 1973	0	61.22N	136.08W	30	160	Canada, Lake LeBarge, etc.	
1417-19531	Sept. 13, 1973	0	59.59N	137.11W	32	159	Skagway	
1417-19534	Sept. 13, 1973	0	58 37N	138.09W	33	157	Mt. Fairweather	
1419-20035	Sept 15, 1973	0	62 44N	137.54W	29	162	Canada, E of Tanacross	
1419-20041	Sept. 15, 1973	0	61 21N	139.01W	30	160	Mt. St. Elias	C
1420-20093	Sept 16, 1973	1	62.47N	139 17W	28	162	E. of Nabesna	C
1422-20201	Sept. 18, 1973	0	65 33N	139 33W	25	165	E. of Charley River	
1422-20203	Sept. 18, 1973	0	64.12N	[illegible]0 55W	26	164	Eagle	C + D
1422-20210	Sept. 18, 1973	0	62.51N	112 09W	27	162	Nabesna	C
1422-20212	Sept 18, 1973	0	61 28N	143 17W	29	161	McCarthy	C + D
1422-20215	Sept. 18, 1973	20	60 05N	114 19W	30	160	Cordova, Bering Glacier, land clear	C
1423-20252	Sept. 19, 1973	5	66.55N	139 21W	23	167	E of Black River	
1423-20255	Sept 19, 1973	0	65 31N	140.51W	25	166	Charley River	D + C
1423-20261	Seot 19, 1973	5	64 13N	142.13W	26	164	Fagle	D + C
1423-20264	Sept 19, 1973	20	62 51N	143.28W	27	162	Nabesna	
1423-20270	Sept 19, 1973	5	61.29N	144 27W	28	161	Valdez, McCarthy	
1421-20340	Sept 20 1973	2	57 21N	118 55W	31	157	Gulf of Alaska	
1426-20153	Sept. 22, 1973	20	57 18N	151 50W	30	158	Kodial	
1427-20511	Sept 23, 1973	10	57 20N	153 19W	30	158	Karlul , Kodial	C
1428-20551	Sept [illegible]4, 1973	20	62 50N	150 38W	25	163	Tallcetna	
1?78-205?4	Sept. 21, 1973	2	61.27N	151 17W	26	162	Tyonel	C + D

1428-20560	Sept. 24, 1973	0	60.05N	152.50W	27	161	Kenai	
1428-20563	Sept 24, 1973	0	58 42N	153.50W	29	159	Mt. Katmai, Afognak	
1428-20565	Sept 28, 1973	1	57 19N	154 45W	30	158	Karluk, Kodiak	
1432-21160	Sept. 28, 1973	0	69.30N	148 44W	18	172	Sagavanirktok	D
1434-19170	Sept 30, 1973	0	60 04N	135.36W	25	162	Skagway	C
1434-19173	Sept 30, 1973	10	58 41N	136.35W	26	160	Mt. Fairweather	C
1434-19475	Sept 30, 1973	10	57 18N	137.30W	28	159	Sitka	
1439-21565	Oct 5, 1973	3	66 52N	162.18W	17	169	Kotzebue, Selawik	
1440-22021	Oct. 6, 1973	0	68 10N	162.06W	16	171	DeLong Mt.	
1440-22023	Oct 6, 1973	5	66 50N	163 46W	17	169	Kotzebue	
1441-20270	Oct 7, 1973	20	60.01N	145.40W	23	162	Cordova	
1441-22072	Oct 7, 1973	10	69 26N	161 44W	14	173	Utukok River	
1441-22075	Oct. 7, 1973	0	68 07N	163 33W	15	171	DeLong Mt.	
1441-22081	Oct 7, 1973	10	66 48N	165.11W	17	169	Kotzebue, Shishmaref	
1442-20310	Oct 8, 1973	5	65 30N	142 16W	17	168	Charley River	
1442-22131	Oct. 8, 1973	20	69.28N	163 12W	14	173	Point Lay	
1443-20385	Oct. 9, 1973	5	58.44N	149 25W	23	162	Tip of Seldovia	
1446-20562	Oct. 12, 1973	20	57.21N	154 35W	23	161	Karluk	
1449-21094	Oct. 15, 1973	20	69.34N	147 03W	11	173	Mt Michelson	
1449-21101	Oct 15, 1973	0	68 15N	149 02W	12	172	Philip Smith Mt.	
1449-21103	Oct. 15, 1973	10	66.56N	150.41W	14	170	Wiseman	
1449-21110	Oct. 15, 1973	10	65 36N	152.12W	15	168	Tanana	
1449-21112	Oct. 15, 1973	5	64.15N	153.34W	16	167	Ruby, Kantishna	
1449-21121	Oct. 15, 1973	20	61.32N	155.58W	18	165	Lime Hills	
1449-21130	Oct. 15, 1973	20	58.46N	158 01W	21	162	Dillingham	
1449-21133	Oct. 15, 1973	10	57.22N	158.55W	22	161	Ugashik	
1449-21135	Oct 15, 1973	60	55.58N	159.46W	23	160	Chignik, crater clear	
1451-19411	Oct. 17, 1973	15	58.45N	135 02W	20	163	Juneau	
1451-19414	Oct. 17, 1973	5	57.21N	135.57W	21	162	Sitka	
1455-20034	Oct. 21, 1973	20	60 07N	139.46W	18	164	Yakutat	D
1455-20040	Oct. 21, 1973	5	58.44N	140 45W	19	163	Gulf of Alaska	
1455-21442	Oct. 21, 1973	1	68.13N	157 36W	10	172	Howard Pass	
1455-21445	Oct. 21, 1973	20	66.54N	159.16W	11	170	Selawik	
1456-20092	Oct. 22, 1973	5	60.08N	141.13W	17	164	Bering Glacier	
1457-20144	Oct. 23, 1973	0	61.28N	141.34W	16	165	McCarthy	
1457-20150	Oct. 23, 1973	0	60.06N	142.37W	17	164	Bering Glacier	
1458-20191	Oct 24, 1973	0	65 33N	139 15W	12	169	E. of Charley River	
1458-20202	Oct. 24, 1973	0	61.28N	143 01W	15	165	McCarthy	
1458-20205	Oct. 24, 1973	15	60.06N	144.05W	17	164	Cordova	
1459-20260	Oct 25, 1973	20	61 28N	144 27W	15	165	Valdez, McCarthy	
1460-20303	Oct. 26, 1973	1	65.30N	142.13W	11	169	Charley River	
1461-20353	Oct. 27, 1973	10	68.11N	140.30W	08	172	Table Mt.	
1461-20362	Oct. 27, 1973	10	65 30N	143 38W	11	169	Charley River	
1461-20364	Oct. 27, 1973	15	64 09N	144.59W	12	168	Big Delta	D
1464-20554	Oct. 30, 1973	2	58.39N	153 43W	16	164	Afognak	
1465-19185	Oct. 31, 1973	15	55.53N	131 05W	18	162	Ketchikan	
1465-20591	Oct. 31, 1973	20	65.30N	149.21W	09	169	Livengood, Fairbanks	
1465-21003	Oct. 31, 1973	10	61 26N	153 07W	13	166	Lime Hills	
1466-19244	Nov 1, 1973	10	55 54N	132 30W	18	162	Craig	
1466-21061	Nov. 1, 1973	15	61.26N	154.32W	13	166	Lake Clark	
1466-21064	Nov. 1, 1973	10	60.04N	155.35W	14	165	Lake Clark	
1467-19300	Nov 2, 1973	0	57.14N	133.08W	16	163	Sumdum	
1467-19302	Nov. 2, 1973	0	55.51N	133.58W	17	162	Craig	
1467-21104	Nov. 2, 1973	5	65.28N	152 16W	09	169	Tanana	
1467-21111	Nov. 2, 1973	0	64.08N	153.37W	10	168	Ruby, Kantishna R.	
1467-21113	Nov. 2, 1973	20	62.46N	154.52W	20	167	McGrath	
1467-21120	Nov. 2, 1973	5	61.24N	156W	12	166	Sleetmute, Lime Hills	
1468-19352	Nov. 3, 1973	5	58 38N	133.41W	15	164	Taku River	
1468-19354	Nov. 3, 1973	0	57.15N	134 35W	16	163	Sitka	
1468-19361	Nov 3, 1973	0	55.49N	135.20W	17	162	Sitka	
1468-21163	Nov. 3, 1973	0	65.30N	153 46W	08	169	Melozitna	
1468-21165	Nov. 3, 1973	10	64 09N	155 07W	10	168	Medfra	
1468-21190	Nov. 3, 1973	10	57.16N	160 26W	16	161	Chignik	
1469-19404	Nov. 4, 1973	10	60.02N	134 09W	13	165	Carcross	
1469-19410	Nov. 4, 1973	15	58.39N	135.07W	14	164	Juneau	
1469-19413	Nov. 4, 1973	0	57.15N	136 00W	15	163	Sitka	
1469-21221	Nov. 4, 1973	0	65 29N	155 08W	08	169	Melozitna	
1469-21224	Nov. 4, 1973	5	64.08N	15?.30W	09	168	Nulato - Ophir	
1469-21230	Nov. 4, 1973	5	62.47N	157 45W	11	167	Iditarod	
1469-21233	Nov. 4, 1973	20	61.25N	158 55W	12	166	Sleetmute	
1470-21285	Nov 5, 1973	10	62.46N	159 09W	10	167	Iditarod	
1470-21294	Nov 5, 1973	3	60 02N	161 22W	13	165	Bethel	
1471-19520	Nov 6, 1973	0	60.03N	137 00W	12	165	Skagway	
1472-19572	Nov 7, 1973	0	61.23N	137.25W	11	166	Haines Junction	
1472-19575	Nov 7, 1973	0	60 00N	138 27W	12	165	Yakutat	
1474-20092	Nov. 9, 1973	0	59 58N	141 17W	12	165	Bering Glacier, Icy Bay	
1477-20260	Nov 12 1973	0	61.20N	144.3?W	10	166	McCarthy	
1477-20263	Nov 12, 1973	0	59 58N	145 38W	11	165	Cordova	
1477-20265	Nov. 12, 1973	0	58 35N	146 36W	12	164	Gulf of Alaska	
1478-20315	Nov 13, 1973	0	61 19N	146 03W	09	166	Valdez	
1478-20321	Nov 13, 1973	10	59 57N	147 06W	11	165	Blying Sound	
1479-20373	Nov. 14, 1973	0	61.19N	147 31W	09	166	Valdez, Anchorage	D
1479-20380	Nov 14, 1973	5	59 56N	148.34W	10	165	Blying Sound	
1483-19145	Nov 18, 1973	20	55 43N	131 13W	13	162	Ketchikan	

ORIGINAL PAGE IS OF POOR QUALITY

1535-19062	January 9, 1974	0	55.45N	128 22W	09	158	East of Ketchikan
1555-19171	January 29, 1974	10	55.55N	131.07W	13	155	Ketchikan
1555-19173	January 29, 1974	10	54 31N	131.55W	14	154	Prince Rupert
1555-20591	January 29, 1974	0	60.04N	154 12W	10	158	Illiamna
1555-20593	January 29, 1974	0	58.41N	155 11W	11	157	Mt Katmai
1556-19222	January 30, 1974	0	57 20N	131 41W	12	156	East of Sumdum
1556-19225	January 30, 1974	3	55.57N	132 32W	13	155	Craig
1560-21274	February 3, 1974	10	60 07N	161 16W	11	157	Bethel
1560-21280	February 3, 1974	20	58 44N	162 15W	12	156	Hagemeister Island
1565-21525	February 8, 1974	0	70.54N	156 31W	03	168	Barrow
1565-21532	February 8, 1974	5	69 37N	158 37W	04	166	Lookout Ridge
1565-21534	February 8, 1974	20	68 18N	160 29W	06	164	Misheguk Mt
1565-21541	February 8, 1974	10	66.59N	162.07W	07	163	Selawik - Noatak
1565-21543	February 8, 1974	5	65.39N	163 38W	08	162	Bendeleben
1565-21550	February 8, 1974	0	64.18N	164 59W	09	160	Nome - Solomon
1565-21552	February 8, 1974	5	62.57N	166.14W	10	159	Black
1565-21555	February 8, 1974	20	61 35N	167.23W	11	158	Hooper Bay
1566-21593	February 9, 1974	20	68 17N	161.54W	06	164	Misheguk Mt
1566-21595	February 9, 1974	0	66.58N	163 33W	07	163	Noatak - Kotzebue
1566-22002	February 9, 1974	10	65 37N	165 03W	08	161	Bendleben
1567-22051	February 10, 1974	5	68.18N	163.18W	06	164	DeLong Mt.
1567-22053	February 10, 1974	20	66.59N	164.59W	07	163	Kotzebue
1567-22060	February 10, 1974	0	65.39N	166.29W	08	161	Teller
1567-22062	February 10, 1974	0	64 18N	167.51W	10	160	Nome
1567-22065	February 10, 1974	3	62.56N	169 06W	11	159	St. Lawrence Is
1568-22123	February 11, 1974	0	62.55N	170 35W	11	159	St. Lawrence Is
1573-20580	February 16, 1974	10	62.51N	151 59W	13	159	Mt McKinley - Talkeetna
1573-20582	February 16, 1974	2	61.29N	153 01W	14	157	Lime Hills - Tyonek
1574-21031	February 17, 1974	0	64 15N	152 10W	12	160	Kantishna River
1574-21034	February 17, 1974	5	62.54N	153.25W	13	158	McGrath
1574-21040	February 17, 1974	0	61 32N	154.34W	14	157	Lime Hills
1574-21043	February 17, 1974	2	60 09N	155.36W	15	156	Lake Clark
1575-21090	February 18, 1974	0	6[illegible] 12N	153.37W	12	160	Kantishna River
1575-21092	February 18, 1974	0	6[illegible] [illegible]N	154.52W	13	158	McGrath
1575-21095	February 18, 1974	0	61 [illegible]N	156.00W	15	157	Sleetmute - Lime Hills
1575-21101	February 18, 1974	0	60 [illegible]N	157 04W	16	156	Taylor Mts
1575-21104	February 18, 1974	0	58 43N	158.02W	17	155	Nushagak Bay
1576-21135	February 19, 1974	0	66.56N	152.10W	10	162	Bettles
1576-21142	February 19, 1974	0	65.35N	153.39W	12	161	Melozitna
1576-21144	February 19, 1974	0	64.14N	154.59W	13	160	Ruby
1576-21151	February 19, 1974	0	62 52N	156.14W	14	158	Iditarod - McGrath
1576-21153	February 19, 1974	0	61 31N	157 23W	15	157	Sleetmute
1576-21160	February 19, 1974	0	60.08N	158.27W	16	156	Taylor Mts.
1576-21162	February 19, 1974	5	58.46N	159.27W	17	155	Nushagak Bay
1577-21191	February 20, 1974	0	68.16N	151 54W	10	164	Chandler Lake
1577-21193	February 20, 1974	0	66.57N	153.34W	11	162	Hughes
1577-21200	February 20, 1974	0	65.36N	155.05W	12	161	Melozitna
1577-21202	February 20, 1974	0	64.15N	156 27W	13	160	Nulato - Ruby
1577-21205	February 20, 1974	0	62.53N	157.41W	14	158	Ophir - Iditarod
1577-21211	February 20, 1974	0	61.31N	158.50W	15	157	Sleetmute
1577-21214	February 20, 1974	2	60 09N	159.53W	16	156	Taylor Mts.
1577-21220	February 20, 1974	5	58.46N	160 52W	17	155	Hagemeister Island
1578-21245	February 21, 1974	0	68.17N	153 18W	10	164	Killik River
1578-21252	February 21, 1974	0	66.58N	154 58W	11	162	Hughes
1578-21254	February 21, 1974	0	65.38N	156.29W	12	161	Kateel River
1578-21261	February 21, 1974	0	64 17N	157 51W	13	160	Nulato
1578-21263	February 21, 1974	0	62.55N	159.06W	14	158	Iditarod
1578-21270	February 21, 1974	0	61.33N	160.15W	16	157	Russian Mission
1578-21272	February 21, 1974	0	60 11N	161 19W	17	156	Bethel
1578-21275	February 21, 1974	0	58.48N	162.18W	18	155	Hagemeister Island
1578-21281	February 21, 1974	0	57.24N	163 13W	19	154	Bering Strait
1579-21304	February 22, 1974	0	68 16N	154 48W	10	164	Killik River
1579-21310	February 22, 1974	0	66 56N	156 27W	12	162	Shungnak
1579-21313	February 22, 1974	10	65.36N	157 57W	13	161	Kateel River
1579-21315	February 22, 1974	0	64 15N	159 19W	14	160	Norton Bay - Nulato
1579-21322	February 22, 1974	5	62 53N	160 34W	15	158	Holy Cross
1579-21324	February 22, 1974	20	61 31N	161.43W	16	157	Russian Mission
1579-21331	February 22, 1974	25	60 08N	162.47W	17	156	Baird Inlet
1580-21362	February 23, 1974	0	68 16N	156 05W	11	164	Howard Pass - Killik River
1580-21364	February 23, 1974	0	66.57N	157 16W	12	162	Shungnak
1580-21371	February 23, 1974	0	65.37N	159117W	13	161	Candle - Kateel River
1580-21373	February 23, 1974	0	64 16N	160 40W	14	160	Norton Bay
1580-21380	February 23, 1974	0	62 55N	161 56W	15	158	Unalakleet
1580-21382	February 23, 1974	0	61 33N	163 06W	16	157	Marshall
1580-21385	February 23, 1974	5	60.10N	164 09W	17	156	Baird Inlet
1581-21420	February 24, 1974	0	68 17N	157 33W	11	164	Howard Pass
1581-21423	February 24, 1974	0	66 58N	159 13W	12	162	Selawik
1581-21425	February 24 1974	0	65.38N	160 41W	13	161	Candle
1581-21432	February 24, 1974	0	64 17N	162 06W	14	160	Norton Bay
1581-21434	February 24, 1974	5	62 56N	163 21W	16	158	Kwigul

ORIGINAL PAGE IS OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

1581-21443	February 24, 1974	10	60 11N	165.36W	18	156	Nunivak Island
1581-21450	February 24, 1974	0	58.49N	166 36W	19	155	Bering Sea
1582-21474	February 25, 1974	0	68 18N	158 55W	12	164	Howard Pass
1582-21481	February 25, 1974	0	67 00N	160 36W	13	162	Baird Mts.
1582-21483	February 25, 1974	0	65 40N	162 00W	14	161	Bendeleben - Candle
1582-21490	February 25, 1974	0	64.19N	163 32W	15	160	Solomon
1582-21492	February 25, 1974	0	62 57N	164 49W	16	158	Kwiguk
1583-20122	February 26, 1974	20	61.32N	141 40W	17	157	McCarthy
1583-20124	February 26, 1974	0	60.10N	142 43W	18	156	Bering Glacier
1583-21521	February 26, 1974	0	72.07N	154 12W	09	170	Arctic Ocean
1583-21524	February 26, 1974	0	70.51N	156 33W	10	168	Wainwright
1583-21530	February 26, 1974	0	69 34N	158 38W	11	166	Lookout Ridge
1583-21533	February 26, 1974	10	68 16N	160 29W	12	164	Misheguk Mtn
1583-21553	February 26, 1974	5	61.31N	167 28W	17	157	Hooper Bay
1584-20165	February 27, 1974	15	65.37N	139 16W	14	161	East of Charley River
1584-20174	February 27, 1974	2	62.54N	141 52W	17	158	Nabesna
1584-20180	February 27, 1974	10	61 32N	143 02W	18	157	McCarthy
1584-22005	February 27, 1974	10	62.54N	167 40W	17	158	St Lawrence Island
1586-20275	March 1, 1974	0	66 58N	140.38W	14	162	Black River
1586-20281	March 1, 1974	0	65.37N	142 09W	15	161	Charley River
1586-20284	March 1, 1974	0	64.16N	143 32W	16	159	Eagle
1586-20290	March 1, 1974	0	62.55N	144 47W	17	158	Gulkana
1586-20293	March 1, 1974	0	61.33N	145.56W	18	157	Valdez
1586-20295	March 1, 1974	2	60.10N	147.00	20	156	Seward
1586-22095	March 1, 1974	0	70.51N	160 48W	11	168	Wainwright
1586-22101	March 1, 1974	0	69.34N	162 53W	12	166	Point Lay
1586-22104	March 1, 1974	0	68.16N	164.44W	13	164	Point Hope
1586-22110	March 1, 1974	0	66.46N	166.25W	14	162	Shishmaref
1586-22113	March 1, 1974	5	65.36N	167 55W	15	161	Teller
1586-22115	March 1, 1974	15	64.15N	169.17W	16	159	Bering Straits
1587-20330	March 2, 1974	0	68.17N	140.24W	13	164	East of Table Mts
1587-20333	March 2, 1974	0	66.57N	142.04W	15	162	Black River
1587-20335	March 2, 1974	0	65.37N	143.35W	16	161	Charley River
1587-22153	March 2, 1974	0	70 52N	162.17W	11	168	Wainwright
1587-22160	March 2, 1974	0	69 35N	164 22W	12	166	Point Lay
1587-22162	March 2, 1974	0	68 17N	166 14W	13	164	Point Hope
1589-22281	March 4, 1974	5	66.57N	170 42W	15	162	Chukotsch Peninsula
1590-20493	March 5, 1974	0	70.47N	140 54W	12	168	Arctic Ocean
1590-20495	March 5, 1974	0	69.30N	142 59W	14	166	Demarcation Point
1590-20502	March 5, 1974	0	68.12N	144 51W	15	164	Arctic
1590-20504	March 5, 1974	0	66.52N	146.30W	16	162	Fort Yukon
1590-20511	March 5, 1974	0	65 32N	148 00W	17	161	Livengood - Fairbanks
1590-20522	March 5, 1974	20	61.27N	151.45W	20	157	Tyonek
1591-19160	March 6, 1974	5	57 19N	130.18W	24	153	Bradfield Canal
1592-19212	March 7, 1974	0	58 44N	130.50W	23	154	East of Taku River
1592-19215	March 7, 1974	0	57 20N	131.45W	24	153	East of Sumdum
1592-19221	March 7, 1974	0	55.57N	132.36W	25	152	Craig
1592-21005	March 7, 1974	0	70 48N	143.44W	13	168	Barter Island
1592-21012	March 7, 1974	0	69.31N	145.49W	14	166	Mt Michelson
1592-21014	March 7, 1974	0	68 12N	147 40W	15	164	Philip Smith Mtns
1592-21021	March 7, 1974	5	66.53N	149 20W	17	162	Beaver
1592-21023	March 7, 1974	0	65.33N	150.50W	18	161	Tanana, Livengood
1592-21030	March 7, 1974	0	64.12N	152.13W	19	159	Kantishna River
1592-21032	March 7, 1974	15	62.50N	153.28W	20	158	McGrath
1593-19270	March 8, 1974	0	58.43N	132.16W	23	154	Taku River
1593-21063	March 8, 1974	20	70.49N	145.15W	14	168	Flaxman Island
1593-21075	March 8, 1974	0	66.54N	150.49W	17	162	Bettles
1593-21081	March 8, 1974	0	65.34N	152 19W	18	161	Tanana
1593-21084	March 8, 1974	0	64.13N	153.41N	19	159	Ruby - Kantishna River
1593-21090	March 8, 1974	0	62 51N	154 56W	20	158	McGrath
1593-21093	March 8, 1974	0	61.29N	156.04W	21	157	Sleetmute - Lime Hills
1593-21095	March 8, 1974	15	60 06N	157.06W	22	155	Taylor Mts
1594-21122	March 9, 1974	0	70 49N	146.36W	14	168	Flaxman Island
1594-21124	March 9, 1974	0	69.32N	148.41W	15	166	Sagavanirktok
1594-21131	March 9, 1974	0	68.13N	150.33W	16	164	Chandler Lake
1594-21133	March 9, 1974	0	66 53N	152.13W	17	162	Bettles
1594-21140	March 9, 1974	0	65.33N	153 43W	18	161	Melozitna
1594-21142	March 9, 1974	0	64.13N	155.04W	19	159	Ruby
1594-21145	March 9, 1974	0	62 51N	156.18W	21	158	Iditarod
1594-21151	March 9, 1974	0	61.29N	157.27W	22	157	Sleetmute
1594-21154	March 9, 1974	0	60.06N	158.30W	23	155	Taylor Mts
1594-21160	March 9, 1974	0	58 43N	159 29W	24	154	Nushagak Bay
1594-21163	March 9, 1974	0	57 20N	160 24W	25	153	Bristol Bay
1594-21172	March 9, 1974	20	51.33N	162 01W	27	151	False Pass
1595-21180	March 10, 1974	2	70 50N	146 05W	14	168	Beechey Point
1595-21183	March 10, 1974	0	69.33N	150 10W	15	166	Sagavanirktok
1595-21185	March 10, 1974	0	68 11N	152.00W	17	164	Chandler Lake
1595-21192	March 10, 1974	0	66 51N	153 10W	18	162	Hughes
1595-21194	March 10, 1974	0	65 31N	155 10W	19	161	Melozitna
1595-21201	March 10, 1974	0	64 13N	156 31W	20	159	Nulato
1595-21203	March 10, 1974	0	62.52N	157 46W	21	158	Iditarod

ORIGINAL PAGE IS OF POOR QUALITY

1595-21210	March 10, 1974	0	61 30N	158 55W	22	157	Sleetmute
1595-21212	March 10, 1974	0	60 07N	159 58W	23	155	Taylor Mts.
1595-21215	March 10, 1974	0	58 44N	160 57W	24	154	Hagemeister Island
1595-21221	March 10, 1974	0	57 21N	161 52W	25	153	Bristol Bay
1596-21234	March 11, 1974	0	70.16N	149 29W	15	168	Beechey Point
1596-21241	March 11, 1974	5	69 29N	151.33W	16	166	Umiat
1596-21243	March 11, 1974	0	68 10N	153.21W	17	164	Chandler Lake
1596-21250	March 11, 1974	0	66.51N	155 03W	18	162	Hughes
1596-21252	March 11, 1974	0	65 31N	156 34W	19	161	Melozitna
1596-21255	March 11, 1974	0	64.10N	157.55W	20	159	Nulato
1596-21261	March 11, 1974	0	62.49N	159.11W	21	158	Holy Cross
1597-19493	March 12, 1974	0	60.05N	137.02W	24	155	North of Skagway
1597-19500	March 12, 1974	0	58 42N	138 01W	25	154	Mt. Fairweather
1597-21304	March 12, 1974	10	66.55N	156.31W	18	162	Shungnak
1597-21325	March 12, 1974	0	60.08N	162 50W	24	155	Bethel
1598-19551	March 13, 1974	0	60.07N	138.30W	24	155	Yakutat
1598-19554	March 13, 1974	0	58.44N	139.29W	25	154	Yakutat & ocean, land clear
1599-20003	March 14, 1974	0	61.29N	138 50W	24	156	East of McCarthy
1599-21414	March 14, 1974	5	68 15N	157 43W	18	164	Howard Pass
1599-21421	March 14, 1974	0	66.56N	159.23W	19	162	Shungnak
1599-21423	March 14, 1974	0	65 36N	160 53W	20	161	Candle
1599-21430	March 14, 1974	0	64.15N	162.14W	21	159	Solomon
1599-21432	March 14, 1974	0	62.53N	163.29W	23	158	Kwiguk
1599-21435	March 14, 1974	0	61.31N	164 38W	24	157	Marshall
1599-21441	March 14, 1974	0	60 08N	165.41W	25	155	Nunivak Island
1600-20055	March 15, 1974	0	62.52N	139 11W	23	158	East of Nabesna
1600-20062	March 15, 1974	0	61.30N	140.20W	24	156	East of McCarthy
1600-20064	March 15, 1974	0	60 07N	141.23W	25	155	Bering Glacier
1600-20071	March 15, 1974	5	58.45N	142.21W	26	154	Pacific Ocean
1600-21461	March 15, 1974	5	72.07N	152.54W	15	171	Arctic Ocean
1600-21464	March 15, 1974	5	70.51N	155.15W	16	168	Barrow
1600-21473	March 15, 1974	0	68.16N	159.11W	19	164	Misheguk Mt.
1600-21475	March 15, 1974	0	66.56N	160.51W	20	162	Selawik
1600-21482	March 15, 1974	5	65.36N	162.21W	21	161	Bendeleben
1600-21484	March 15, 1974	0	64.15N	163.42W	22	159	Solomon
1600-21491	March 15, 1974	0	62.54N	164.57W	23	158	Kwiguk
1601-20111	March 16, 1974	0	64.15N	139.17W	22	159	East of Eagle
1601-20113	March 16, 1974	0	62.53N	140.32W	23	158	East of Nabesna
1601-20120	March 16, 1974	0	61.31N	141.41W	24	157	McCarthy
1601-20122	March 16, 1974	0	60.09N	142 45W	25	155	Bering Glacier
1601-21515	March 16, 1974	10	72.07N	154.17W	16	171	Arctic Ocean
1601-21522	March 16, 1974	0	70.51N	156.38W	17	168	Barrow
1601-21524	March 16, 1974	0	69.34N	158 43W	18	166	Lookout Ridge
1601-21531	March 16, 1974	0	68 16N	160.36W	19	164	Misheguk Mt.
1601-21533	March 16, 1974	0	66.56N	162.16W	20	162	Noatak
1601-21540	March 16, 1974	0	65.36N	163.46W	21	161	Bendeleben
1601-21542	March 16, 1974	2	64.16N	165.08W	22	159	Nome
1602-21574	March 17, 1974	0	72 08N	155.50W	16	171	Barrow
1602-21580	March 17, 1974	0	70 52N	158.10W	17	168	Meade River
1602-21583	March 17, 1974	0	69.35N	160 15W	18	166	Utukok River
1602-21585	March 17, 1974	0	68.16N	162 05W	19	164	DeLong Mt.
1603-20223	March 18, 1974	25	64.15N	142 10W	23	159	Eagle
1603-20232	March 18 1974	20	61.31N	144.34W	25	156	Valdez
1603-22032	March 18, 1974	0	72.07N	157 08W	16	171	Arctic Ocean
1603-22034	March 18, 1974	0	70 51N	159.34W	18	168	Wainwright
1603-22041	March 18, 1974	0	69.33N	161.39W	19	166	Utukok River
1603-22043	March 18, 1974	2	68.15N	163.29W	20	164	Delong Mt.
1604-20270	March 19, 1974	20	68.08N	139.14W	20	164	East of Table Mt
1604-20275	March 19, 1974	20	65 28N	142 22W	22	161	Charley River
1604-22090	March 19, 1974	0	72.00N	158 50W	17	171	Barrow
1604-22093	March 19, 1974	0	70.44N	161.09W	18	168	Wainwright
1604-22095	March 19, 1974	0	69.27N	163.14W	19	166	Point Lay
1604-22102	March 19, 1974	0	68.09N	165.05W	20	164	Point Hope
1604-22104	March 19, 1974	15	66 49N	166.44W	21	162	Shishmaref
1605-22145	March 20, 1974	0	71.59N	160 14W	17	171	Arctic Ocean
1605-22151	March 20, 1974	0	70.43N	162.34W	18	168	Wainwright
1605-22154	March 20, 1974	0	69 26N	164.38W	20	166	Point Lay
1605-22160	March 20, 1974	10	68.07N	166 28W	21	164	Point Hope
1606-18592	March 21, 1974	0	54 27N	127 44W	32	150	East of Prince Rupert
1606-20380	March 21, 1974	0	69 25N	140.17W	20	166	Herschel Island
1606-22203	March 21, 1974	20	71 58N	161.42W	18	171	N of Wainwright
1607-20432	March 22, 1974	20	70 13N	139.43W	19	168	Arctic Ocean
1607-20435	March 22, 1974	20	69 25N	141 45W	20	166	Demarcation Point
1607-20453	March 22, 1974	0	64 06N	148 02W	25	159	Fairbanks
1608-20191	March 23, 1974	5	70 43N	141 09W	20	168	Arctic Ocean
1608-20193	March 23, 1974	0	69.26N	143 12W	21	166	Barter Island
1609-20513	March 24, 1974	0	70 43N	142.38W	20	168	Barter Island
1609-20551	March 24, 1974	0	69 25N	141 40W	21	166	Mt Michelson
1609-20554	March 2 , 1974	1	68 07N	146 29W	22	164	Arctic
1609-20560	March 24, 1974	20	66 47N	148 07W	23	162	Beaver
1610-21003	March 25 1974	0	70 13N	141 01W	20	168	Barter Island
1610-21010	March 25 1974	0	69.25N	146.07W	22	166	Mt. Michelson

1610-21012	March 25, 1974	0	68 07N	147 56W	23	164	Philip Smith Mtns..
1610-21015	March 25, 1974	0	66 47N	149 35W	24	162	Beaver
1610-21021	March 25, 1974	0	65.27N	151.04W	25	161	Tanana - Livengood
1610-21024	March 25, 1974	0	64.06N	152.24W	26	159	Kantishna River
1611-21064	March 26, 1974	5	69.25N	147 25W	22	166	Sagavanirktok
1611-21070	March 26, 1974	0	68.06N	149 24W	23	164	Philip Smith Mts.
1611-21073	March 26, 1974	0	66.47N	151.02W	24	162	Bettles
1611-21075	March 26, 1974	0	65.27N	152.31W	25	161	Tanana
1611-21082	March 26, 1974	5	64.06N	153 52W	26	159	Ruby
1611-21084	March 26, 1974	0	62 44N	155.05W	27	158	McGrath
1611-21091	March 26, 1974	0	61.22N	156 13W	29	156	Sleetmute
1611-21100	March 26, 1974	5	58.36N	158 13W	31	154	Naknek - Nushagak Bay
1612-21125	March 27, 1974	0	68 07N	150.47W	23	164	Chandler Lake
1612-21131	March 27, 1974	0	66 47N	152.25W	25	163	Bettles
1612-21134	March 27, 1974	0	65.26N	153.53W	26	161	Melozitna
1612-21140	March 27, 1974	0	64.06N	155.14W	27	159	Ruby
1612-21143	March 27, 1974	0	62 44N	156.28W	28	158	Iditarod
1612-21145	March 27, 1974	0	61.22N	157 37W	29	156	Sleetmute
1612-21152	March 27, 1974	10	59 59N	158.40W	30	155	Goodnews - Dillingham
1612-21154	March 27, 1974	20	58.36N	159 38W	31	154	Hagemeister Island - Nushagak Bay
1613-21174	March 28, 1974	10	70.43N	148.24W	22	169	Beechey Point
1613-21181	March 28, 1974	10	69 25N	150.28W	23	166	Umiat
1613-21183	March 28, 1974	0	68.06N	152 17W	24	164	Chandler Lake
1613-21190	March 28, 1974	10	66 46N	153.55W	25	163	Hughes
1613-21192	March 28, 1974	0	65 26N	155.24W	26	161	Melozitna
1613-21195	March 28, 1974	0	64.05N	156.44W	27	159	Nulato
1613-21201	March 28, 1974	5	62.44N	157.58W	28	158	Iditarod
1613-21204	March 28, 1974	5	61.22N	159.05W	29	156	Russian Mission
1614-21232	March 29, 1974	0	70.42N	149 50W	22	169	Beechey Point
1614-21235	March 29, 1974	0	69.25N	151.52W	23	166	Umiat
1614-21241	March 29, 1974	0	68.06N	153.42W	24	164	Killik River - Chandler Lake
1614-21244	March 29, 1974	0	66.47N	155.20W	25	163	Hughes
1614-21250	March 29, 1974	0	65.26N	156 48W	26	161	Kateel River - Melozitna
1615-21284	March 30, 1974	0	71 58N	149 00W	21	171	Arctic Ocean
1615-21291	March 30, 1974	20	70.42N	151.18W	22	169	Harrison Bay
1615-21293	March 30, 1974	0	69.24N	153.21W	24	166	Ikpikpuk River
1615-21300	March 30, 1974	0	68.06N	155.10W	25	164	Killik River
1615-21302	March 30, 1974	0	66.46N	156 48W	26	163	Shungnak
1615-21305	March 30, 1974	0	65.26N	158 16W	27	161	Kateel River
1616-21342	March 31, 1974	0	71.50N	150.25W	22	171	Arctic Ocean
1616-21345	March 31, 1974	10	70 41N	152 43W	23	169	Harrison Bay
1616-21351	March 31, 1974	15	69.24N	154.45W	24	167	Ikpikpuk River
1616-21354	March 31, 1974	0	68.06N	156.34W	25	164	Howard Pass
1616-21360	March 31, 1974	0	66.46N	158 12W	26	163	Shungnak
1616-21363	March 31, 1974	0	65.26N	159 40W	27	161	Candle
1616-21365	March 31, 1974	0	64.05N	161.01W	28	159	Norton Bay
1616-21372	March 31, 1974	15	62.44N	162.14W	29	158	Holy Cross
1616-21374	March 31, 1974	15	61.22N	163.23W	31	156	Marshall
1617-19595	April 1, 1974	0	62 44N	137 54W	30	158	East of Nabesna
1617-20001	April 1, 1974	10	61.23N	139.02W	31	156	East of McCarthy
1617-20004	April 1, 1974	20	60 00N	140.05W	32	155	Mt. St. Elias - Yakutat
1617-20010	April 1, 1974	0	58.37N	141.03W	33	153	Pacific Ocean
1617-21401	April 1, 1974	0	72.00N	151.47W	22	171	N of Harrison Bay, Arctic Ocean
1617-21403	April 1, 1974	0	70.44N	154 05W	23	169	Teshekpuk
1617-21410	April 1, 1974	0	69.27N	156.08W	24	167	Lookout Ridge
1617-21412	April 1, 1974	0	68 09N	157.58W	25	165	Howard Pass
1617-21415	April 1, 1974	0	66.50N	159 36W	27	163	Shungnak
1617-21421	April 1, 1974	0	65 29N	161.06W	28	161	Candle
1617-21424	April 1, 1974	0	64.09N	162 26W	29	159	Norton Bay
1617-21430	April 1, 1974	0	62.47N	163.40W	30	158	Kwiguk
1618-20053	April 2, 1974	0	62.44N	139 19W	30	158	East of Nabesna
1618-20055	April 2, 1974	0	61.21N	140.26W	31	156	McCarthy
1618-21455	April 2, 1974	0	71 57N	153.16W	22	171	N of Teshekpuk
1618-21462	April 2, 1974	0	70.41N	155.34W	24	169	Barrow - Teshekpuk
1618-21464	April 2, 1974	0	69.24N	157.37W	25	167	Lookout Ridge
1618-21471	April 2, 1974	0	68 06N	159 26W	26	165	Misheguk Mtn.
1618-21473	April 2, 1974	0	66.46N	161 05W	27	163	Noatak
1618-21480	April 2, 1974	0	65.26N	162.34W	28	161	Bendeleben
1618-21482	April 2, 1974	0	64.05N	163 54W	29	159	Solomon
1618-21485	April 2, 1974	0	62 44N	165.06W	30	158	Kwiguk
1619-20105	April 3, 1974	0	64 06N	139 34W	30	159	East of Eagle
1619-20111	April 3, 1974	0	62 44N	140 47W	31	158	East of Nabesna
1619-20114	April 3, 1974	0	61 22N	141 54W	32	156	McCarthy
1619-21513	April 3, 1974	0	71.57N	154 45W	23	171	Barrow
1619-21520	April 3, 1974	0	70 10N	157.03W	24	169	Meade River
1619-21522	April 3, 1974	0	69 23N	159 05W	25	167	Utukok River
1619-21525	April 3, 1974	0	68 05N	160 51W	26	165	Misheguk Mtn
1619-21531	April 3, 1974	0	66 45N	[illegible]	27	163	Kotzebue
1619-21531	April 3, 1974	0	65 25N	161 01W	28	161	Bendeleben
1620-20161	April 4, 1974	0	65 26N	139 10W	29	161	East of Charley River
1620-20163	April 4, 1974	0	64 05N	141.01W	30	159	Eagle

ORIGINAL PAGE IS OF POOR QUALITY

1620-20170	April 1, 1974	0	62.[illegible]N	142 14W	31	158	Nabesna
1620-21572	April 4, 1974	20	71.59N	156.08W	23	171	Arctic Ocean
1620-21574	April 1, 1974	20	70.43N	158 27W	24	169	Barrow - Meade River
1620-21581	April 1, 1974	20	69.26N	160 29W	25	167	Utukok River
1621-20212	April 5, 1974	0	66 47N	139 32W	28	163	East of Black River
1621-20215	April 5, 1974	0	65 27N	141.01W	29	161	Charley River
1621-20221	April 5, 1974	20	64 06N	142.22W	30	159	Eagle
1621-22030	April 5, 1974	0	71.58N	157 35W	24	171	Barrow
1621-22032	April 5, 1974	10	70 42N	159.53W	25	169	Meade River
1621-22035	April 5, 1974	10	69 25N	161 55W	26	167	Utukok River
1621-22050	April 5, 1974	20	65 27N	166 50W	29	161	Teller
1622-22100	April 6, 1974	5	68 06N	165 10W	27	165	Point Hope
1622-20264	April 6, 1974	0	68 06N	139 22W	27	165	East of Table Mtn
1623-20320	April 7, 1974	0	69 25N	139 03W	27	167	Herschel Island
1623-22154	April 7, 1974	10	68.05N	166.41W	28	165	Point Hope
1623-22160	April 7, 1974	20	66 46N	168 19W	29	163	Bering Straits
1624-20374	April 8, 1974	0	69 23N	140 31W	27	167	Herschel Island
1625-20430	April 9, 1974	0	70.40	139.56W	26	169	Arctic Ocean
1625-20432	April 9, 1974	0	69.23N	141.57W	27	167	Demarcation Point
1625-20435	April 9, 1974	0	68.05N	143 46W	29	165	Table Mt.
1625-22262	April 9, 1974	0	70.39N	165.45W	26	169	Arctic Ocean
1625-22264	April 9, 1974	0	69.22N	167.46W	27	167	Chukchi Sea
1625-22271	April 9, 1974	0	68.03N	169 35W	29	165	Chukchi Sea
1626-20484	April 10, 1974	0	70.40N	141 22W	27	169	Barter Island
1626-20491	April 10, 1974	0	69 22N	143.24W	28	167	Demarcation Point
1626-20500	April 10, 1974	20	66.44N	146.50W	30	163	Fort Yukon
1626-20502	April 10, 1974	30	65.23N	148 17W	31	161	Fairbanks - Livengood
1626-20505	April 10, 1974	25	64.02N	149.37W	32	159	Fairbanks - Healy
1627-20543	April 11, 1974	0	70.38N	142.49W	27	169	Barter Island
1627-20545	April 11, 1974	0	69.21N	144.50W	28	167	Mt. Michelson
1627-20552	April 11, 1974	0	68 03N	146.39W	29	165	Arctic
1628-21003	April 12, 1974	2	69.21N	146.22W	29	167	Mt. Michelson
1628-21010	April 12, 1974	0	68.03N	148.10W	30	165	Philip Smith Mtns.
1628-21012	April 12, 1974	0	66 44N	149.48W	31	163	Beaver
1628-21033	April 12, 1974	25	59 56N	155.57W	36	154	Illiamna
1631-21174	April 15, 1974	10	69 23N	150.37W	30	167	Umiat
1631-21181	April 15, 1974	25	68.04N	152 26W	31	165	Chandler Lake
1632-21250	April 16, 1974	10	64.03N	158.16W	34	159	Nulato
1632-21253	April 16, 1974	25	62.41N	159.28W	36	158	Iditarod
1634-19540	April 18, 1974	5	61 22N	137.37W	37	156	North of Skagway
1634-21340	April 18, 1974	0	71.58N	150.32W	28	172	Arctic Ocean
1634-21342	April 18, 1974	15	70 42N	152 50W	30	169	Harrison Bay
1635-19592	April 19, 1974	0	62.43N	137.59W	37	158	East of Nabesna
1635-19595	April 19, 1974	0	61 21N	139.07W	38	156	East of McCarthy
1637-20111	April 21, 1974	10	61 23N	141.53W	38	156	McCarthy
1638-21572	April 22, 1974	5	70.41N	158 29W	31	170	Meade River
1638-21574	April 22, 1974	0	69.24N	160 31W	32	167	Utukok River
1638-21581	April 22, 1974	0	68.05N	162 21W	33	165	DeLong Mt.
1638-21583	April 22, 1974	0	66.46N	163 58W	34	163	Cape Espenberg
1639-22023	April 23, 1974	0	71.56N	157.45W	30	172	N. Barrow
1639-22030	April 23, 1974	0	70.40N	160.02W	31	170	Wainwright
1639-22032	April 23, 1974	0	69 23N	162.05W	32	167	Point Lay
1641-20320	April 25, 1974	0	68.02N	140.56W	34	165	Table Mtn.
1641-20322	April 25, 1974	0	66 43N	142.33W	35	163	Black River
1641-20325	April 25, 1974	10	65.23N	144.02W	36	161	Circle
1641-20331	April 25, 1974	5	64.02N	145.22W	38	159	Big Delta
1641-20334	April 25, 1974	20	62.40N	146.36W	39	157	Gulkana
1641-20340	April 25, 1974	20	61.18N	147 44W	40	156	Anchorage - Valdez
1642-20381	April 26, 1974	0	66.46N	143.59W	36	163	Fort Yukon
1642-20383	April 26, 1974	0	65 25N	145.27W	37	161	Circle
1642-20390	April 26, 1974	0	64 05N	146.47W	38	159	Fairbanks - Delta
1642-20392	April 26, 1974	0	62 43N	148 01W	39	157	Talkeetna Mt.
1642-20395	April 26, 1974	0	61.21N	149 09W	40	156	Anchorage
1643-20432	April 27, 1974	0	68 04N	143.49W	35	165	Table Mt.
1643-20435	April 27, 1974	0	66.45N	145 27W	36	163	Fort Yukon
1643-20441	April 27, 1974	0	65.24N	146 54W	37	161	Fairbanks
1643-22255	April 27, 1974	0	70.42N	165.43W	33	170	Arctic Ocean
1643-22261	April 27, 1974	0	69.25N	167.44W	34	167	Arctic Ocean
1643-22264	April 27, 1974	0	68 06N	169.34W	35	165	Chukchi Sea
1646-20594	April 30, 1974	15	70 40N	144.17W	34	170	Barter Island
1646-21001	April 30, 1974	0	69 22N	146.18W	35	167	Mt. Michelson
1646-21003	April 30, 1974	0	68 03N	148 07W	36	167	Philip Smith Mts
1646-21010	April 30, 1974	0	66.41N	149.44W	37	163	Beaver
1646-21012	April 30, 1974	0	65.24N	151.12W	38	161	Tanana
1646-21015	April 30, 1974	0	64.03N	152.32W	39	159	Kantishna River
1646-21021	April 30, 1974	0	62 42N	153.46W	40	157	Talkeetna
1646-21024	April 30, 1974	0	61 19N	154 53W	41	155	Lime Hills
1647-21064	May 1, 1974	10	66 47N	151 13W	37	163	Bettles
1647-21070	May 1, 1974	10	65 27N	152 41W	38	161	Tanana
1647-21073	May 1, 1974	5	64 06N	154 01W	39	159	Ruby
1647-21075	May 1, 1974	0	62 41N	155.14W	40	157	McGrath
1647-2108[illegible]	May 1, 1974	0	61 22N	156.21W	42	155	Lime Hills
1649-21171	May 3, 1974	0	69 21N	150 40W	36	167	Umiat
1649-21180	May 3, 1974	5	66 46N	154 01W	38	163	Hughes
1649-21183	May 3, 1974	0	65 25N	155.32W	39	161	Melozitna
1649-21185	May 3, 1974	0	64 01N	156 52W	40	159	Nulato

1649-21197	May 3, 1974	0	62.43N	158 06W	41	157	Iditarod
1649-21191	May 3, 1974	0	61.21N	159 14W	42	155	Russian Mission
1650-21223	May 4, 1974	10	70.44N	149.58W	35	170	Beechey Point
1650-21230	May 4, 1974	10	69.27N	152.00W	36	167	Umiat
1650-21232	May 4, 1974	0	68.08N	153 48W	37	165	Killik River
1650-21235	May 4, 1974	0	66.49N	155 25W	38	163	Survey Pass
1650-21241	May 4, 1974	0	65.29N	156.54W	39	161	Kateel River
1650-21244	May 4, 1974	0	64.08N	158.15W	40	159	Nulato
1650-21250	May 4, 1974	0	62.47N	159.29W	41	157	Holy Cross
1650-21253	May 4, 1974	0	61.25N	160 37W	42	155	Russian Mission
1650-21255	May 4, 1974	0	60.02N	161.39W	43	154	Bethel
1651-21275	May 5, 1974	0	71 58N	149.05W	34	172	Arctic Ocean
1651-21281	May 5, 1974	40	70 43N	151 23W	35	170	Harrison Bay
1651-21284	May 5, 1974	40	69 25N	153.25W	36	167	Ikpikpuk River
1651-21290	May 5, 1974	10	68.07N	155 14W	37	165	Killik River
1651-21293	May 5, 1974	0	66.48N	156.51W	38	163	Shungnak
1651-21295	May 5, 1974	0	65.28N	158.19W	39	161	Kateel River
1651-21302	May 5, 1974	0	64.06N	159 39W	41	159	Norton Bay
1651-21304	May 5, 1974	0	62.15N	160.53W	42	157	Holy Cross
1651-21311	May 5, 1974	0	61.23N	162 00W	43	155	Russian Mission
1652-21345	May 6, 1974	20	68.09N	156 39W	37	165	Howard Pass
1652-21351	May 6, 1974	10	66.50N	158.18W	39	163	Shungnak
1652-21354	May 6, 1974	10	65.29N	159.47W	40	161	Candle
1652-21360	May 6, 1974	0	64.08N	161.07W	41	159	Norton Bay
1652-21363	May 6, 1974	1	62.47N	162.20W	42	157	Kwiguk
1652-21365	May 6, 1974	1	61.25N	163.27W	43	155	Marshall
1652-21372	May 6, 1974	5	60.03N	164.29W	44	153	Baird Inlet
1653-21394	May 7, 1974	0	70.45N	154.18W	36	170	Teshekpuk
1653-21400	May 7, 1974	0	69.28N	156 20W	37	167	Lookout Ridge
1653-21403	May 7, 1974	10	68.09N	158.10W	38	165	Howard Pass
1653-21405	May 7, 1974	10	66.50N	159 47W	39	163	Selawik
1653-21414	May 7, 1974	10	64.09N	162.37W	41	159	Solomon
1653-21421	May 7, 1974	0	62.47N	163.51W	42	157	Kwiguk
1654-21450	May 8, 1974	0	71.59N	153 26W	35	172	Arctic Ocean
1654-21452	May 8, 1974	10	70.43N	155.44W	36	170	Barrow
1654-21473	May 8, 1974	5	64.07N	164.02W	41	159	Solomon
1655-21504	May 9, 1974	10	72.01N	154.50W	35	172	Arctic Ocean
1655-21515	May 9, 1974	0	68.10N	160.57W	38	165	Misheguk Mountain
1655-21522	May 9, 1974	10	66 50N	162.35W	39	163	Kotzebue - Selawik
1656-20151	May 10, 1974	10	65.29N	139.41W	41	161	Charley River
1656-21574	May 10, 1974	0	68.08N	162.28W	39	165	DeLong Mts
1661-20425	May 15, 1974	0	68.07N	143.47W	40	165.	Table Mtn
1667-21180	May 21, 1974	20	65.33N	155.29W	43	160	Melozitna
1667-21200	May 21, 1974	5	58.42N	161.10W	48	150	Hagemeister Island
1669-21292	May 23, 1974	0	65 34N	158.16W	44	160	Kateel River
1669-21310	May 23, 1974	0	60 08N	163.01W	48	152	Baird Inlet
1670-21344	May 24, 1974	0	66 56N	158.13W	43	162	Ambler River
1670-21360	May 24, 1974	0	62 53N	162.17W	46	156	Kwiguk
1670-21362	May 24, 1974	0	61 32N	163.25W	47	154	Marshall
1671-21400	May 25, 1974	0	68 14N	158 03W	42	164	Howard Pass
1671-21405	May 25, 1974	0	65 34N	161.10W	44	160	Candle
1671-21420	May 25, 1974	0	61 29N	164.56W	47	154	Hooper Bay
1672-21454	May 26, 1974	0	68.15N	159 29W	42	164	Misheguk Mtn.
1672-21461	May 26, 1974	0	66 55N	161.08W	43	162	Selawik
1672-21463	May 26, 1974	0	65.35N	162 37W	44	160	Bendeleben
1672-21470	May 26, 1974	0	64 16N	163 57W	45	158	Solomon
1672-21472	May 26, 1974	0	62 54N	165.11W	46	156	Black - Kwiguk
1672-21475	May 26, 1974	0	61 32N	166.19W	47	154	Hooper Bay
1673-21512	May 27, 1974	0	68.17N	160.57W	41	164	Misheguk Mtn.
1673-21515	May 27, 1974	0	66.57N	162 35W	43	162	Kotzebue - Baldwin Penn.
1673-21521	May 27, 1974	0	65 38N	164 03W	44	160	Bendeleben
1674-20132	May 28, 1974	0	69.34N	134 43W	41	167	MacKenzie Bay
1674-21442	May 28, 1974	10	73.25N	153 27W	38	175	Beaufort Sea
1674-21561	May 28, 1974	20	70.55N	158 26W	40	169	Barrow
1674-21570	May 28, 1974	0	68 19N	162 20W	42	164	DeLong Mtns.
1674-21573	May 28, 1974	0	66.59N	163.50W	43	162	Kotzebue
1675-20182	May 29, 1974	10	72.05N	131.48W	39	172	Beaufort Sea
1675-20184	May 29, 1974	0	70.50N	134.05W	40	169	Beaufort Sea
1675-20191	May 29, 1974	0	69.32N	136 10W	41	166	MacKenzie Bay
1675-22031	May 29, 1974	0	66 53N	165 29W	44	162	Shishmaref
1675-22034	May 29, 1974	15	65 33N	166 57W	45	159	Teller
1676-20263	May 30, 1974	5	64.14N	143.54W	46	157	Delta - Eagle
1676-22090	May 30, 1974	0	66 55N	166.55W	44	162	Shishmaref
1676-22092	May 30, 1974	0	65 34N	158 21W	45	159	Teller
1676-22095	May 30, 1974	0	64.13N	169 46W	46	157	St Lawrence Is
1676-22101	May 30, 1974	0	62.51N	170 59W	47	155	St. Lawrence Is
1676-22104	May 30, 1974	0	61 29N	172 06W	48	153	Bering Sea
1676-22110	May 30, 1974	2	60 07N	173 09W	49	151	St Matthew
1677-22141	May 31, 1974	0	68 15N	166 36W	43	164	Point Hope
1677-22144	May 31, 1974	0	66 55N	168 15W	44	162	Chukchi Sea
1677-22151	May 31, 1974	1	64 15N	171 05W	46	157	St Lawrence Is
1677-22150	May 31, 1974	0	65 35N	169 44W	45	159	Bering Straits
1677-22155	May 31, 1974	10	62 53N	172 20W	47	155	St Lawrence Is

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

1678-22211	June 1, 1974	0	64 16N	172 31W	46	157	Siberia	
1678-22213	June 1, 1974	5	62.55N	173 45W	47	155	St Lawrence Island	
1678-22220	June 1, 1974	5	61 33N	174 53W	48	153	Bering Sea	
1679-20443	June 2, 1974	30	61 29N	150.34W	48	153	Tyonek	
1680-20462	June 3, 1974	0	73 23N	136 16W	39	175	Beaufort Sea	
1680-20465	June 3, 1974	0	72.09N	138 55W	40	172	Beaufort Sea	
1680-20501	June 3, 1974	30	61.32N	152 00W	48	153	Tyonek	
1680-20510	June 3, 1974	0	58 46N	154 01W	50	149	Mt. Katmai	
1680-20512	June 3, 1974	0	57.23N	154 55W	51	147	Karluk	
1686-21224	June 9, 1974	0	66.59N	155 20W	45	161	Hughes	
1686-21242	June 9, 1974	0	61 34N	160 34W	49	152	Russian Mission	
1686-21245	June 9, 1974	0	60 11N	161.36W	50	150	Bethel	
1686-21251	June 9, 1974	0	58.48N	162 35W	51	148	Hagemeister Island	
1686-21254	June 9, 1974	10	57 24N	163 28W	52	146	Bristol Bay	
1687-21312	June 10, 1974	20	57.23N	164 57W	52	146	Bristol Bay	
1687-21315	June 10, 1974	10	55 59N	165.48W	53	144	Bering Sea	
1687-21321	June 10, 1974	10	54 35N	166.36W	54	141	Unimak Island	
1688-21361	June 11, 1974	20	60 10N	164 26W	50	150	Kuskokwim Bay	
1692-20143	June 15, 1974	5	64.18N	140.54W	47	156	Eagle	
1692-20150	June 15, 1974	2	62.56N	142.08W	48	154	Nabesna	C
1692-20152	June 15, 1974	20	61 34N	143.17W	49	152	McCarthy	C
1692-22002	June 15, 1974	15	56.02N	172.56W	53	143	Bering Sea	
1693-22060	June 16, 1974	20	56.01N	174.25W	53	143	Bering Sea	
1694-22071	June 17, 1974	0	70.53N	161.16W	42	168	Barrow	
1694-22073	June 17, 1974	0	69 36N	163 20W	43	165	Point Lay	
1694-22080	June 17, 1974	0	68.17N	165 11W	44	163	Point Hope	
1694-22082	June 17, 1974	0	66.58N	166 50W	45	160	Shishmaref	
1694-22085	June 17, 1974	0	65.37N	168.20W	46	158	Teller	
1694-22091	June 17, 1974	0	64.16N	169 41W	47	156	St. Lawrence Island	
1694-22094	June 17, 1974	20	62.54N	170.55W	48	153	St. Lawrence Island	
1694-22103	June 17, 1974	5	60.09N	173.04W	50	149	St. Matthews	
1695-22134	June 18, 1975	10	68.17N	166 37W	44	163	Point Hope	
1697-20421	June 20, 1974	2	66.57N	145 19W	45	160	Fort Yukon	
1697-20424	June 20, 1974	1	65.36N	146 48W	46	158	Circle	
1698-20464	June 21, 1974	0	70.54N	141 08W	42	168	Beaufort Sea	
1698-20491	June 21, 1974	20	62.54N	150 47W	48	153	Talkeetna	D + C
1698-20493	June 21, 1974	2	61.32N	151 54W	49	151	Tyonek	D
1698-22300	June 21, 1974	5	70 52N	167 02W	42	167	Chukchi Sea	
1698-22302	June 21, 1974	0	69 35N	169 06W	43	165	Chukchi Sea	
1698-22305	June 21, 1974	0	68 17N	170.57W	44	162	Chukchi Sea	
1699-20522	June 22, 1974	0	70 54N	142.42W	42	167	Beaufort Sea	
1699-20570	June 22, 1974	10	55 59N	157.10W	53	142	Sutwik Island	
1699-22360	June 22, 1974	10	69 37N	170 37W	43	165	Chukchi Sea	
1700-20592	June 23, 1974	30	66 55N	149.40W	45	160	Beaver	
1702-21084	June 25, 1974	0	73.23N	141.58W	39	173	Beaufort Sea	
1702-21090	June 25, 1974	0	72.09N	144 37W	41	170	Beaufort Sea	
1702-21093	June 25, 1974	0	70 53N	146 58W	42	167	Beechey Point	C + D
1702-21095	June 25, 1974	5	69 36N	149 03W	43	164	Sagavanirktok	
1703-21151	June 26, 1974	0	70.54N	148 17W	42	167	Prudhoe - Beechey Point	
1706-19522	June 29, 1974	50	60 09N	138 39W	50	148	Yakutat	
1706-21322	June 29, 1974	0	70.54N	152 42W	42	167	Harrison Bay	
1706-21342	June 29, 1974	0	64 16N	161.05W	47	155	Norton Bay	D + C
1706-21345	June 29, 1974	0	62.54N	162.19W	48	153	St. Michael	
1706-21351	June 29, 1974	0	61.31N	163.27W	49	150	Marshall	
1706-21354	June 29, 1974	10	60 08N	164 29W	50	148	Nunivak Island	
1707-21391	June 30, 1974	0	66.59N	159.43W	45	159	Baird Mts.	C
1707-21400	June 30, 1974	20	64 17N	162.34W	47	155	Solomon	
1707-21403	June 30, 1974	15	62.55N	163 47W	48	152	St. Michael	
1708-20035	July 1, 1974	0	60.10N	141 30W	50	148	Icy Bay	
1708-20041	July 1, 1974	20	58 48N	142.29W	51	146	Gulf of Alaska	
1709-20090	July 2, 1974	5	61.32N	141 57W	49	150	McCarthy & East	D + C
1709-20093	July 2, 1974	30	60 09N	142 59W	50	148	Bering Glacier	
1709-21504	July 2, 1974	0	67 02N	162.27W	45	159	Baldwin Penn	C
1709-21510	July 2, 1974	5	65 41N	163.58W	46	157	Bendeleben	D + C
1709-21513	July 2, 1974	0	64 20N	165 19W	47	155	Nome	C
1709-21515	July 2, 1974	15	62.58N	166 35W	48	152	Black	
1710-21551	July 3, 1974	5	70.53N	158.28W	41	167	Barrow	
1710-21553	July 3, 1974	0	69.35N	160 31W	42	164	Utukok River	C
1710-21562	July 3, 1974	2	66.57N	163 59W	44	159	Shishmaref	
1710-21565	July 3, 1974	0	65.36N	165 29W	46	157	Teller - Bendeleben	D + C
1710-21571	July 3, 1974	0	64 15N	166 51W	47	154	Nome	
1710-21574	July 3, 1974	0	62.54N	168 05W	48	152	Tip of St Lawrence Is	
1710-21580	July 3, 1974	0	61.32N	169 13W	48	150	Bering Sea	
1710-21583	July 3, 1974	0	60.09N	170 15W	49	148	Bering Sea	
1710-21585	July 3, 1974	0	58 45N	171 12W	50	146	Bering Sea	
1711-22014	July 4, 1974	0	68 17N	163 50W	43	161	DeLong Mts	
1711-22020	July 4, 1974	5	66 58N	165 29W	44	159	Shishmaref	
1711-22023	July 4, 1974	0	65.37N	166.58W	45	157	Teller	D + C
1711-22025	July 4, 1974	0	64 15N	168 19W	46	154	Bering Sea	
1711-22032	July 4, 1974	0	62.53N	169.33W	47	152	St Lawrence Island	
1713-20281	July 6, 1974	0	73 24N	131 53W	39	173	Beaufort Sea	
1713-22121	July 6, 1974	5	70 52N	162 41W	41	167	Wainwright	
1713-22144	July 6, 1974	2	62 53N	172 21W	47	152	St Lawrence Island	
1713-22151	July 6, 1974	5	61 30N	173 29W	48	150	Bering Sea	
1714-22182	July 7, 1974	5	69 35N	166 18W	42	164	Tip of Point Hope	
1714-22193	July 7, 1974	15	65.36N	171.13W	45	157	Siberia	
1715-22254	July 8, 1974	20	64 14N	173 57W	46	154	Chukotsk Penn	
1717-20562	July 10, 1974	5	55 55N	157 12W	51	142	Sutwik Is	
1717-22353	July 10, 1974	10	69 31N	170 42W	42	164	Chukchi Sea	
1719-21025	July 12, 1974	0	72.05N	143 20W	39	169	Beaufort Sea	
1719-21031	July 12, 1974	0	70 49N	145 39W	40	166	Flaxman Island	
1720-21080	July 13, 1974	30	73.20N	142 10W	38	172	Beaufort Sea	

ORIGINAL PAGE IS OF POOR QUALITY

1722-21213	July 15, 1974	10	66 51N	155.26W	43	158	Walker Lake	C
1720-21103	July 13, 1974	2	65.33N	154 06W	44	156	Melozitna	
1720-22512	July 13, 1974	0	73 21N	167.58W	38	172	Chukchi Sea	
1720-22514	July 13, 1974	0	72 07N	170 36W	39	169	Chukchi Sea	
1721-21141	July 14, 1974	0	72 06N	146 07W	39	169	Beaufort Sea	
1721-21143	July 14, 1974	0	70.50N	148.27W	40	166	Beechey Point	
1721-21150	July 14, 1974	0	69 33N	150 30W	41	163	Umiat	
1722-21195	July 15, 1974	1	72 04N	147 39W	39	169	Beaufort Sea	
1722-21202	July 15, 1974	0	70 48N	149.58W	40	166	Beechey Point	
1722-21204	July 15, 1974	0	69.30N	152 02W	41	163	Umiat	
1722-21211	July 15, 1974	0	68 11N	153.50W	42	161	Chandler Lake	C
1723-21251	July 16, 1974	0	73 19N	146 28W	37	172	Beaufort SEa	-
1723-21253	July 16, 1974	0	72 04N	149 06W	39	169	Beaufort Sea	
1723-21260	July 16, 1974	0	70.48N	151.25W	40	166	Harrison Bay	
1723-21262	July 16, 1974	1	69 31N	153.28W	41	163	Ikpikpuk River	D + C
1727-21485	July 20, 1974	30	70 48N	157 07W	39	166	Pt. Barrow	
1728-21540	July 21, 1974	10	72.05N	156 14W	38	169	Barrow	
1730-22064	July 23, 1974	15	68.12N	165 16W	40	161	Chukchi Sea	
1730-22080	July 23, 1974	5	64.10N	169 46W	44	154	St. Lawrence Island	
1730-22082	July 23, 1974	10	62.48N	171 00W	45	152	St Lawrence Island	
1732-20331	July 25, 1974	15	73 16N	133.31W	36	172	Beaufort Sea	
1732-20334	July 25, 1974	0	72.01N	136 10W	37	169	Beaufort Sea	
1733-20433	July 26, 1974	30	58.37N	152.37W	47	146	Afognak	
1734-20464	July 27, 1974	30	66.49N	146 47W	41	159	Fort Yukon	
1734-20471	July 27, 1974	10	65.28N	148.17W	42	156	Fairbanks - Livengood	D + C
1734-20473	July 27, 1974	30	64.07N	149.38W	43	154	Healy	D + C
1734-20480	July 27, 1974	30	62 45N	150.51W	44	152	Mt. McKinley	D + C
1734-20482	July 27, 1974	5	61.23N	151.59W	45	150	Tyonek	D + C
1734-20491	July 27, 1974	0	58 37N	153 59W	47	146	Mt Katmai	C
1734-20494	July 27, 1974	0	57.14N	154.52W	48	145	Kodiak	C
1734-20500	July 27, 1974	10	55.50N	155.43W	48	143	Trinity Island	
1737-21064	July 30, 1974	15	57.14N	159 14W	47	145	Bristol Bay	
1738-19284	July 31, 1974	30	58 38N	133 54W	46	147	Taku River	
1738-19291	July 31, 1974	20	57.14N	134 47W	47	145	Sitka	
1738-22511	July 31, 1974	0	72.01N	170 38W	35	169	Chukchi Sea	
1740-21191	August 2, 1974	10	71.59N	147.47W	35	169	Beaufort Sea	
1740-21194	August 2, 1974	2	70.42N	150 04W	36	166	Harrison Bay	
1742-21315	August 4, 1974	20	68.07N	156 44W	38	161	Howard Pass	C
1742-21331	August 4, 1974	15	64.05N	161.09W	41	155	Norton Bay	
1742-21333	August 4, 1974	15	62.53N	162 23W	42	153	Kwiguk	
1743-21374	August 5, 1974	0	68.07N	158.10W	37	161	Howard Pass	C
1743-21385	August 5, 1974	5	64.05N	162.35W	41	155	Solomon	
1744-21432	August 6, 1974	1	68.07N	159.32W	37	161	Misheguk Mtn.	
1744-21434	August 6, 1974	20	66.48N	161.09W	38	159	Selawik	D + C
1744-21443	August 6, 1974	20	64.06N	163 58W	40	155	Solomon	
1745-20052	August 7, 1974	3	69.36N	133.24W	36	164	MacKenzie Bay	
1734-20485	[illegible] 27, 1974	5	6[illegible]N	153 [illegible]W	46	148	[illegible]	
1745-20072	August 7, 1974	40	62 44N	140 52W	41	153	Nabesna and East	C
1745-21472	August 7, 1974	10	73.14N	152 20W	33	172	Beaufort Sea	
1747-22011	August 9, 1974	30	65.25N	166 58W	38	157	Teller	
1749-22115	August 11, 1974	20	68.05N	166.52W	36	162	Point Hope	
1752-20481	August 14, 1974	15	59 56N	153 07W	41	150	Illiamna	
1752-20483	August 14, 1974	10	58 32N	154.04W	42	149	Mt. Katmai	
1753-20535	August 15, 1974	0	59 57N	154.33W	41	151	Illiamna	C
1759-21280	August 21, 1974	30	59.57N	163.09W	39	157	Kuskokwim Bay	
1760-21302	August 22, 1974	0	70 40N	153.01W	30	167	Teshekpuk	C
1760-21305	August 22, 1974	5	69 21N	155 03W	31	165	Ikpikpuk River	C
1760-21323	August 22, 1974	0	64.03N	161 13W	36	157	Norton Sound	
1760-21325	August 22, 1974	15	62 41N	162 26W	37	155	Kwiguk	
1764-20102	August 26, 1974	0	69.19N	134.58W	30	165	MacKenzie Bay	
1768-20342	August 30, 1974	1	65 22N	145.35W	32	160	Circle	
1768-20345	August 30, 1974	2	64 00N	146 54W	33	158	Fairbanks - Delta	
1768-20351	August 30, 1974	20	62.38N	148.06W	34	156	Talkeetna Mts	C
1769-20403	August 31, 1974	25	63 59N	148 18W	33	158	Healy	C
1770-20450	September 1, 1974	5	68.00N	145.23W	29	164	Arctic	
1770-20452	September 1, 1974	40	66 41N	147.00W	30	162	Fort Yukon	
1771-20504	September 2, 1974	40	68.00N	146.45W	29	164	Arctic	
1771-20510	September 2, 1974	25	66.39N	148 22W	25	162	Beaver	
1771-20513	September 2, 1974	0	65 19N	149 49W	31	160	Livengood	D + C
1771-20515	September 2, 1974	20	63 58N	151 09W	32	158	Mt McKinley	D + C
1771-20540	September 2, 1974	30	57 06N	156 20W	37	151	Ugashik	C
1772-20571	September 3, 1974	5	65.19N	151 16W	31	160	Tanana	
1772-20574	September 3, 1974	0	63 58N	152.35W	32	159	Kantishna River - Mt. McKinley	C
1772-20580	September 3, 1974	0	62.36N	153.47W	33	157	McGrath	C
1772-20583	September 3, 1974	0	61.14N	154 54W	34	155	Lake Clark, Lime Hills	C
1772-20585	September 3, 1974	2	59.52N	155 56W	35	154	Illiamna	C
1772-20592	September 3, 1974	5	58.28N	156 54W	36	152	Nahnek	C
1773-21011	September 4, 1974	0	70 37N	145 49W	26	168	Flaxman Island	
1773-21014	September 4, 1974	0	69 19N	147.49W	27	166	Mt. Michelson	
1773-21020	September 4, 1974	0	68 01N	149 36W	28	164	Philip Smith Mtn	C
1773-21025	September 4, 1974	0	65.22N	152 40W	30	160	Tanana	
1773-21034	September 4, 1974	0	62 39N	155 12W	32	157	McGrath	
1773-21041	September 4, 1974	0	61 17N	156 19W	33	156	Sleetmute - Lime Hills	
1773-21043	September 4, 1974	0	59 54N	157 20W	34	154	Dillingham	C
1774-21065	September 5, 1974	10	70 36N	147 16W	25	169	Beechey Point	
1774-21072	September 5, 1974	0	69 19N	149 16W	26	166	Sagavanirktok	
1775-21121	September 6, 1974	20	71.53N	146.27W	24	171	Beaufort Sea	
1775-21124	September 6, 1974	0	70.36N	148 43W	25	169	Beechey Point	
1775-21130	September 6, 1974	0	69 19N	150.44W	26	166	Sagavanirktok	
1775-21133	September 6, 1974	0	68 00N	152 31W	27	164	Chandler Lake	
1776-21200	September 7, 1974	0	65 19N	157 02W	29	161	Kateel River	
1776-21202	September 7, 1974	0	63 58N	158 22W	30	159	Nulato	
1776-21205	September 7, 1974	0	62 36N	159 38W	31	158	Holy Cross	
1777-21233	September 8, 1974	0	71 51N	149 22W	23	171	Beaufort Sea	

1778-21292	September 9, 1974	0	71.53N	150 39W	23	171	Beaufort Sea
1778-21301	September 9, 1974	1	69.20N	154 56W	25	167	Teshekpuk
1778-21303	September 9, 1974	0	68.01N	156.44W	26	165	Lookout Ridge
1778-21310	September 9, 1974	0	66 42N	158 21W	27	163	Selawik
1778-21312	September 9, 1974	0	65 21N	159 48W	28	161	Candle
1778-21315	September 9, 1974	0	64 01N	161 07W	29	160	Norton Bay
1778-21321	September 9, 1974	0	62 39N	162 20W	31	158	St. Michael - Kwiguk
1779-21361	September 10, 1974	0	68 04N	158 10W	26	165	Howard Pass
1779-21364	September 10, 1974	1	66 45N	159.47W	27	163	Selawik
1779-21370	September 10, 1974	0	65 25N	161 15W	28	161	Candle
1779-21373	September 10, 1974	0	64.04N	162 34W	29	160	Solomon
1779-21375	September 10, 1974	20	62.42N	163.47W	30	158	Kwiguk
1784-20244	September 15, 1974	20	57.11N	149.04W	33	154	Gulf of Alaska
1786-20340	September 17, 1974	30	63.59N	146 45W	27	161	Big Delta
1787-20421	September 18, 1974	10	55 45N	154.15W	33	153	Gulf of Alaska
1789-20493	September 20, 1974	5	69 21N	144.50W	21	168	Mt. Michelson
1793-21110	September 24, 1974	5	78 07N	143 44W	16	176	Beaufort Sea
1794-21170	September 25, 1974	5	71 57N	147.37W	17	173	Beaufort Sea
1802-20213	October 3, 1974	0	65.29N	142.28W	19	165	Charley River
1802-20220	October 3, 1974	0	64 08N	143 49W	20	163	Delta - Eagle
1802-20222	October 3, 1974	0	62.46N	145.02W	22	162	Gulkana
1802-20225	October 3, 1974	0	61.24N	146.09W	23	160	Valdez
1802-20231	October 3, 1974	2	60.02N	147.10W	24	159	Seward - Cordova
1802-22040	October 3, 1974	15	68 11N	165.10W	17	168	Point Hope
1802-22043	October 3, 1974	2	66.51N	166 48W	18	166	Shishmaref
1803-20263	October 4, 1974	0	68.11N	140 39W	16	168	Table Mt
1803-20265	October 4, 1974	0	66.52N	142.17W	18	166	Coleen
1803-22085	October 4, 1974	0	70 46N	162.34W	14	172	Wainwright
1803-22092	October 4, 1974	0	69 30N	164.37W	15	170	Point Lay
1803-22094	October 4, 1974	5	68.11N	166.27W	16	168	Point Hope
1803-22110	October 4, 1974	10	64 12N	170.56W	20	163	St. Lawrence Island
1804-20310	October 5, 1974	0	72.01N	135.44W	13	174	Beaufort Sea
1804-20312	October 5, 1974	5	70.45N	138 04W	14	172	MacKenzie Bay
1805-20373	October 6, 1974	10	69.25N	141 40W	15	170	Demarcation Point
1808-20585	October 9, 1974	30	55.55N	158 28W	25	157	Stepovak Bay
1808-20592	October 9, 1974	30	54 31N	159.16W	26	156	Simeonof Island
1809-21012	October 10, 1974	0	66.54N	150 53W	15	167	Bettles
1812-21172	October 13, 1974	15	70.50N	149.32W	11	173	Beechey Point
1812-21174	October 13, 1974	10	69.32N	151.36W	12	171	Umiat
1814-21302	October 15, 1974	0	65.36N	159.26W	15	166	Candle
1816-19595	October 17, 1974	10	61.28N	140 23W	18	162	McCarthy & East
1816-21422	October 17, 1974	0	64 10N	163 45W	15	165	Solomon
1816-21424	October 17, 1974	5	62 48N	165 00W	16	163	Black - Kwiguk
1816-21431	October 17, 1974	15	61 27N	166 09W	17	162	Hooper Bay
1817-21453	October 18, 1974	0	72.03N	154.26W	08	175	Beaufort Sea
1817-21460	October 18, 1974	0	70.47N	156.46W	09	173	Barrow
1817-21462	October 18, 1974	0	69 30N	158.50W	10	171	Lookout Ridge
1817-21471	October 18, 1974	3	66.52N	162.19W	12	168	Kotzebue
1817-21480	October 18, 1974	15	64.11N	165 10W	15	165	Solomon
1818-21532	October 19, 1974	15	65.34N	165.24W	13	166	Teller - Nome
1818-21534	October 19, 1974	20	64.12N	166 45W	14	165	Nome
1819-21595	October 20, 1974	20	62 51N	169.26W	15	164	St. Lawrence Island
1820-22054	October 21, 1974	3	62 50N	170.51W	15	164	St. Lawrence Island
1821-22094	October 22, 1974	20	68.13N	166.29W	10	169	Point Hope
1821-22100	October 22, 1974	0	66.53N	168.08W	11	168	Chukchi Sea
1821-22105	October 22, 1974	5	64 12N	171.00W	13	165	St. Lawrence Island
1826-20584	October 27, 1974	20	55.54N	158 28W	19	159	Stepovak Bay
1835-21463	November 5, 1974	0	66 55N	162.22W	06	168	Kotzebue
1829-20293	November 9, 1974	20	55.58N	151 14W	15	160	Gulf of Alaska
1840-20324	November 10, 1974	0	64.14N	146 32W	07	166	Fairbanks - Delta
1840-20335	November 10, 1974	0	60.07N	149.58W	11	162	Kenai - Seward
1840-20342	Novmeber 10, 1974	15	58 44N	150.57W	12	162	Gulf of Alaska
1840-22155	November 10, 1974	30	64.13N	172 21W	07	166	Siberia - St Lawrence Is.
1840-22162	November 10, 1974	15	62 51N	173.37W	09	165	Bering Sea
1923-19504	February 1, 1975	5	58.37N	141 01W	11	154	Gulf of Alaska
1932-20413	February 10, 1975	0	59 59N	153 00W	12	154	Illiamna
1932-20420	February 10, 1975	0	58 36N	153 57W	13	153	Afognak
1932-20422	February 10, 1975	0	57.13N	154 51W	14	152	Karluk
1932-20425	February 10, 1975	0	55.50N	155.41W	15	151	Trinity Islands
1933-20474	February 11, 1975	0	58.34N	155.26W	14	152	Mt Katmai
1942-21371	February 20, 1975	10	64 17N	163.48W	12	156	Solomon
1942-21374	February 20, 1975	0	62.56N	165 02W	13	155	Yukon River Delta
1942-21380	February 20, 1975	0	61 34N	166 11W	14	154	Hooper Bay
1942-21383	February 20, 1975	0	60 11N	167.14W	15	153	Nunivak Island
1942-21385	February 20, 1975	20	58 48N	168 13W	17	152	Bering Sea
1943-21403	February 21, 1975	10	72 04N	154 33W	06	167	North of Barrow
1943-21405	February 21, 1975	30	70.48N	156 52W	08	165	Meade River
1945-21521	February 23, 1975	30	70 49N	159.45W	08	165	Wainwright
1946-20164	February 24, 1975	5	64 12N	143 48W	14	156	Delta - Eagle
1946-21582	February 24, 1975	30	69 30N	163 17W	10	162	Point Lay
1946-21585	February 24, 1975	20	68 11N	165 08W	11	161	Point Hope
1946-21591	February 24, 1975	0	66 52N	166 46W	12	159	Bering Straits
1946-21594	February 24, 1975	0	65 31N	168 16W	13	158	Bering Straits
1947-22040	February 25, 1975	5	69 31N	164 40W	10	162	Point Lay
1947-22043	February 25, 1975	5	68 13N	166 30W	11	161	Point Hope
1947-22045	February 25, 1975	10	66 53N	168 10W	12	159	Chukchi Sea
1948-20265	February 26, 1975	20	68.12N	142 13W	11	161	Table Mt
1948-22094	February 26, 1975	10	69 30N	166 09W	10	162	Arctic Ocean
1948-22101	February 26, 1975	5	68 11N	168 00W	12	161	Point Hope & Chukchi Sea
1949-22152	February 27, 1975	5	69 31N	167 33W	11	162	Chukchi Sea
1949-22155	February 27, 1975	2	68 1?N	169 23W	12	161	Chukchi Sea
1949-22164	February 27, 1975	10	65.33N	172 32W	14	157	Bering Straits
1949-22170	February 27, 1975	0	61 12N	173 51W	15	156	Chukotsk Penn

ORIGINAL PAGE IS
OF POOR QUALITY

1949-22173	February 27, 1975	0	62 51N	175 08W	16	155	Bering Sea
1949-22175	February 27, 1975	0	61.29N	176 17W	17	154	Bering Sea
1950-20375	February 28, 1975	0	69 30N	143.12W	11	162	Demarcation Point
1950-20382	February 28, 1975	0	68 12N	145 02W	12	161	Arctic
1951-20433	March 1, 1975	0	69 28N	144.37W	12	162	Mt. Michelson
1951-20440	March 1, 1975	1	68 10N	146 27W	13	161	Arctic
1952-20491	March 2, 1975	0	69.30N	146 04W	12	162	Mt. Michelson
1952-20500	March 2, 1975	15	66 53N	149 34W	14	159	Chandalar - Beaver
1954-21040	March 4, 1975	15	58 43N	159 42W	21	151	Nushagak Bay
1956-21113	March 6, 1975	0	70 55N	149 34W	12	165	Beechey Point
1956-21120	March 6, 1975	0	69.38N	151 39W	13	163	Umiat
1957-21171	March 7, 1975	10	70 54N	151.06W	13	165	Harrison Bay
1957-21174	March 7, 1975	10	69 37N	153 11W	14	163	Ikpikpuk River
1958-21230	March 8, 1975	20	70.56N	152 22W	13	165	Harrison Bay
1959-21281	March 9, 1975	0	72 14N	151.24W	12	167	Beaufort Sea
1959-21284	March 9, 1975	0	70 58N	153 47W	13	165	Teshekpuk
1959-21295	March 9, 1975	0	67 04N	159 25W	17	159	Baird Mountains
1959-21302	March 9, 1975	20	65.43N	160 56W	18	157	Candle
1959-21304	March 9, 1975	5	64.22N	162.18W	19	156	Norton Sound
1960-21335	March 10, 1975	0	72 12N	152 53W	13	167	Beaufort Sea
1960-21342	March 10, 1975	0	70.57N	155 15W	14	165	Barrow
1965-20200	March 15, 1975	0	69 30N	139 00W	17	163	Herschel Island
1965-20211	March 15, 1975	0	65.31N	143.59W	20	157	Circle - Charlie River
1965-20214	March 15, 1975	0	64.10N	145.21W	21	156	Big Delta
1965-20220	March 15, 1975	5	62.48N	146.35W	22	154	Mt Hayes
1966-20242	March 16, 1975	0	73 21N	133.22W	14	170	Beaufort Sea
1966-20245	March 16, 1975	0	72 07N	136 01W	15	167	Beaufort Sea
1966-20251	March 16, 1975	0	70 51N	138 21W	16	165	Beaufort Sea
1966-20254	March 16, 1975	2	69.34N	140.25W	17	163	Herschel Island
1966-20274	March 16, 1975	0	62.53N	148.00W	23	154	Healy - Talkeetna Mts.
1968-20355	March 18, 1975	0	73.19N	136 10W	15	170	Beaufort SEa
1968-20361	March 18, 1975	0	72.05N	138 49W	16	167	Beaufort SEa
1968-20370	March 18, 1975	1	69 32N	143 12W	18	163	Demarcation Point
1968-20373	March 18, 1975	0	68.13N	145.03W	19	161	Arctic
1968-20375	March 16, 1975	10	66.53N	146 42W	20	159	Christian
1968-22202	March 18, 1975	10	69.31N	169 04W	18	163	Chukchi Sea
1969-20413	March 19, 1975	0	73.21N	137.33W	15	170	Beaufort Sea
1969-20442	March 19, 1975	10	64 14N	150 59W	23	156	Kantishna River - Fairbanks
1974-21111	March 24, 1975	05	69.34N	151.54W	21	163	Umiat
1975-21163	March 25, 1975	5	70.52N	151.17W	20	165	N.of Harrison Bay
1976-21212	March 26, 1975	0	73.24N	147.30W	18	170	Beaufort Sea
1976-21221	March 26, 1975	0	70.53N	152 31W	20	165	Harrison Bay
1977-21272	March 27, 1975	20	72.09N	151.44W	20	168	Beaufort Sea
1979-21382	March 29, 1975	0	73.21N	151.57W	19	170	Beaufort Sea
1979-21385	March 29, 1975	0	72 06N	154.34W	20	168	Beaufort Sea
1980-21443	March 30, 1975	5	72 07N	156.09W	21	168	N. of Barrow
1982-21564	April 1, 1975	5	69.30N	163.27W	24	163	Point Lay
1982-21571	April 1, 1975	5	68.12N	165.10W	25	161	Point Hope
1983-22011	April 2, 1975	0	73.18N	157.53W	21	171	Chukchi Sea
1983-22013	April 2, 1975	0	72 04N	160 31W	22	168	Floeberg
1983-22022	April 2, 1975	0	69.30N	164.52W	24	163	Point Lay - Chukchi Sea
1983-22025	April 2, 1975	0	68.11N	166 42W	25	161	Point Hope
1983-22031	April 2, 1975	5	66 52N	168.21W	26	159	Bering Straits
1984-20242	April 3, 1975	0	70 44N	138 33W	24	165	Beaufort Sea
1984-20245	April 3, 1975	20	69.27N	140.35W	25	163	Herschel Island
1984-20251	April 3, 1975	0	68.08N	142 24W	26	161	Table Mts
1984-20254	April 3, 1975	0	66 48N	144.02W	27	159	Fort Yukon
1984-20260	April 3, 1975	0	65.27N	145.29W	28	157	Circle
1984-20263	April 3, 1975	0	64 06N	146.49W	29	155	Fairbanks - Delta
1984-20265	April 3, 1975	0	62.44N	148 03W	30	154	Talkeetna Mts.
1984-22065	April 3, 1975	0	73 17N	159 22W	21	171	Chukchi Sea
1984-22080	April 3, 1975	20	69.29N	166.22W	25	163	Chukchi Sea
1985-20291	April 4, 1975	0	73 17N	134 57W	22	171	Beaufort Sea
1985-20303	April 4, 1975	0	69 30N	141 56W	25	163	Demarcation Point
1985-20305	April 4, 1975	0	68 11N	143.46W	26	161	Table Mts.
1985-20312	April 4, 1975	0	66.51N	145.24W	27	159	Fort Yukon
1986-20354	April 5, 1975	5	70 48N	141.19W	24	165	Beaufort Sea
1986-20361	April 5, 1975	5	69 30N	143 14W	25	163	Demarcation Point
1986-20363	April 5, 1975	0	68.11N	145.11W	26	161	Arctic
5000-20141	April 19, 1975	25	64.06N	144 00W	35	155	Delta - Eagle
5003-20291	April 22, 1975	0	70 43N	140 02W	31	166	Beaufort Sea
5003-20293	April 22, 1975	2	69 36N	142.05W	32	163	Demarcation Pt
5003-20300	April 22, 1975	0	68.07N	143.54W	33	161	Table Mt
5003-20302	April 22, 1975	0	66 47N	145 32W	34	159	Fort Yukon
5003-20305	April 22, 1975	0	65.27N	147 01W	35	157	Livengood
5003-20311	April 22, 1975	0	64 06N	148 21W	36	155	Fairbanks
5003-20314	April 22, 1975	0	62.44N	149.33W	37	153	Talkeetna Mts.
5004-20351	April 23, 1975	10	69 26N	143 32W	32	163	Demarcation Point
5004-20354	April 23, 1975	0	68.07N	145.21W	33	161	Arctic
5004-20360	April 23, 1975	0	66 47N	147 00W	34	159	Fort Yukon
5020-20230	May 9, 1975	15	69.23N	140 46W	37	163	Herschel Island
2072-21280	April 4, 1975	0	72 04N	149 44W	23	170	Beaufort Sea
2075-21452	April 7, 1975	0	72.03N	154 13W	24	170	Beaufort Sea
2075-21484	April 7, 1975	0	61 25N	167 25W	33	155	Hooper Bay
2075-21490	April 7, 1975	10	60 02N	168.29W	34	153	Bering Sea
2076-21540	April 8, 1975	5	62 49N	167 45W	32	156	Black
2076-21542	April 8, 1975	0	61 27N	168 54W	33	155	Hooper Bay
2076-21510	April 8, 1975	0	72 04N	155 44W	25	170	Beaufort Sea
2076-21513	April 8, 1975	10	70 48N	158 01W	26	168	Meade River
2076-21515	April 8, 1975	10	69 31N	160 09W	27	166	Utukok River
2076-21522	April 8, 1975	10	68 12N	162 00W	28	163	DeLong Mt

2076-21524	April 8, 1975	15	66.52N	163 40W	29	161	Kotzebue
2076-21533	April 8, 1975	0	64.11N	166 31W	31	158	Nome
2076-21545	April 8, 1975	5	60 04N	169 57W	34	153	Bering Sea
2077-21580	April 9, 1975	2	68.10N	163 28W	28	163	DeLong Mts
2077-21583	April 9, 1975	0	66.50N	165 06W	29	161	Shishmaref
2077-21585	April 9, 1975	0	65 30N	166 35W	30	160	Teller
2077-21592	April 9, 1975	0	64 09N	167.56W	31	158	Nome
2078-22030	April 10, 1975	10	70 41N	161 00W	26	168	Wainwright
2078-22032	April 10, 1975	10	69 24N	163.03W	28	165	Point Lay
2078-22035	April 10, 1975	0	68.05N	164 54W	29	163	Point Hope
2078-22041	April 10, 1975	0	66 45N	166.33W	30	161	Shishmaref
2078-22044	April 10, 1975	0	65.25N	168.02W	31	160	Teller
2078-22050	April 10, 1975	0	64.04N	169.23W	32	158	St Lawrence Island
2078-22053	April 10, 1975	0	62.42N	170 37W	33	156	St. Lawrence Island
2079-22084	April 11, 1975	20	70 40N	162 35W	27	168	Wainwright
2079-22091	April 11, 1975	10	69.22N	164.38W	28	165	Point Lay
2079-22093	April 11, 1975	0	68 04N	166 29W	29	163	Point Hope
2079-22100	April 11, 1975	0	66.44N	168 08W	30	161	Chukchi Sea
2080-20343	April 12, 1975	20	59.56N	149.58W	36	153	Blying Sound
2080-20352	April 12, 1975	10	57 09N	151.50W	38	150	Gulf of Alaska
2080-20354	April 12, 1975	10	55 45N	152.42W	39	143	Gulf of Alaska
2080-22145	April 12, 1975	10	69.22N	166.03W	28	165	Point Hope
2080-22151	April 12, 1975	0	68.04N	167 52W	29	163	Point Hope
2080-22160	April 12, 1975	5	65.23N	171 00W	32	159	Chukotsk Penn
2081-20372	April 13, 1975	15	69.20N	141.48W	29	165	Demarcation Point
2082-22262	April 14, 1975	10	69 16N	169.04W	29	165	Chukchi Sea
2083-20473	April 15, 1975	5	73.05N	137.49W	26	173	Beaufort Sea
2083-22320	April 15, 1975	0	69.16N	170.35W	30	165	Chukchi Sea
2085-20595	April 17, 1975	5	70 44N	145 19W	29	168	Flaxman Island
2085-22421	April 17, 1975	0	73.14N	166 07W	27	174	Chukchi Sea
2087-21105	April 19, 1975	0	72.00N	145 54W	29	171	Beaufort Sea
2087-21112	April 19, 1975	0	70 43N	148 13W	30	168	Beechey Pt
2087-21114	April 19, 1975	0	69 26N	150 15W	31	166	Umiat
2088-21161	April 20, 1975	0	73.14N	144 42W	28	174	Beaufort Sea
2088-21163	April 20, 1975	0	71.59N	147 20W	29	171	Beaufort SEa
2088-21170	April 20, 1975	0	70 43N	149 39W	30	168	Beechey Point
2088-2-172	April 20, 1975	0	69 26N	151 42W	31	166	Umiat
2091-19544	April 23, 1975	15	58 35N	140 52W	41	151	Gulf of Alaska
2092-20000	April 24, 1975	0	59.56N	141.20W	40	152	Icy Bay
2092-20002	April 24, 1975	5	58 33N	142 18W	41	151	Gulf of Alaska
2092-20011	April 24, 1975	10	55.46N	144 02W	43	148	Gulf of Alaska
2092-20014	April 24, 1975	20	54.22N	144.50W	44	146	Gulf of Alaska
2092-21393	April 24, 1975	0	71.56N	153 02W	30	171	Beaufort Sea
2092-21402	April 24, 1975	0	69.22N	157.24W	33	166	Lookout Ridge
2092-21411	April 24, 1975	0	66.44N	160.52W	35	162	Selawik
2092-21414	April 24, 1975	0	65.23N	162 21W	36	160	Bendeleben
2093-21451	April 25, 1975	0	71.54N	154 30W	31	171	Beaufort Sea
2094-21542	April 26, 1975	0	61.17N	168.52W	40	154	Bering Sea
2094-21544	April 26, 1975	10	59 54N	169.59W	41	152	Bering Sea
2095-21564	April 27, 1975	0	71.52N	157.31W	31	171	Chukchi Sea
2095-21571	April 27, 1975	0	70.36N	159 48W	32	168	Wainwright
2095-21573	April 27, 1975	25	69.18N	161 50W	34	166	Utukok River
2095-21585	April 27, 1975	15	65.19N	166.44W	37	159	Teller
2095-21591	April 27, 1975	10	63.58N	168.04W	38	158	Norton Sound
2095-21594	April 27, 1975	10	62.37N	169 18W	39	156	St Lawrence Island
2095-22000	April 27, 1975	0	61 15N	170 25W	40	154	Bering Sea
2096-22025	April 28, 1975	20	70.31N	161.24W	33	168	Wainwright
2096-22032	April 28, 1975	20	69.13N	163.25W	84	166	Point Lay
2096-22034	April 28, 1975	15	67.54N	165.13W	35	163	Point Hope
2096-22041	April 28, 1975	0	66.34N	166 49W	36	161	Shishmaref
2096-22050	April 28, 1975	20	63.53N	169.34W	38	157	St Lawrence Island
2096-22052	April 28, 1975	15	62 31N	170 47W	39	156	St. Lawrence Island
2096-22055	April 28, 1975	10	61.09N	171 54W	40	154	BEring Sea
2096-22061	April 28, 1975	10	59.47N	172.57W	41	152	St. Matthew
2097-22075	April 29, 1975	0	73 00N	158.00W	31	174	Chukchi Sea
2096-22081	April 29, 1975	0	71 45N	160 36W	32	171	Floeberg
2097-22084	April 29, 1975	20	70.29N	162 52W	33	168	Wainwright
2097-22090	April 29, 1975	15	69.11N	164 52W	34	166	Point Lay
2097-22093	April 29, 1975	10	67 53N	166.39W	35	163	Point Hope
2097-22102	April 29, 1975	0	65.13N	169 44W	38	159	Bering Straits
2097-22104	April 29, 1975	5	63.53N	171 03W	39	157	St. Lawrence Island
2097-22113	April 29, 1975	5	61 08N	173 23W	41	154	Bering Sea
2098-20310	April 30, 1975	0	70.34N	138.22W	33	168	Beaufort Sea
2098-20313	April 30, 1975	2	69.16N	140.23W	35	166	Herschel Island
2098-22142	April 30, 1975	15	70 34N	164 07W	33	168	Chukchi Sea
2098-22144	April 30, 1975	0	69 16N	166 09W	35	166	Point Hope
2098-22153	April 30, 1975	0	66 38N	169 36W	37	161	Chukchi Sea
2099-20360	May 1, 1975	15	73 03N	134 55W	31	174	Beaufort Sea
2099-20371	May 1, 1975	20	69 15N	141 47W	35	166	Demarcation Point
2099-20383	May 1, 1975	0	65 17N	146 41W	38	159	Fairbanks - Circle
2099-20385	May 1, 1975	3	63 55N	148 02W	39	157	Fairbanks - Healy
2099-22200	May 1, 1975	20	70.32N	165.39W	34	168	Chukchi Sea
2099-22214	May 1, 1975	0	65 15N	172.34W	34	159	Siberia
2099-22221	May 1, 1975	0	63 54N	173 53W	39	157	Siberia
2099-22223	May 1, 1975	0	62 33N	175 06W	40	155	Bering Sea
2099-22230	May 1, 1975	3	61 10N	176 14W	41	154	Bering Sea
2099-22232	May 1, 1975	0	59.48N	177 16W	42	152	Bering Sea
2100-20444	May 2, 1975	0	63 53N	149 33W	40	157	Fairbanks - Healy
2100-20450	May 2, 1975	5	62 31N	150 46W	41	155	Talkeetna
2100-20455	May 2, 1975	10	59 46N	152 51W	43	152	Illiamna, Seldovia
2100-22250	May 2, 1975	3	73 01N	162.19W	32	174	Chukchi Sea
2100-22252	May 2, 1975	10	71 46N	164 53W	33	171	Chukchi Sea

ORIGINAL PAGE IS
OF POOR QUALITY

2103-21001	May 5, 1975	20	68.58N	147.58W	36	165	Sagavanirktok
2104-21055	May 6, 1975	20	68.56N	149 28W	37	165	Philip Smith Mountains
2104-21062	May 6, 1975	20	67.37N	151.14W	38	163	Wiseman
2105-21120	May 7, 1975	20	67.57N	152.12W	38	163	Wiseman
2105-21140	May 7, 1975	20	61.13N	158.59W	43	153	Sleetmute
2105-21145	May 7, 1975	15	58.27N	160.59W	45	150	Hagemeister Island
2105-21152	May 7, 1975	15	57.04N	161.52W	46	148	Bristol Bay
2106-21174	May 8, 1975	0	67.55N	153.42W	38	163	Survey Pass
2106-21181	May 8, 1975	5	66.35N	155 20W	39	161	Hughes
2106-21183	May 8, 1975	15	65.15N	156.48W	40	159	Kateel River
2106-21190	May 8, 1975	10	63.54N	158.08W	41	157	Ophir
2106-21192	May 8, 1975	5	62.32N	159.21W	42	155	Holy Cross
2106-21201	May 8, 1975	20	59.48N	161.30W	44	151	Goodnews
2106-21204	May 8, 1975	20	58.25N	162.27W	45	150	Hagemeister Island
2107-19412	May 9, 1975	5	63.55N	133.52W	41	157	Canada
2107-19421	May 9, 1975	5	61.11N	136.02W	44	153	Lake Laberge
2107-19424	May 9, 1975	0	59.49N	137.04W	45	151	Skagway
2107-19430	May 9, 1975	0	58.27N	138.02W	46	150	Mt. Fairweather
2107-21232	May 9, 1975	20	67.56N	155.07W	38	163	Survey Pass
2107-21235	May 9, 1975	0	66.36N	156.45W	39	161	Shungnak
2107-21241	May 9, 1975	0	65.16N	158.12W	40	159	Kateel River
2108-19473	May 10, 1975	0	62.31N	136 25W	43	155	Canada
2109-21363	May 11, 1975	15	62.28N	163.40W	43	155	Kwiguk
2109-21370	May 11, 1975	5	61.06N	164.45W	44	153	Hooper Bay
2109-21372	May 11, 1975	5	59 44N	165.47W	45	151	Nunivak Island
2110-21404	May 12, 1975	0	67 49N	159.32W	39	163	Baird Mts
2-10-21410	May 12, 1975	10	66.29N	161.09W	40	161	Selawik
2110-21413	May 12, 1975	0	65.08N	162.36W	41	159	Bendeleben
2110-21415	May 12, 1975	20	63.47N	163.55W	42	157	Norton Sound
2110-21431	May 12, 1975	0	59.41N	167.17W	45	151	Nunivak Island
2111-21480	May 13, 1975	0	62.26N	166 34W	44	155	Black
2111-21482	May 13, 1975	0	61.03N	167.41W	45	153	Hooper Bay
2111-21485	May 13, 1975	20	59.41N	168 43W	46	151	Bering Sea
2111-21491	May 13, 1975	5	58.18N	169.40W	47	149	BEring Sea
2112-20093	May 14, 1975	20	65.15N	139.35W	42	159	E. of Charley River
2112-21504	May 14, 1975	0	71.47N	156.11W	35	171	N. of Barrow
2112-21513	May 14, 1975	20	69.13N	160 28W	38	165	Utukok River
2112-21520	May 14, 1975	0	67 54N	162.16W	40	163	Noatak
2113-20143	May 15, 1975	0	67.55N	137.53W	40	163	Canada
2113-20145	May 15, 1975	0	66.36N	139.30W	41	161	East of Black River
2113-20152	May 15, 1975	20	65.15N	140.59W	42	159	Charley River
2113-21560	May 15, 1975	20	73.01N	155.06W	35	174	Beaufort Sea
2113-21590	May 15, 1975	10	63.53N	168.07W	43	157	St Lawrence
2113-21563	May 15, 1975	1	71.46N	157.40W	36	171	Chukchi Sea
2113-21565	May 15, 1975	0	70.30N	159.56W	38	168	Wainwright
2113-21572	May 15, 1975	15	69.13N	161.56W	39	165	Utukok River
2113-21574	May 15, 1975	0	67.54N	163 44W	40	163	Noatak
2113-21581	May 15, 1975	40	66.35N	165.20W	41	161	Shishmaref
2114-20201	May 16, 1975	0	67.55N	139.21W	40	163	East of Coleen
2114-22030	May 16, 1975	20	69.13N	163.21W	39	165	Point Lay
2114-22033	May 16, 1975	0	67.54N	165.08W	40	163	Noatak
2114-22035	May 16, 1975	10	66.35N	166.45W	41	161	Shishmaref
2114-22042	May 16, 1975	5	65.15N	168 13W	42	159	Teller
2115-22105	May 17, 1975	0	62.32N	172.12W	44	155	Bering Sea
2115-22111	May 17, 1975	0	61 09N	173.19W	46	153	BEring Sea
2115-22114	May 17, 1975	0	59.47N	174.20W	47	151	BEring Sea
2115-22120	May 17, 1975	0	58.24N	175.18W	47	149	Bering Sea
2116-20350	May 18, 1975	2	56.58N	151.53W	49	147	Gulf of Alaska
2117-20372	May 19, 1975	15	67.50N	143 41W	41	163	Black River
2117-20374	May 19, 1975	15	66 31N	145 17W	42	160	Circle
2118-20424	May 20, 1975	5	69.15N	143 18W	40	165	Demarcation Point
2118-20430	May 20, 1975	10	67.55N	145 05W	41	163	Christian
2118-20433	May 20, 1975	25	66 36N	146 42W	42	161	Fort Yukon
2118-22255	May 20, 1975	5	69.18N	168.57W	40	165	Chukchi Sea
2119-20482	May 21, 1975	10	69.29N	144.16W	40	166	Mt. Michelson
2119-20484	May 21, 1975	0	68.11N	146.07W	41	163	Arctic
2120-20584	May 22, 1975	20	54.40N	158.57W	51	143	Simeonof Island
2122-19254	May 24, 1975	0	58.28N	133.43W	49	148	Juneau
2124-21160	May 26, 1975	10	73.04N	144.57W	38	174	Beaufort Sea
2126-21273	May 28, 1975	0	73.01N	147.56W	38	173	Beaufort Sea
2126-21275	May 28, 1975	20	71.47N	150.29W	39	170	Beaufort Sea
2127-21345	May 29, 1975	20	67 53N	158.06W	43	162	Ambler River
2127-21352	May 29, 1975	20	66.33N	159.43W	44	160	Selawik
2127-21354	May 29, 1975	10	65.13N	161.11W	45	158	Candle
2127-21361	May 29, 1975	5	63.52N	162.31W	46	156	St. Michael
2127-21363	May 29, 1975	10	62.30N	163.43W	47	153	Kwiguk
2127-21375	May 29, 1975	5	58.24N	166 47W	50	147	Bering Sea
2128-21390	May 30, 1975	15	73.00N	150.53W	38	173	Beaufort SEa
2129-21472	May 31, 1975	15	65.12N	164 02W	45	157	Bendeleben
2129-21474	May 31, 1975	0	63.51N	165 22W	46	155	Norton Sound
2129-21481	May 31, 1975	10	62.30N	166 35W	47	153	Black
2129-21483	May 31, 1975	30	61.07N	167.42W	48	151	Hooper Bay
2130-21530	June 1, 1975	5	65.09N	165.33W	45	157	Teller
2131-21580	June 2, 1975	0	67.49N	163.56W	43	162	Noatak
2131-21585	June 2, 1975	15	65.09N	166.58W	45	157	Teller
2132-22034	June 3, 1975	0	67.45N	165.27W	43	162	Noatak
2134-22154	June 5, 1975	20	66.33N	169.45W	44	159	Bering Straits
2134-22160	June 5, 1975	15	65.13N	171.12W	46	157	Chukotsk Penn.
2135-22215	June 6, 1975	5	65.12N	172.38W	46	157	Chukotsk Penn.
2135-22221	June 6, 1975	20	63.52N	173.58W	47	155	Bering Sea

APPENDIX B

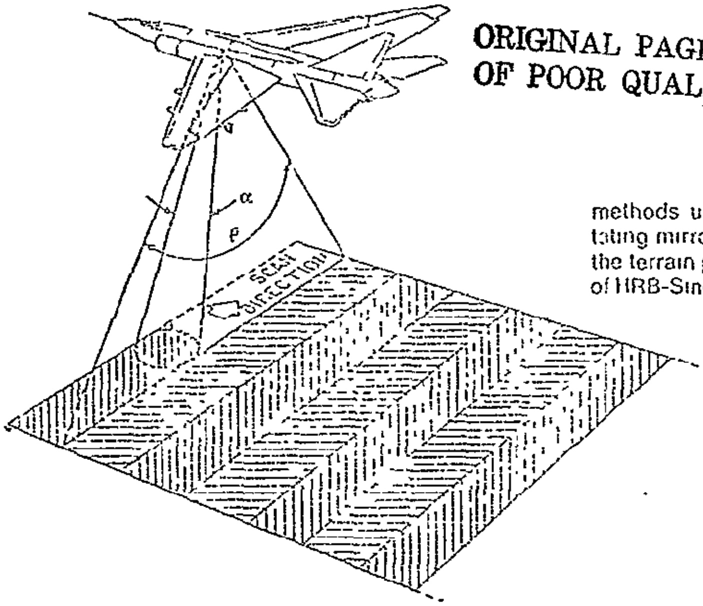
Description of Geology 494

"Remote Sensing"

Remote sensing techniques

REMOTE SENSING

ORIGINAL PAGE IS OF POOR QUALITY



One of many possible line-scanning methods utilized in airborne infrared sensing. A rotating mirror in the infrared sensing equipment scans the terrain perpendicular to the line of flight. Courtesy of HRB-Singer, Inc.

GEOLOGY 494 SPRING SEMESTER 1975

Everything you wanted to know about remote sensing, but didn't know how to ask.

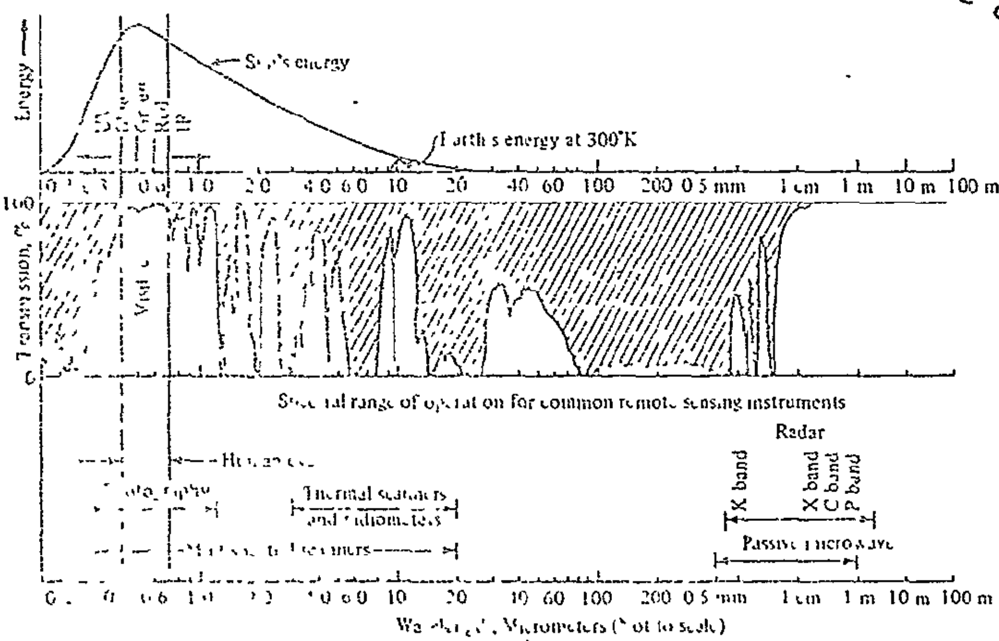
Course Title: Geoscience Applications of Remote Sensing

Credits: 3

Instructor: Dr. P. Jan Cannon, Assistant Professor of Geology

FOR MORE INFORMATION CONTACT:

Dr. Cannon in 304A Brooks Building or phone 479-7809



SLAR

RBV

IFV

UV

ERTS

spectral

thermal inertia

multiband

infrared photography

false color IR

radar imagery

thermal infrared imagery

synthetic aperture

UNIVERSITY OF ALASKA

REMOTE SENSING

Geol. 494 GEOSCIENCE APPLICATIONS OF REMOTE SENSING 3 credits
Spring, 1975
Instructor: Dr. P. Jan Cannon

Course Outline

ORIGINAL PAGE IS OF POOR QUALITY

Electromagnetic Spectrum: Reflection, Refraction, and Absorption

Photographic and Imaging (Non-Photographic) Systems: Camera Versus Line-Scan, Active and Passive Systems, Resolution

Photography in the Visible: Black and White, Color, Multiband

IR (Infrared) Photography: Black and White, False Color

Infrared Photography -- color, black and white - Applications
- Rock Types and Stratigraphy
- Identification of Soils
- Groundwater and Geologic Structure
- Applications to Mining and Environmental Geology
- Vegetation Surveys

Multiband Photography - Applications
- Shallow Submarine Geology
- Rock Type Descrimination
- Applications to Mining Geology

Radar Imagery: Theory, Systems, Geometry, Resolution, Distortions, Limits

Radar Imagery -- Applications
- Landform Identification
- Geomorphic Analyses
- Rock Type Descrimination and Identification
- Applications to Structural and Stratigraphic Problems
- Recognition of Soils, Surface Water, and Groundwater
- Vegetation Surveys

IR Imagery and Microwave Systems: Theory, Temperature and Spatial Resolution

Thermal Infrared and Microwave Imagery
- Possible Landform Identification
- Geomorphic Analyses
- Rock Type Identification
- Surface Water and Soils
- Groundwater and Caverns
- Active Geologic Processes
- Structural and Stratigraphic Applications
- Environmental Geology
- Vegetation and Animal Surveys

Remote Sensing of Earth from Space, Part I. --- ERTS

Remote Sensing of Earth from Space, Part II -- a) Skylab b) Gemini and Apollo

Remote Sensing of Other Planets

APPENDIX C

APPLICATION OF SATELLITE REMOTE SENSING DATA TO LAND SELECTION AND MANAGEMENT ACTIVITIES OF DOYON, LTD. OF INTERIOR ALASKA

Prepared by:
Dr. William Stringer, Project Scientist, Geophysical Institute
Dr. Lewis Shapiro, Geologist, Geophysical Institute
Dr. James Anderson, Plant Ecologist, Institute of Arctic Biology

May 1975
Final Report
Bureau of Indian Affairs
Contract No. E00C14201079
Project Leader: John M. Miller

Interim Report
National Aeronautics and Space Administration
Grant No. NGL-02-001-092
Principal Investigators: Albert E. Belon and John M. Miller

Prepared for:
Bureau of Indian Affairs
National Aeronautics and Space Administration
Doyon, Ltd.

APPLICATION OF SATELLITE REMOTE-SENSING DATA TO LAND SELECTION AND MANAGEMENT ACTIVITIES OF DOYON, LTD. OF INTERIOR ALASKA

TABLE OF CONTENTS

APPLICATION OF SATELLITE REMOTE SENSING DATA
TO LAND SELECTION AND MANAGEMENT ACTIVITIES
OF DOYON, LTD. OF INTERIOR ALASKA

ORIGINAL PAGE IS
OF POOR QUALITY

I. INTRODUCTION AND BACKGROUND

Currently the Alaskan regional Native corporations and village councils are engaged in selection of lands authorized by the Alaska Native Land Claims Settlement Act. The work reported here was performed as a result of a request by Doyon, Ltd., a regional corporation of interior Alaskan Natives, for assistance in obtaining resource information and in training their personnel for the process of land selection and the management of lands selected.

The Geophysical Institute proposed to the Bureau of Indian Affairs to produce data products to aid Doyon, Ltd. in their selection process. This project was to be looked upon as a pilot program of resource surveys designed to assist Alaskan Native corporations and villages in the process of land selection and management after selection. This project proved to be of longer duration and cost than initially anticipated. Additional funds have been used from other related projects, particularly NASA grant NGL-02-001-092, in order that the work be completed in a form that meets the scientific standards of the Geophysical Institute.

Because of the general lack of resource data - particularly vegetation and land use maps - throughout Alaska, the Geophysical Institute proposed to utilize Earth Resources Technology Satellite (ERTS) data supplemented by aerial photographs and the limited available field data for land use analyses of the regional deficiency areas identified as being of greatest interest by Doyon, Ltd. The University of Alaska has been a major participant in the National Aeronautics and Space Administration's ERTS program, and as a result of this activity, has brought scientists together from the disciplines of geology, ecology, forestry, mineral engineering, wildlife management, hydrology, meteorology, agriculture, and the marine sciences to develop methods for applying remotely sensed data to regional land use surveys in Alaska.

It is believed that many of the techniques and approaches which have been developed by the ERTS program can be utilized directly by regional and village corporations in the process of making land use decisions. This report illustrates the use of these techniques with the hope that the results of this pilot study will provide guidelines which can be applied to other regional corporations, village corporations, and state and regional governmental agencies facing similar land use decisions.

II. APPROACH - PRODUCT PREPARATION

All existing Alaskan resource data, including the recently acquired ERTS data, was used to provide a resource base for land use maps and/or prospecting area maps of 250 townships considered to be of high priority for selection decision by Doyon, Ltd. In addition, township and range data were projected onto 1:250,000 scale ERTS images to aid visual examination of the imagery for land use decisions.

In the following paragraphs, a general description of the processes used to produce the prospecting area and land use maps and their utility will be discussed. Following this general description the individual reports for each selection area will be presented.

A. Prospecting Area Maps

The objective of the mineralization analysis was to delineate areas for which interpretation of ERTS images, combined with existing ground and aerial

ORIGINAL PAGE IS
OF POOR QUALITY

data indicated a favorable probability of metallic or non-metallic mineral products. It should be emphasized that ERTS data alone will not permit mineral deposits to be identified and located. However, interpretation of ERTS data in conjunction with other available geophysical data, including the distribution and characteristics of known ore deposits, may be adequate to define areas where further prospecting is warranted.

The importance of this type of information must be clearly recognized. The size of the areas held for selection is so great that the cost of doing a rapid geologic reconnaissance for identification of favorable prospecting areas by any other means would have been prohibitive. This is particularly true in view of the time frame within which the land selections must be completed.

The basic steps in a prospecting area analysis are:

(1) Assemble and organize all geophysical data relating to the likelihood of ore deposits in the area under study. These data are organized to indicate the distribution of potential mineralization regions of similar types and the nature of the geological control prevailing in each region.

(2) Prepare maps of mining districts, known mining claims and other relevant data and locate these on the ERTS images.

(3) Interpret the ERTS data to identify distinctive features of the geologic environment, land forms, vegetation, and tectonic faults which can be associated with each potential mineralized province, and determine which combination of these features might justify extending the boundaries of known mining districts or projecting the trends of known deposits into new areas.

(4) Prepare maps of the study area indicating locations of favorable prospecting areas.

This process does not immediately pinpoint ore deposits. However, it is believed to have served the land selection requirements of the regional corporation effectively because those requirements call for a selection by Doyon of approximately 1/3 of the lands held available for land claims settlement purposes. Hence, even if the corporation did not have sufficient time or funds for detailed prospecting in these areas, the areas considered suitable for further prospecting could be selected for ownership by the regional corporation, based in part on the results of this project.

B. Land-Use Maps

Land-use maps of Alaskan areas are of increasing importance with the current widespread rush into land disposition and resource exploitation. Such maps provide a spatial inventory of selected resources, and they may serve as a guide for land selection and sensible management planning. Land-use maps may help in organizing activities compatible with the integrity of the natural environmental and the rational and long-range economic needs of the owner.

The land-use maps prepared as part of this project are essentially vegetation maps depicting broadly-defined vegetation types at the scale, on the originals, of 1:250,000. Although botanically coarse and of small scale, these maps provide more information, especially spatial, than any previous vegetation maps of the areas and are a step toward the production of more accurate land-use maps in Alaska.

The land-use maps were based principally on visual photointerpretation of Earth Resources Technology Satellite (ERTS) images. The reasons for this were

ORIGINAL PAGE IS
OF POOR QUALITY

(1) ERTS image availability, (2) the usefulness of ERTS imagery for mapping broadly-defined vegetation types over large areas in a relatively short time and, (3) lack of complete aerial photographic coverage. ERTS images used for mapping were 16"x20" photographically enlarged prints produced at a scale of 1:250,000. The land use classification adopted for this map series is a system developed by the U. S. Geological Survey under the direction of James R. Anderson.

Some of the scenes, printed in black and white, were acquired by the satellite in the late winter, when the landscape was generally snow-covered, but when plants taller than the snow pack were free of snow. In the forest zone of interior Alaska snow accumulation by late winter usually is about one meter. Actual snowfall in late winter is normally infrequent and light. The late winter images permitted estimations of vegetation structure based on a gray scale continuum related to plant height and cover.

Other ERTS scenes, acquired during the summer seasons, were reconstituted and printed in simulated color infrared which permitted several coarse floristic distinctions based on knowledge of the infrared reflectance of high-cover species or species groups.

Information from the winter and summer images together was used in making vegetation distinctions to the extent that the latter may be expressed by the adopted classification system. Interpretations were also based on physiographic information obtained from topographic maps, as there are general relationships between vegetation and physiography.

Available aerial photographs of part of the regions under study were

ORIGINAL PAGE IS
OF POOR QUALITY

also used as training sets for the visual photointerpretation of the satellite images.

Finally low-level aerial reconnaissance was utilized to spot check and verify the accuracy of the land-use maps produced in this project.

The identification of vegetation containing trees of possible commercial timber grade required first the identification of forest vegetation, then an estimation of composition and stature using the kinds of spectral and physiographic information described above. A quantitative definition of commercial timber was not intended. The commercial stands depicted on the maps are those in which the occurrence of a number of larger trees suitable for lumber production appears likely. This extension of vegetation-type classification to include possible commercial timber was performed because other than mineralization, timber resources represent a major possible consideration for land selection decisions.

C. Combination Maps of Prospecting Areas and Possible Commercial Timber

Generally, the various selection areas either contained chiefly mineral potential or timber potential but not both. Therefore, on the basis of a preliminary evaluation, most areas were analysed only on the basis of only one resource type. However, two areas, the Kaltag area and the Purcell Mountain area were mapped in terms of both resources. In these two cases a third map was produced showing both prospecting areas and areas which appeared to contain potential commercial timber. In that way the amount and location of land to be considered for selection in terms of these two resource categories can be seen together, thereby aiding the selection process.

III RESOURCE REPORTS FOR INDIVIDUAL SELECTION AREAS

In this section the resource reports for the individual selection areas are presented. Because of the specific locations of the selection areas, some were considered to have both vegetation and mineral resource possibilities while others were considered to chiefly contain only one of these resources. The areas analysed in terms of both vegetation and mineralization potential were the "Kaltag" and "Purcell Mountain" areas while the "Alatna", "Wiseman", and "Allakaket" areas were analysed in terms of mineralization potential alone and the "Tanana" and "North" and "South Fork Kuskokwim" areas were analysed in terms of only vegetation.

The maps referenced in this section of the report were prepared at a scale of 1:250,000 and are rather large in some cases. Therefore they were presented to Doyon, Ltd. in a large scale and mounted on poster board. They appear in this report photographically reduced to eight to ten inch format.

ORIGINAL PAGE IS
OF POOR QUALITY

A. THE KALTAG SELECTION AREA

This withdrawal area, located south of Kaltag (see map) along the Yukon River is relatively remote. There are no settlements along the Yukon for nearly 100 miles south of Kaltag. There are no roads to or within the area nor are there any airfields within it. During summer there is barge transportation available to either Nenana, on the Alaska Railroad, or to ocean-going shipping at the mouth of the Yukon. The closest airport is located at Kaltag.

The only known mineral extraction within the area consists of two coal mines which were operated early in the century. Logging, if any, was mostly likely limited to production of cord wood for steamboats. Today it appears that the mineral potential is still largely unexplored and many fine stands of commercial-size spruce and hardwoods are found within the area.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

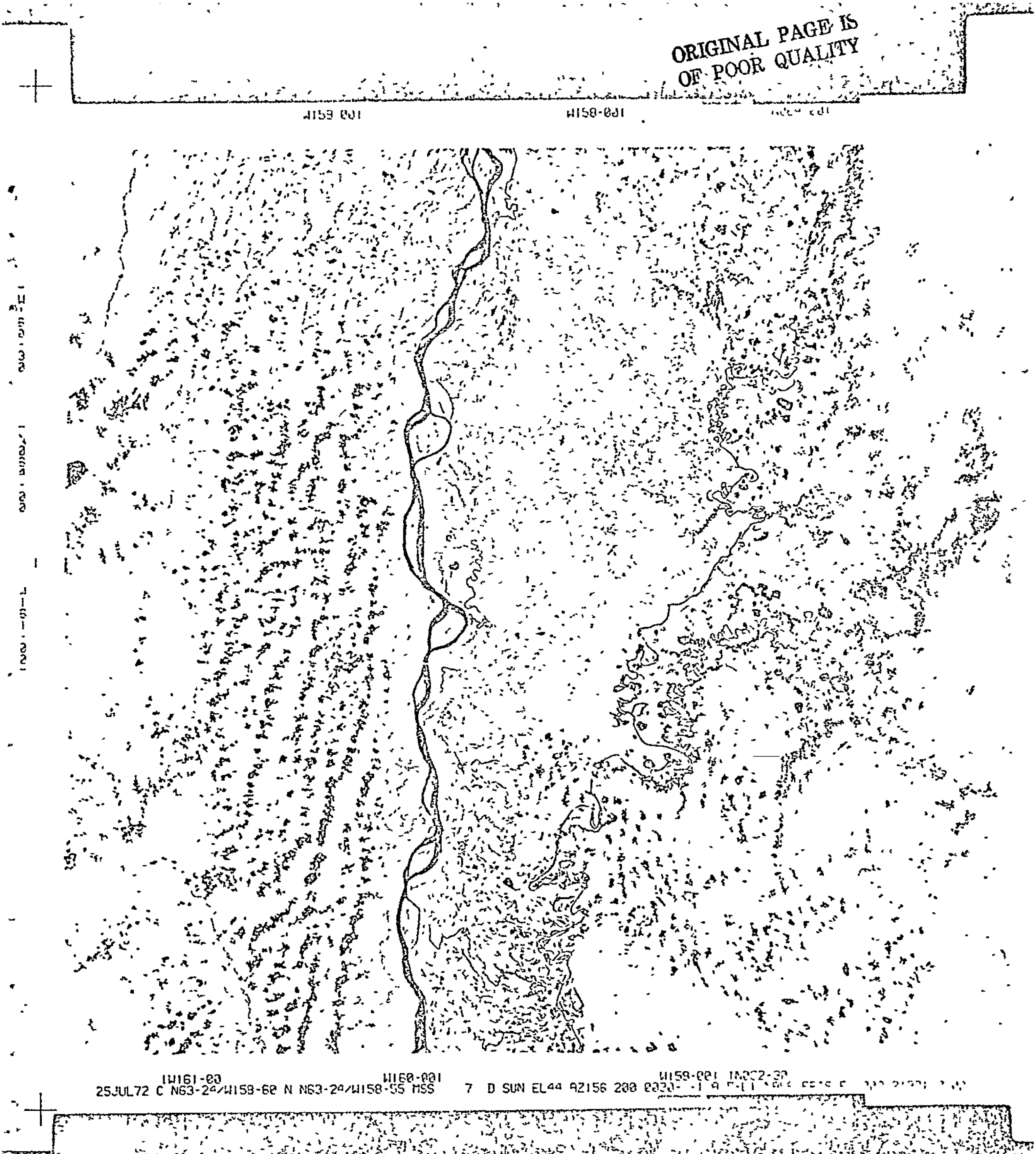
ALASKA

ALASKA MAP C

FOR SALE BY U S GEOLOGICAL SURVEY FEDERAL CENTER DENVER, COLORADO OR WASHINGTON 25, D C

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY



A portion of this scene, 1002-21321, obtained July 25, 1972, was color reconstituted using spectral bands 4, 5, and 7, and enlarged to a scale of 1:250,000. This was then used as an aid in vegetation and mineral mapping for the designated area.

PRECEDING PAGE BLANK NOT FILMED

1. Summary Recommendations

These pages constitute a summary of the results of analysis of the Kaltag selection area and recommendations based on these results. The map drawn for this section merely shown which townships might be considered for mineral prospecting and for possible commercial timber development. Detailed reports and maps are in succeeding sections.

ORIGINAL PAGE IS
OF POOR QUA

PRECEDING PAGE BLANK NOT FILMED

a. Summary of Mineral Recommendations

Information presently available is not adequate for a preliminary evaluation of the mineral potential of the Kaltag-Grayling withdrawal area. Thus it is recommended that a program of field investigations be conducted during the next field season. This should consist of collection and analysis of about 500 stream sediment, soil and rock samples from the following localities:

1. Approximately 200 stream sediment, soil, and rock samples from the southern half of T. 26 S., R. 3 W., Kateel River Meridian, and adjacent areas, to determine the extent of the molybdenum mineralization discovered at the McLeod Prospect.

2. Approximagely 150-200 stream sediment samples from the Blackburn Hills to evaluate the mineral potential of the granitic rocks which underlie the area and their associated contact zones. The area of interest includes T. 24 S., R. 6 W.; T. 25 S., R. 7 W.; about 1/2 of T. 25 S., R. 6 W., Kateel River Meridian, and smaller parts of adjacent townships.

3. A reconnaissance stream sediment sampling program is recommended for the igneous and metamorphic terraine of T. 26 and 27 S., R. 3 W.; T. 25 S., R. 2 W.; T. 20 S., R. 1 W.; T. 21 S., R. 2 W.; Kateel River Meridian, and adjacent areas. A total of about 100 samples from these areas should be adequate.

All of the remaining area of this withdrawal should be eliminated from further consideration for selection as potential mineral lands.

PRECEDING PAGE BLANK NOT FILMED

b. Forest Product Recommendation

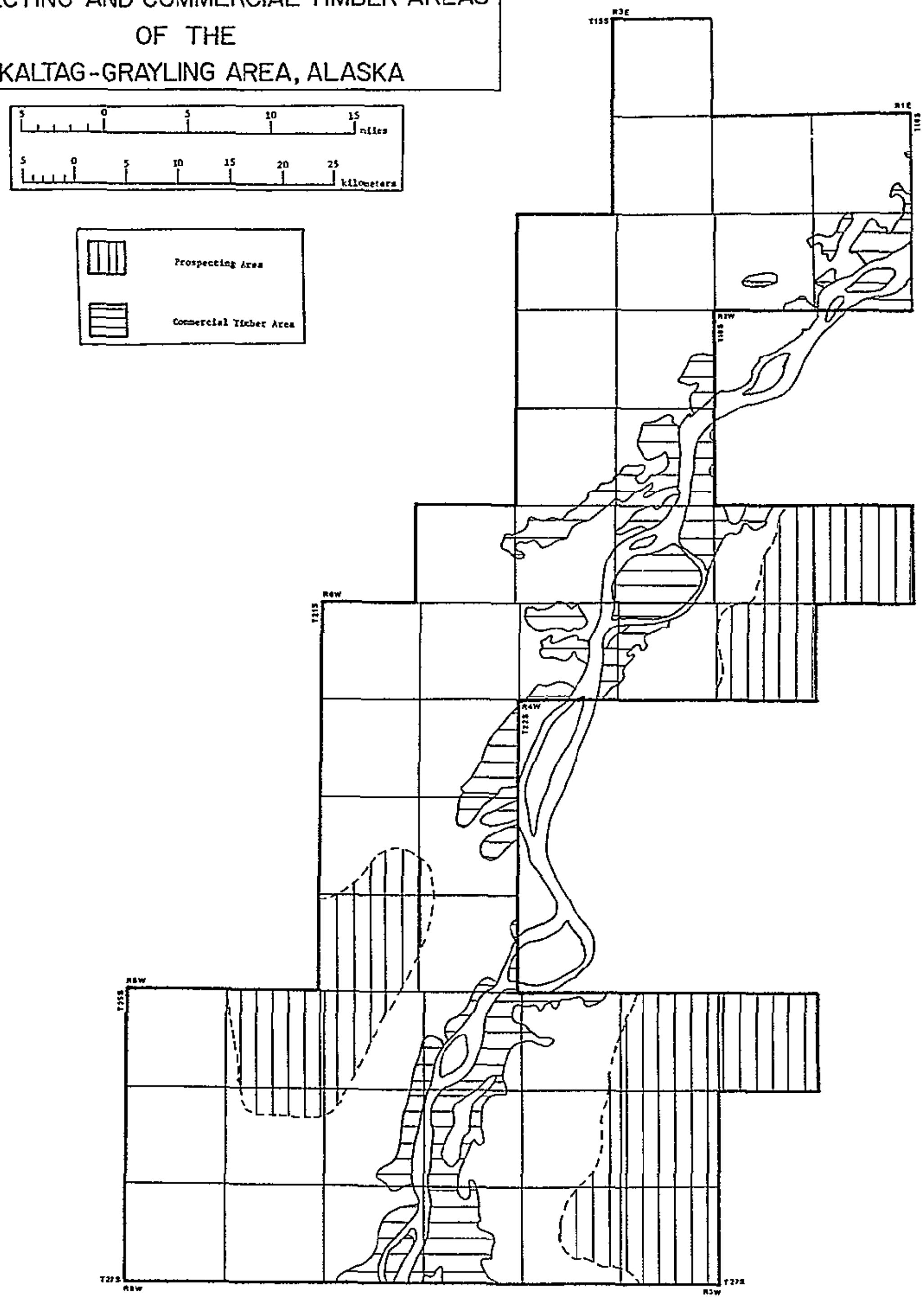
In this analysis we have mapped areas of hardwood and softwood trees that appear sufficiently large to be generally considered commercial types when located near a market. This is not to say that these are commercial forests because that designation involves many economic factors not considered here. The areas designated here as commercial forest should be regarded as those stands of timber that have the greatest likelihood of being commercial forests.

No analysis has been made to determine timber volume charts for trees in this area. The nearest location of a study of that nature is along the Kuskokwim near Aniak.

As part of the Alaska Forest Inventory, aerial photographs were obtained along flight lines 30 miles apart over wide areas of Alaska including the Kaltag selection area. A small area on each photograph was analyzed by stereoscopic viewing. Occasionally, one of these samples was field-checked. These data, archived in Juneau, very likely represent the only ground-based investigation of the quality of trees in this area.

Before any selections are made on the basis of possible timber-related income, timber volumes should be established and an economic forester should be consulted to determine the economic feasibility of such a venture.

PROSPECTING AND COMMERCIAL TIMBER AREAS
OF THE
KALTAG-GRAYLING AREA, ALASKA



2. Provisional Land Use Map of the Kaltag-Grayling Area, Alaska

a. Introduction

Land use maps of Alaskan areas are of increasing importance with the current widespread rush into land disposition and resource exploitation. Such maps provide a spatial and quantitative inventory of selected resources and some basis for sensible planning. Land use maps may help in organizing activities which would be compatible with (1) a natural environmental integrity and hence with regeneration potentials and esthetic qualities and (2) with the rational and long-range needs of the exploiting agency.

Land use maps where little land use, as such, has begun are particularly important. These tend to emphasize vegetation, the most visible and functionally important component of most ecosystems. The importance of vegetation includes its immediate resource values, such as timber and wildlife habitat, and its indicator values. Vegetation is an integrated expression of the history of the site and the nature of soils, drainage, permafrost, topography and small and large-scale climates.

The land use map of the Kaltag-Grayling area is the first of a series of maps of Alaskan areas of particular interest to the Bureau of Indian Affairs, the agency funding the mapping, and the Doyon Native Regional Corporation, within whose jurisdiction the map-area lies. It is essentially a vegetation map depicting broadly defined vegetation types at the relatively small scale, on the original, of 1:250,000.

Although limited in vegetation detail and scale, this map provides more information than any previous map and is a step toward the production of more meaningful land use maps of Alaska.

b. Approach

The map was drawn from Earth Resources Technology Satellite (ERTS) images. The reasons were (1) ERTS image availability, (2) the usefulness of ERTS imagery for mapping broadly defined vegetation types over large areas in a relatively short time and (3) lack of complete aerial photograph coverage.

The scenes used were numbers 1002-21321, 1038-21301, 1273-21370 and 1273-21373. Images for mapping were made as photographic prints enlarged to a scale of 1:250,000.

Two of the scenes, printed in black and white, were obtained in late winter, when the landscape was generally snow-covered, but when plants taller than the snow pack were free of snow. Images made from these scenes permitted determinations of vegetation structure, based on a gray scale continuum related to plant cover. Areas of no plant cover or of vegetation too low to show above the snow appeared nearly white. Areas of some plant cover appeared somewhat gray. Areas of intermediate plant cover appeared grayer, and areas of closed vegetation, where no snow showed, were dark gray. Briefly, nearly white was interpreted as tundra, intermediate gray as scrub or open forest, and dark gray as closed forest.

Two other scenes, obtained in the summer, were printed in color-infrared. These permitted gross floristic distinctions, based on some knowledge of the infrared reflectance of major species or species groups. Broad-leaved trees and shrubs reflect highly in the near infrared and therefore appear bright red on the imagery. Most needle-leaved species have low near infrared reflectance and therefore appear dark gray. Intermediate gray colors seem to indicate ericaceous shrubs.

The winter and summer images were used together in making the vegetation and other land use distinctions expressed in the classification system. Interpretations were further facilitated by physiographic information obtained from topographic maps, as there are some relationships between vegetation and physiography. For example, wetlands occur in low-lying flat areas; broad-leaved forests and forests dominated by white spruce are the main forest types on east, south and west slopes; and upland bogs and black spruce bog woodlands occur more frequently than the former on north slopes. Flood plains in the vicinity of streams commonly are occupied by white spruce and balsam poplar vegetation types containing trees of commercial grade.

Initially, most of the interpretations of the spectral units on the imagery were made through comparisons with aerial photographs covering parts of the map-area. Alaska Forest Inventory photographs in black and white modified infrared were obtained from the U.S. Forest Service, and some small-scale color-infrared photography was obtained from the National Aeronautics and Space Administration and its summer 1974 U-2 aerial photography mission. In general, more information is available on aerial photographs than is necessary for establishing or validating the broad land use classes recognizable on ERTS imagery.

The identification of vegetation containing trees of possible commercial timber grade involved the recognition of forest, then an estimation of forest composition and stature from the spectral and physiographic information described above. A quantitative definition of commercial timber is not intended. The commercial stands depicted on the map are those in which the occurrence of a number of larger trees suitable for lumber production is likely. White spruce, balsam poplar and paper birch are the potentially commercial grade species.

The mechanics of mapping included (1) tracing streams, lakes and other prominent landmarks onto a transparent plastic overlay of the base map, a U. S. Geological Survey topographic map, (2) positioning the overlay on the ERTS image according to these landmarks, (3) tracing identified spectral units onto the overlay, (4) positioning the base map over the overlay on a light table and (5) tracing the vegetation and other land use boundaries on the overlay onto the base map and labeling them.

A preliminary map was made in the laboratory by these methods, using all available control in the form of aerial photographs and written and oral information. This map was used as a guide to a route of travel by light aircraft for field checking. Comparing the preliminary map with certain parts of the map-area confirmed earlier interpretations of the ERTS imagery in many cases, but showed also some faulty interpretations. This field work led to the revised and more nearly accurate map presented here.

c. The Map

The map depicts 11 land use classes which, in this case, are all vegetation types of rather broad definition. The classification system and symbolism is from the latest revision of A Land Use Classification System for use with Remote Sensor Data by James R. Anderson et al, U.S. Geological Survey, 1972-74. The distribution of units depicting vegetation containing trees of possible commercial grade is emphasized by crosshatching. The general composition of the vegeetation types is as follows:

3 2. Scrub. Scrub is a major physiognomic vegetation type, equivalent in rank to forest, bog, etc., dominated by shrubs or young, shrub-sized individuals of tree species. Much of the scrub in the map-area, particularly in the southeast, is believed to be the latter, chiefly post-fire stands of young aspen and birch. Closer to the Yukon River, however, scrub stands contain willows (Salix spp.) and alders (Alnus spp.) usually as dominants in flood plain and point bar early successional vegetation. Shrub dominated areas in bogs are not included, but fall within class 6 2, and high elevation shrub tundra is covered by class 8. Scrub is an important vegetation type for wildlife, especially large game animals, because of the high proportion in it of browse food material.

3 2 B. Recent burn. This designates an area recently burned by wildfire. Charred vegetation and downed trees occur in the area, and new herbaceous and shrub growth is widespread. The area will be increasingly valuable as wildlife habitat in the next few years.

4 1. Forest, broad-leaved. Forested areas are identified by a 4, and broad-leaved, usually deciduous forest by 4 1. Here the major species are paper birch (Betula papyrifera), aspen (Populus tremuloides) and balsam poplar (Populus balsamifera). Paper birch is the most widespread, occurring throughout the range of the broad-leaved forest type. Aspen is also widespread, but occurs mostly on more or less south facing slopes of moderate steepness. Balsam poplar is relatively limited, large trees occurring as stand dominants only on old flood plains in the vicinity of major streams. In the map-area, most broad-leaved forest is characterized by trees of small to intermediate size. Some of these may be important as pulp timber.

4 1 C. Broad-leaved forest, commercial. Broad-leaved forest believed to contain large trees of timber grade are designated by a C (commercial) and by crosshatching. These forests are mostly on the old flood plains in the vicinity of the Yukon River, and the principal species is balsam poplar. Some commercial broad-leaved forest stands on upland sites farther from the river are characterized by paper birch and some aspen.

4 2. Forest, needle-leaved. Needle-leaved, mostly evergreen forest, dominated by white spruce (Picea glauca) and/or black spruce (Picea mariana) is widely distributed in the map-area, but is considerably less

important areally than broad-leaved forest. White spruce is the dominant species on upland sites on most slopes. North slope needle-leaved forests are more often characterized by black spruce in closed and open stands. Needle-leaved forests on low-lying flat areas also are dominated more often by black spruce than white spruce.

4 2 C. Needle-leaved forest, commercial. White spruce is almost exclusive as the commercial grade dominant in commercial needle-leaved forests. Such forests are limited to the older flood plains, where white spruce forest usually follows broad-leaved forest as a late stage in vegetation succession.

4 3. Forest, mixed broad-leaved and needle-leaved. Most forest vegetation in the map-area is characterized by mixtures of broad-leaved and needle-leaved trees. This is a reflection of widespread heterogeneity in a number of environmental and historical factors. Mixed forest is by far the most important areally, but most of this is dominated by trees of intermediate size or, at higher elevations, by small trees. Some of this forest is open in nature, with low tree density and a correspondingly abundant shrub component. In general, therefore, mixed forest in the map-area may be of pulp value in some places and of value as habitat for large game animals in others.

4 3 C. Mixed forest, commercial. As mixed forest is the most important non-commercial forest type in the map-area, it is also the areally most important commercial type. Like the other two commercial types, it also is limited to lower elevation areas near the Yukon River.

Here the most important broad-leaved species is balsam poplar, but paper birch is widespread. Aspen is of some importance on sites somewhat removed from the river. White spruce is the only important needle-leaved component.

6 1. Wetland, forested. A 6 designates wetland, a broad class of vegetation and land use types generally characterized by a soil water table at or near the surface most of the year. A 6 1 designates wetland areas where the water table is just low enough to allow some tree growth. In the map-area, this growth is characterized by black spruce and some paper birch. Trees are small to intermediate in size, and their density is low. Hence the vegetation is mostly open forest and, where tree density is even lower, woodland. In the latter, which is the areally most important in the forested wetland class, a bog woodland, specifically a black spruce bog woodland, is involved. The bog components comprise shrub and dwarf-shrub layers and a thick cryptogam layer. Shrubs are several ericaceous species, shrub birch (Betula glandulosa) and some willows. The cryptogam layer is made up of several moss species, and some Sphagnum spp. and lichens. Herbs are widespread but of relatively low density.

6 2. Wetland, non-forested. Some non-forested wetlands are similar to the preceding, but lack trees. Dwarf-shrub, herbaceous and cryptogam vegetation is dominant. The herbaceous component includes much cottongrass (Eriophorum spp.) and sedge (Carex spp.). The cryptogam component is characterized by a higher proportion of Sphagnum spp. than the equivalent forested wetland component.

This type is known as bog or, colloquially, muskeg, and is further characterized by the slow and possibly intermittent accumulation of peat. This accumulation leads to cold soils and near-surface permafrost development.

Another kind of vegetation in the non-forested wetland class is marsh, characterized by a thoroughly wet soil, with the water table above the surface, and a vegetation of graminoids and bryophytes. Sedges and several grass species are characteristic. In the map-area, stands designated 6 2 located near small, slow-flowing streams, ponds and lakes in flat areas are more often marsh than bog.

8. Tundra. Higher elevation areas, generally above approximately 2,500 feet, are occupied by tundra, a broad landscape category characterized by at least four major physiognomic vegetation types. These are scrub, dwarf-scrub, meadow and felifield. These types were not distinguished in the Kaltag-Grayling map-area.

d. Example of Application for Land Selection

An example of a use to which a map of this kind can be put is the compilation of townships within which stands of commercial timber occur. Here is a list of these, all on the Kateel River meridian:

Nulato Quadrangle

R1E: T15S, T16S, T17S

R1W: T16S, T17S

R2W: T17S

Ophir Quadrangle

R1E: T17S, T18S

R1W: T17S, T18S

R2W: T17S, T18S, T19S

Unalakleet Quadrangle

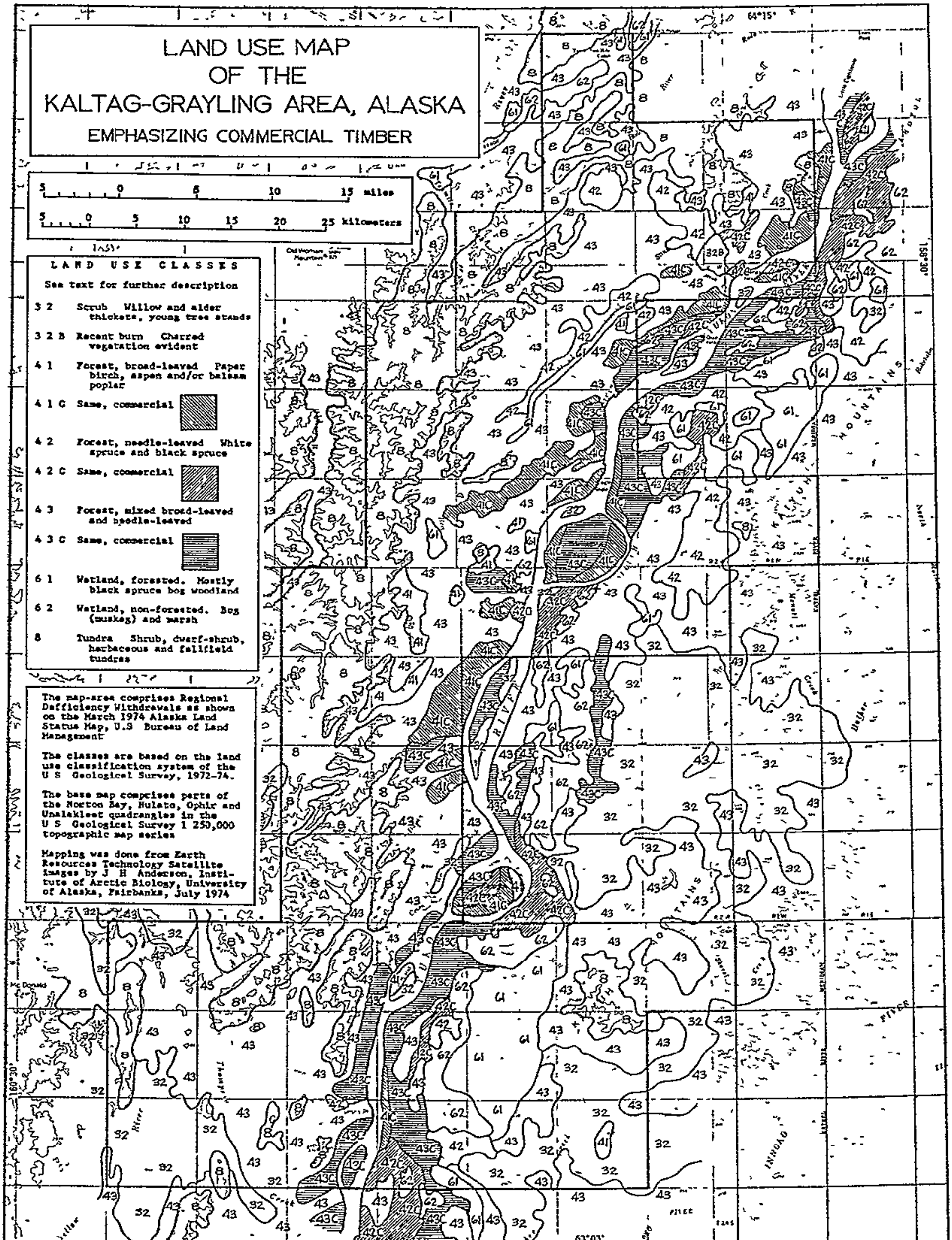
R2W: T17S, T18S, T19S, T20S

R3W: T18S, T19S, T20S, T21S, T22S, T23S, T24S

R4W: T19S, T20S, T21S, T22S, T23S, T24S, T25S

R5W: T22S, T23S, T24S, T25S, T26S, T27S, T28S

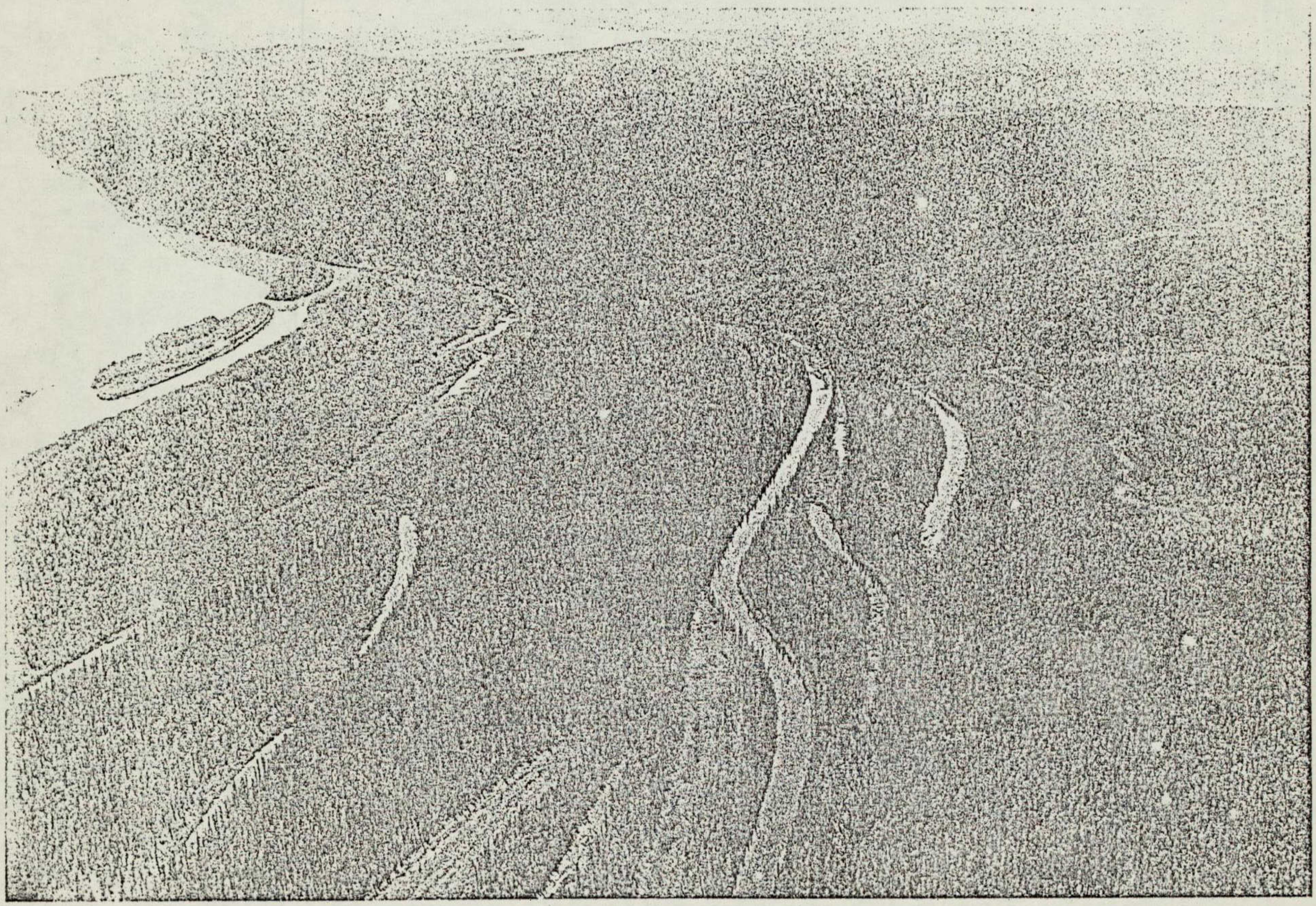
R6W: T26S, T27S, T28S



ORIGINAL PAGE IS
OF POOR QUALITY

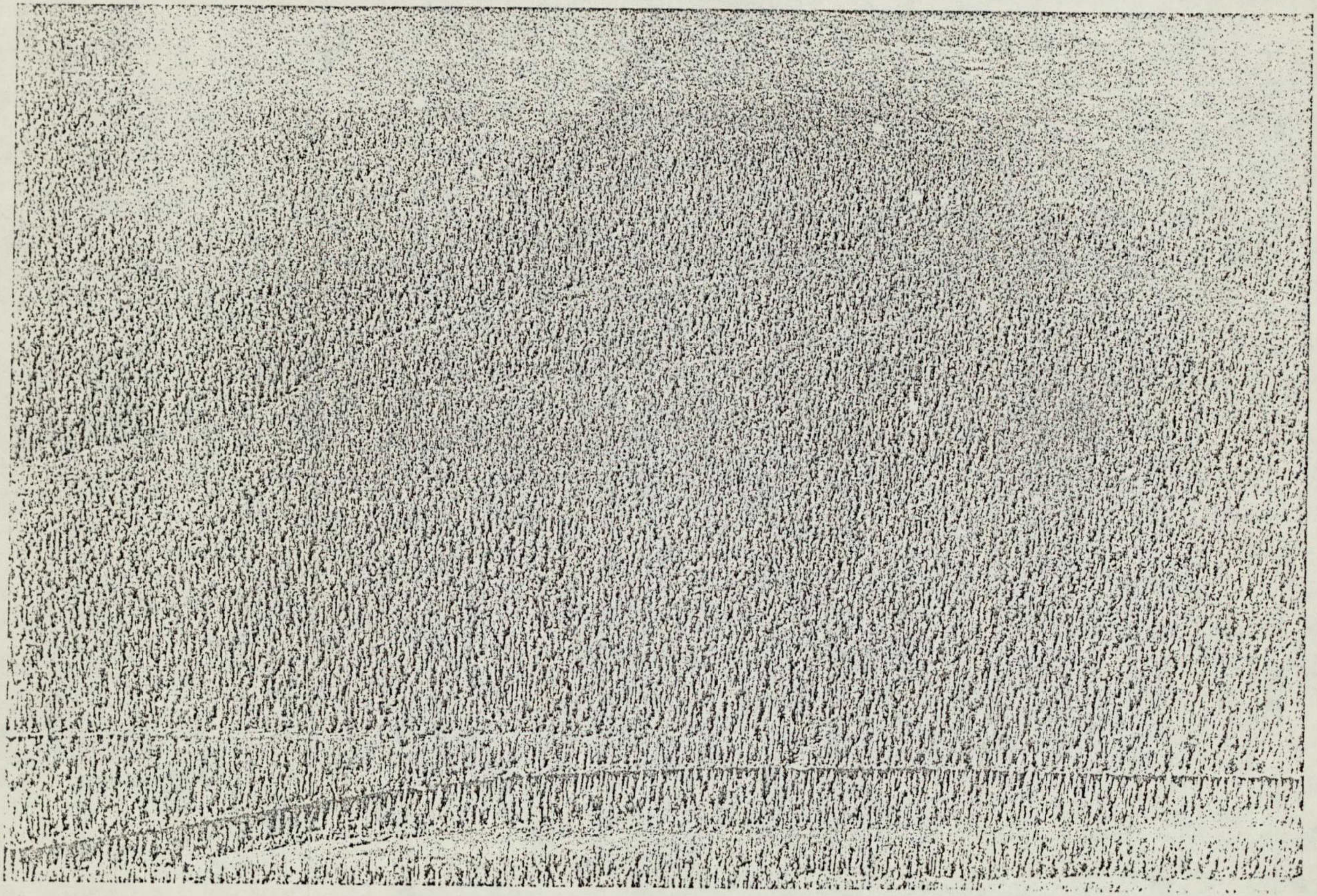
e. Oblique Aerial Photography

A field check of preliminary versions of the maps presented in this folio was made by light aircraft August 5, 1974. At that time several oblique 35 mm photographs were taken for the purpose of illustration. These photographs were taken under varying lighting conditions through the plexiglass windows of the aircraft which results in some loss of quality. The location of each photograph is indicated on the copy of the vegetation map included here.



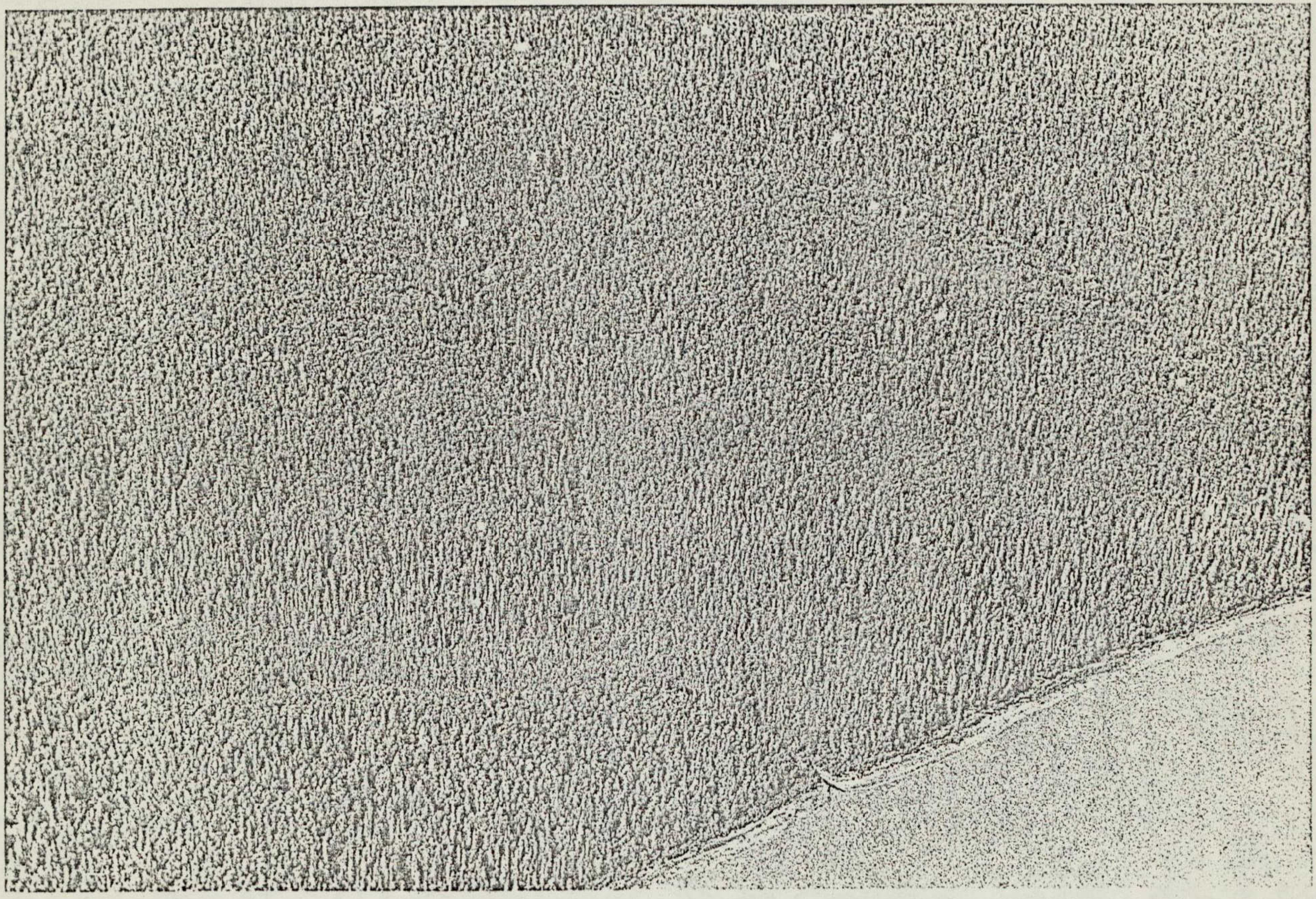
1. This photograph was taken looking downriver. Steamboat slough is in the foreground. The photograph looks over an area described as mixed broad-leaved and needle-leaved trees of commercial size.

ORIGINAL PAGE IS
OF POOR QUALITY



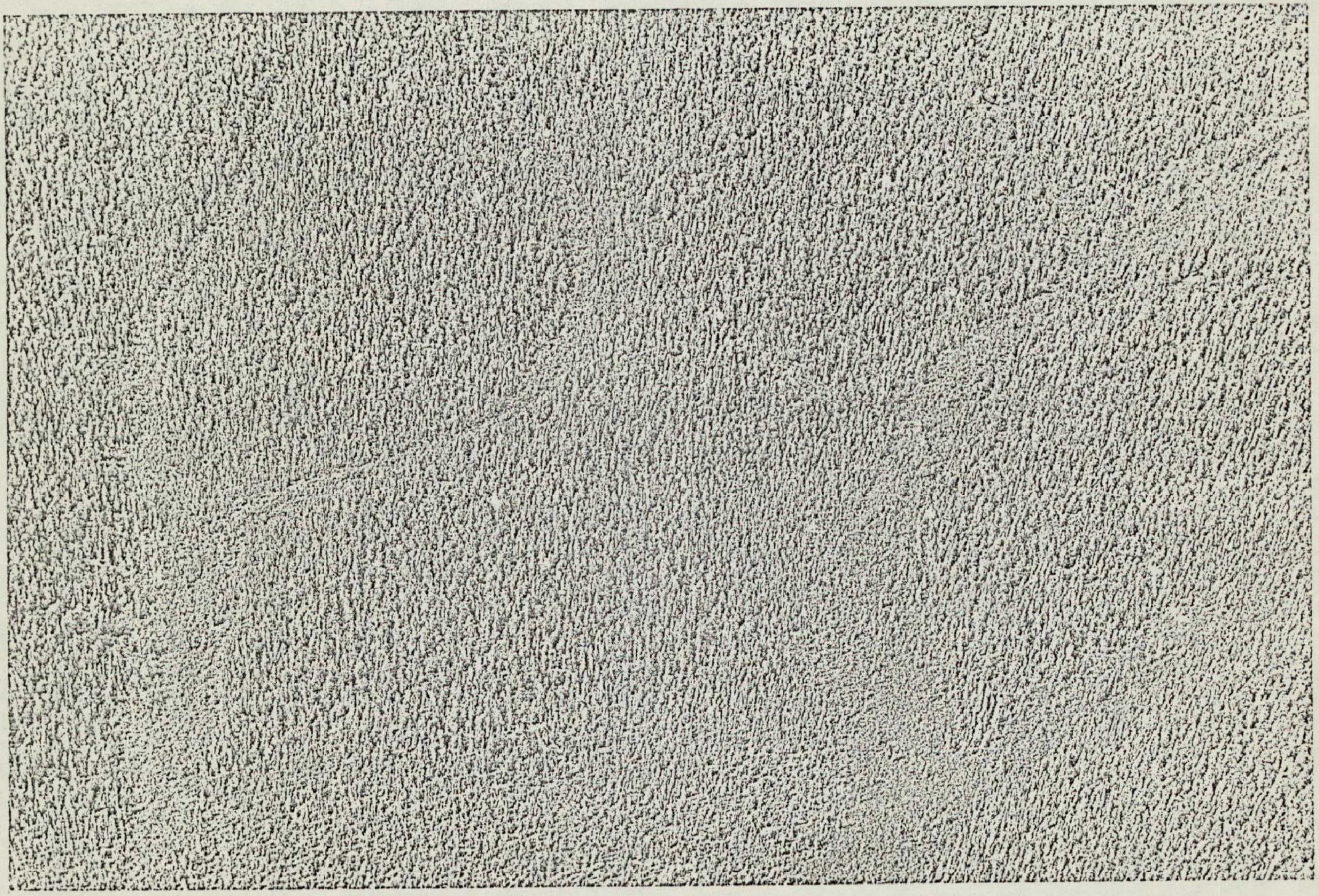
2. This photograph was taken while over the Yukon River looking west just downriver from the previous picture. Here also the timber was characterized as mixed, commercial grade trees.

ORIGINAL PAGE IS
OF POOR QUALITY



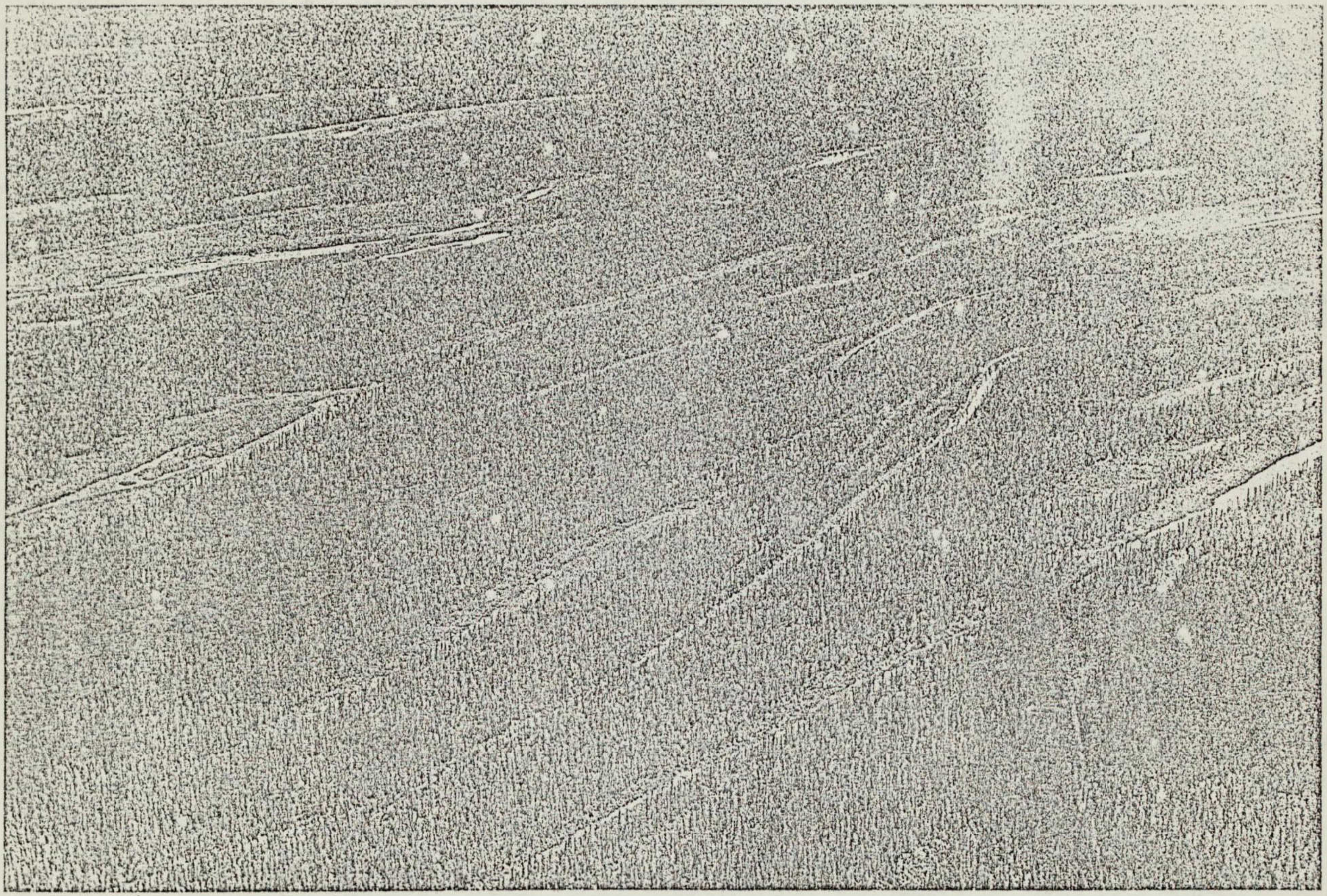
3 . This photograph was taken while over the Yukon River looking west. Although judged to be dominantly commercial-sized broad-leaved trees, some needle-leaved trees of commercial size can also be seen.

ORIGINAL PAGE IS
OF POOR QUALITY



4 , This photograph is characteristic of the mixed forest on the west side of the Yukon River just opposite Alice Island. Stands of commercial mixed forest lie to either side of this photograph.

ORIGINAL PAGE IS OF POOR QUALITY



5 . This photograph shows the stand of commercial-sized needle-leaved trees located just east of the Yukon River at the southern side of the selection area.

ORIGINAL PAGE IS
OF POOR QUALITY

Brief reports on the geology of known coal resources in the area are given in Mertie (1937) and Barnes (1967). Descriptions and locations of lode and placer deposits of base and precious metals are given in Cobb (1968). No data are available regarding the possible presence of non-metallic mineral resources or sand and gravel deposits.

The only known occurrence of sulfide mineralization with the withdrawal area is the McLeod prospect, located on the line between T. 25 S. and T. 26 S., R. 3 W. in the Unalakleet 1:250,000 quadrangle map. Samples of molybdenum sulfide minerals in vein quartz, associated with rhyolite prophyry, probably collected from this locality, were described by Mertie (1937). The prospect was opened in 1942 by a series of shallow trenches through the four feet of overburden which covers the area but the results of this work are not known. A U. S. Geological Survey field party visited the site in 1945 as part of an exploration program for radioactive minerals. Results of this work were negative (West, 1954). An analysis of heavy mineral separations from one sample each of the rhyolite porphyry and vein quartz indicated the presence of pyrite, pyrrhotite and oxides and sulfides of molybdenum. No further work is known from the prospect since that time.

Few mineral prospects are known from areas adjacent to the withdrawal area. In about 1900 placer claims were located along the Anvik and (probably) Yellow Rivers which drain part of the Blackburn Hills, but there is no record of any production from these. A single lode claim was staked on the Rado River, a few miles from Kaltag, but mal and vegetation was not well-developed. Unfortunately, no such imagery is available at present, but if it is acquired prior to the termination of the project, it will be examined, and the report revised if necessary.

The utility of the ERTS imagery to the present problem depends upon the accuracy with which the nature of bedrock can be deduced from the imagery. The minimal ground truth available for the area is generally adequate for the purpose of providing criteria for identification of general bedrock types.

Alluvium filled valleys and flood plains are easily recognized on the ERTS imagery by interpretation of vegetation patterns and identification of characteristic topographic features such as old meander loops, which are typical of flood plain deposits. The area underlain by Cretaceous sedimentary rocks is defined by a well-developed trellis drainage pattern in which the longer drainages probably indicate the strike of the structural grain. The presence of igneous rocks is indicated by two means. First, interruptions in the trellis drainage pattern, by local radial drainages around topographic domes (in particular), are taken as implying the possible presence of igneous intrusive bodies. Second, the boundaries of the granitic plution in the Blackburn Hills, which was noted above, are recognizable by interpretation of tonal differences between bands of the ERTS imagery, because the higher hills, in which the granite occurs, are not covered by vegetation. Finally, areas of probable mixed igneous and metamorphic rocks in the eastern and southeastern parts of the withdrawal were identified as topographic extensions of the Kaiyuh Mountains to the northeast.

Based on the above criteria and known geologic information regarding the area, the withdrawal can be mapped into six categories for the purpose of classification into prospecting areas. These are (see map):

1. Alluvium covered areas along the Yukon River and some of its tributaries, where bedrock is not visible at the surface.

2. Areas in which the surface rocks consist primarily of sedimentary rocks of Cretaceous age.

3. A terraine of probably mixed igneous and sedimentary rocks in the northern part of the withdrawal area.

4. The area of assumed mixed igneous and metamorphic rocks of the Kaiyuh Mountains.

5. The outcrop of granitic rocks in the southwestern part of the withdrawal area, which includes the stock noted above, and numerous adjacent igneous bodies which are assumed to be dikes radiating from the stock.

6. A part of the Kaiyuh Mountains in the southeastern part of the withdrawal, consisting of a topographic dome, with the McLeod prospect near its summit.

b. Discussion and recommendations

As noted in the introduction, there is not sufficient information available in the form of geologic maps and geochemical sampling, to prepare a preliminary evaluation of the potential of this withdrawal for the occurrence of base or precious metal deposits. As a result, there is no basis for recommending selection of specific townships at this time. Instead, it is considered advisable that, prior to selection, an attempt be made to acquire additional information upon which a choice can be based. The present study has been focused on eliminating areas in which such investigations can reasonably be expected to yield negative results (particularly in view of the time limitations on the selection process), and to establish a schedule of priorities for additional field work in those areas where the surface rocks indicate the possibility of discovering metallic mineral deposits. Some recommendations as to the nature of this field work are discussed below. It should be emphasized that the suggested work will not define or indicate the presence of commercial orebodies. Instead, it will serve only to delineate areas which merit additional study. It is assumed that such work would be done by an interested mining organization under some agreement with Doyon.

The approach adopted here has been to identify areas in which the surface rocks are dominantly igneous or metamorphic, because these are most likely to contain deposits of metallic minerals. The character of these areas, in terms of topography and extent of outcrop, was determined from study of available maps, ERTS imagery, and observations during a light aircraft flight over the entire withdrawal area. A review of the literature provided data on previous mining or prospecting activity in the area. The results suggest the following actions:

1. Areas covered by flood plain or other alluvial deposits

should be eliminated from further consideration because no information is presently available regarding the nature of bedrock underlying these deposits, and none is likely to be developed prior to the selection deadline.

2. That part of the withdrawal where the surface rocks are Cretaceous sedimentary rocks is considered to have low potential for the occurrence of metallic mineral deposits, except possibly in the area around Blackburn Hills where it is in contact with granitic intrusive rocks. As noted, coal deposits are present in the sedimentary rock section, but information presently available indicates that the potential for commercial production of coal is low. Further, additional work, including detailed geologic mapping would be required to thoroughly evaluate the coal resource, and it would not be possible to accomplish this in the time available.

3. The geology of the northern part of the withdrawal (those townships which lie in the Norton Bay and Nulato quadrangles) has been mapped and the results indicate a low potential for the occurrence of ore deposits. The area should thus be eliminated from consideration.

4. The Blackburn Hills in the southwestern part of the withdrawal merit further work. As noted above, the area is dominated by granitic rocks, including a stock and possibly dikes radiating away from it. Both these rocks, and the zones where they are in

contact with the adjacent sedimentary rocks, are potential hosts for mineralization. The topography of the area and the absence of vegetation indicate that a modest stream sediment sampling program would provide adequate information for a preliminary appraisal of the mineral potential of the area. It is recommended that such a program be instituted during the next field season. A total of about 150 to 200 samples would be required.

5. That part of the withdrawal which is underlain by the rocks of the Kaiyuh Mountains has been subdivided into two areas on the map. One of these, as noted above, is the topographic dome which includes the McLeod prospect near its summit. The occurrence of molybdenum minerals in quartz veins, and in association with rhyolite prophyry as the host rock is suggestive of the possible presence of a deposite of low-grade copper and/or molybdenum ores. As a result, it is recommended that a program of stream sediment, soil and rock sampling be conducted in the area during the coming field season. It is important to define the approximate geometry of the rhyolite porphyry mass, and to determine whether or not it is mineralized other than at the site of the McLeod prospect. Such a program would require about 200 soil and stream sediment samples to be collected and analyzed, plus examination of outcrops and analysis of rock samples collected from these.

6. The remaining area underlain by the rocks of the Kaiyuh Mountains also merits further study. In this case, about 100 stream sediment samples should be adequate for a preliminary evaluation.

ORIGINAL PAGE IS
OF POOR QUALITY

c. References Cited

Barnes, F.F., 1967, Coal resources of Alaska: U. S. Geological Survey Bull. 1242-13, p. 131-B36.

Cass, J.T., 1959a, Reconnaissance Geologic Map of the Norton Bay Quadrangle, Alaska: U.S. Geological Survey Misc. Geol. Inv. Map I-286.

Cass, J.T., 1959b, Reconnaissance Geologic Map of the Norton Bay Quadrangle, Alaska: U.S. Geological Survey Misc. Geol. Inv. Map I-288.

Cass, J.T., 1959c, Reconnaissance Geologic Map of the Norton Bay Quadrangle, Alaska: U.S. Geological Survey Misc. Geol. Inv. Map I-291.

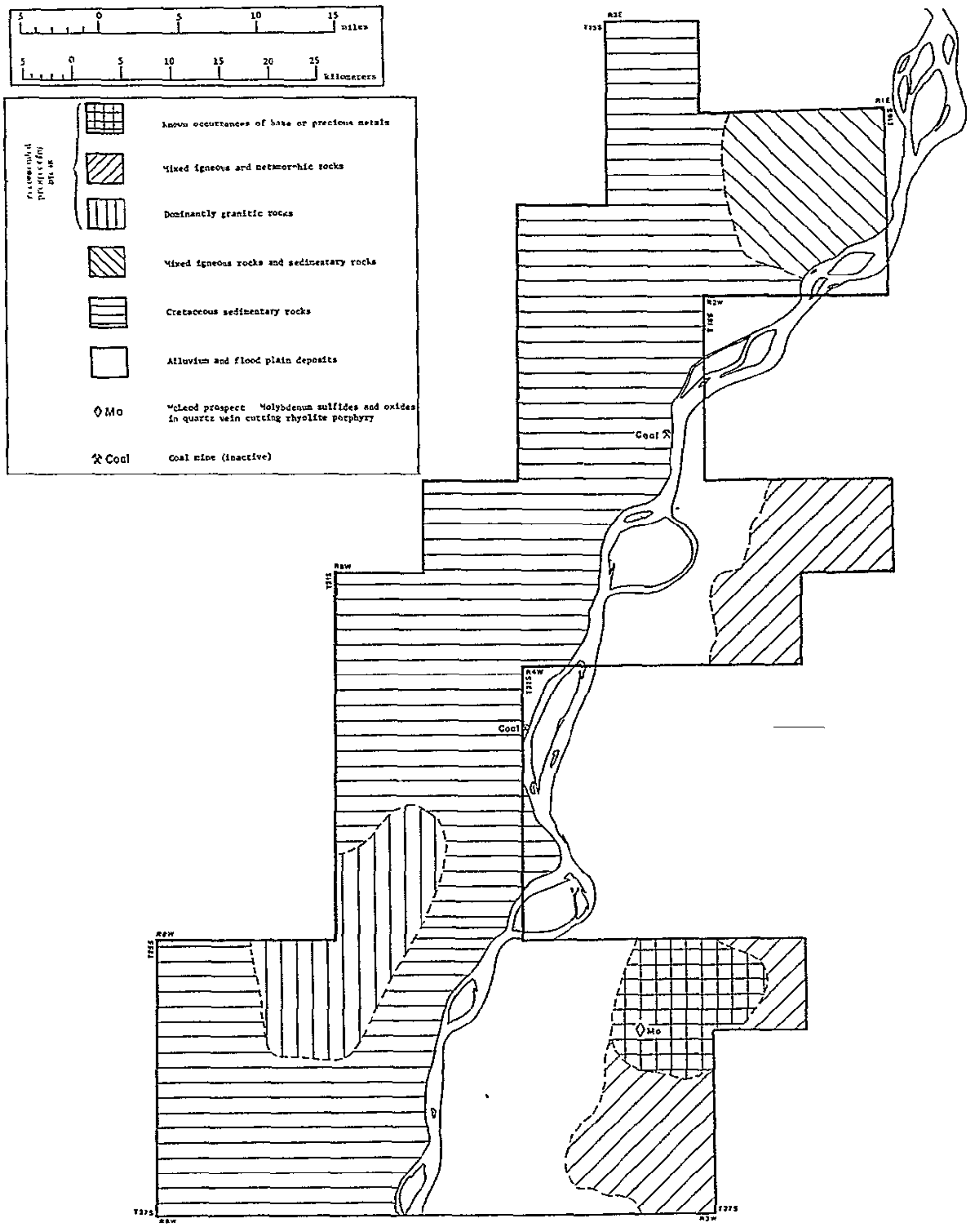
Cobb, E.H.. 1968, Metallic mineral resources of nine Alaskan quadrangles: U.S. Geological Survey Open-file report.

Mertie, J.B., Jr., 1937, The Kaiyuh Hills, Alaska: U.S. Geological Survey Bulletin 868-D, p. 145-178.

West, W.S., 1954, Reconnaissance for radioactive deposits in the lower Yukon-Kuskokwim region, Alaska: U.S. Geological Survey Circular 328.

ORIGINAL PAGE IS
OF POOR QUALITY

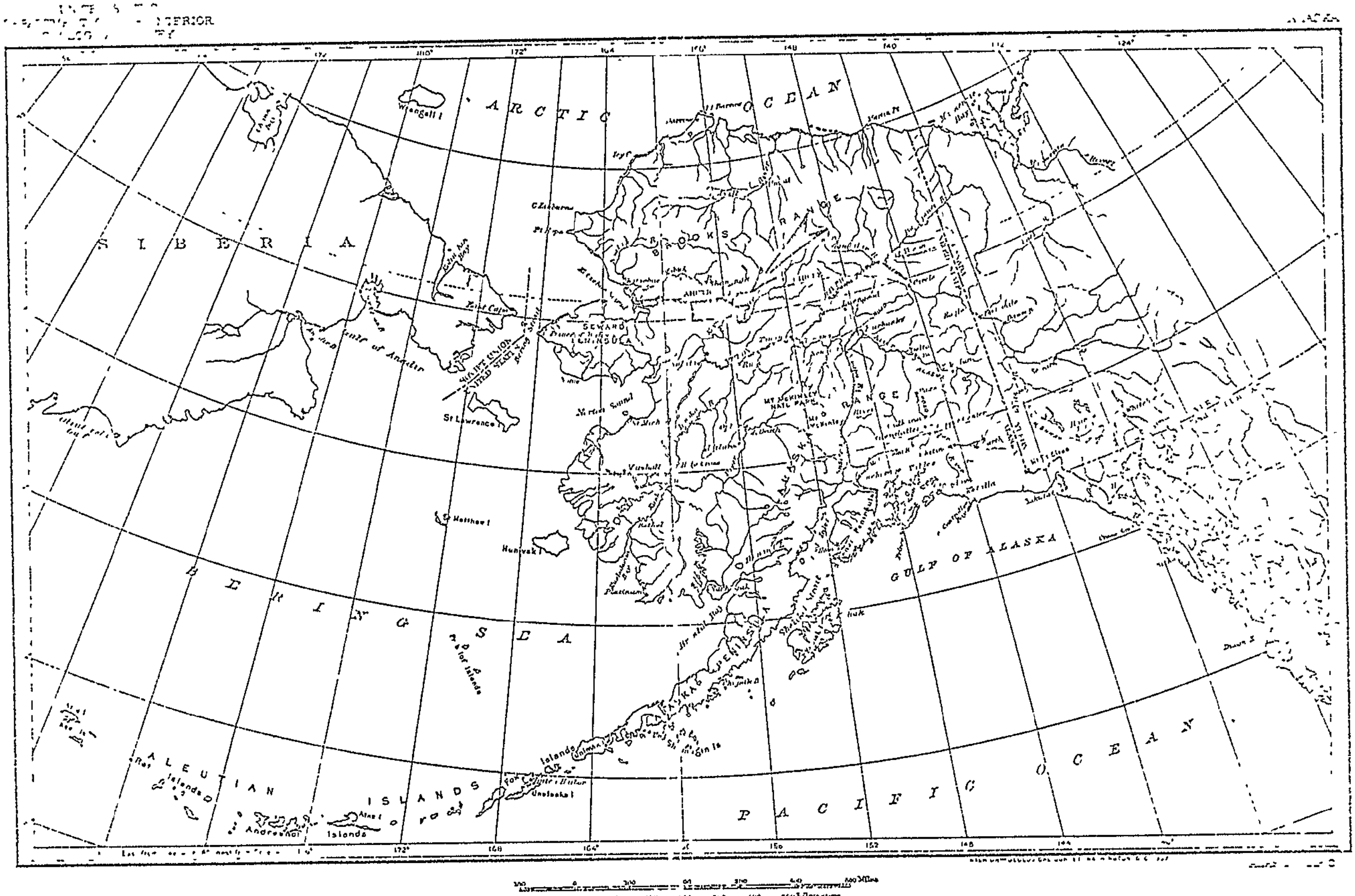
PROSPECTING AREAS
OF THE
KALTAG-GRAYLING AREA, ALASKA



B. THE PURCELL MOUNTAINS SELECTION AREA

This withdrawal area, located north of Galena (see map) between the Koyukuk and Kobuk Rivers, contains 66 townships. It is quite remote. There are no roads to or within the area nor are there any airfields within it. Barge traffic on the Koyukuk is more restricted than on the Yukon but would make available transportation to either Nenana or the mouth of the Yukon.

Little or no commercial mineral extraction is known to have taken place within the area although there appears to be reason for extensive prospecting. Similarly, but probably less significant, several areas of moderate-sized spruce forest can be found within this selection area.



FOR SALE BY U S GEOLOGICAL SURVEY FEDERAL CENTER DENVER COLORADO OR WASHINGTON 25 D C

ORIGINAL PAGE IS OF POOR QUALITY

1. <u>Summary Recommendations</u>

These pages constitute a summary of the results of analysis of the Purcell Mountains selection area and recommendations based on these results. The map drawn for this section merely shows which townships might be considered for mineral prospecting and for possible commercial timber development. Detailed reports and maps are in succeeding sections.

ORIGINAL PAGE IS
OF POOR QUALITY

a. Summary of Recommendations for Forest Product Potential

In this analysis we have mapped areas of hardwood and softwood trees that appear sufficiently large to be generally considered commercial types when located near a market. This is not to say that these are commercial forests because that designation involves many economic factors not considered here. The areas designated here as commercial forests should be regarded as those stands of timber that have the greatest likelihood of being commercial forests.

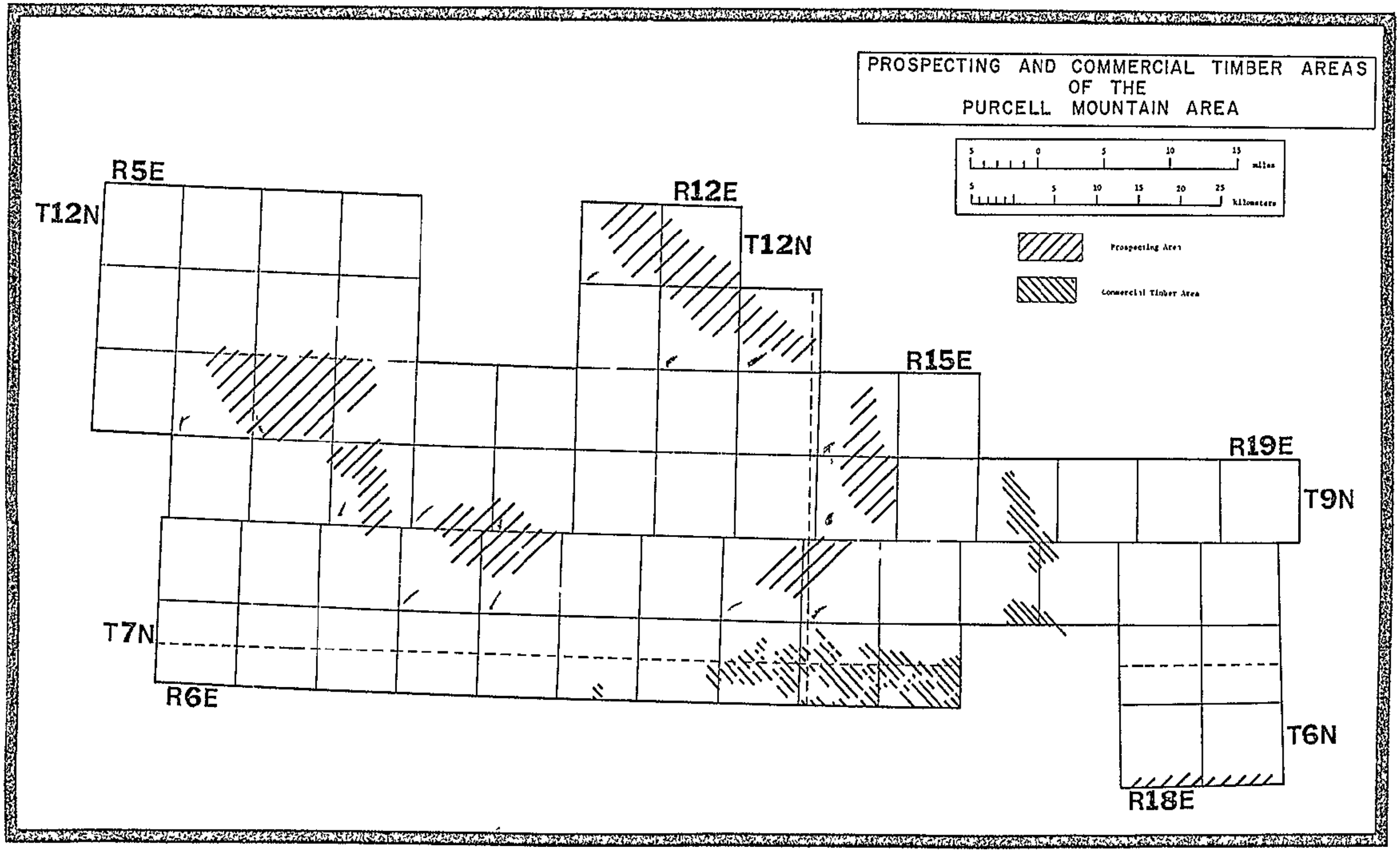
No analysis has been made to determine timber volume charts for the trees in this area.

As part of the Alaska Forest inventory, aerial photographs were obtained along flight lines 30 miles apart over wide areas of Alaska including the Purcell Mountains withdrawal area. A small area on each photograph was analyzed by stereoscopic viewing. Occasionally, one of these samples was field-checked. These data, archived in Juneau, very likely represent the only ground-based investigation of the quality of trees in this area.

Before any selections are made on the basis of possible timber-related income, timber volumes should be established and an economic forester should be consulted to determine the economic feasibility of such a venture.

ORIGINAL PAGE IS
OF POOR QUALITY

it would be worth considering conducting an airborne scintillometer survey of the area, followed by examination of anomalous areas on the ground. This could be an expensive operation, and it is recommended that Doyon seek approximate cost estimates for such a survey from private organizations and decide whether the cost is within the means of the company. If a decision is made to proceed with a program of this type, specific recommendations can be made at a later time.


PROSPECTING AND COMMERCIAL TIMBER AREAS
OF THE
PURCELL MOUNTAIN AREA
5 0 5 10 15 miles
5 5 10 15 20 25 kilometers
Prospecting Area
Commercial Timber Area
R5E
T12N
R12E
T12N
R15E
R19E
T9N
T7N
R6E
T6N
R18E

Land-Use Map of the Purcell Mountains Area, Alaska

ORIGINAL PAGE IS
OF POOR QUALITY

a. Introduction

Land use maps of Alaskan areas are of increasing importance with the current widespread rush into land disposition and resource exploitation. Such maps provide a spatial and possibly a quantitative inventory of selected resources and some basis for sensible planning. Land use maps may help in organizing activities compatible with (1) a natural environmental integrity and hence with regeneration potentials and esthetic qualities and (2) the rational and long-range needs of the exploiter.

Land use maps for locations where little land use by man has begun are particularly important. These tend to emphasize vegetation, the most visible and functionally important component of most ecosystems. Vegetation may provide material resources, principally food and timber; wildlife habitat; and cultural and recreational values. Vegetation is also important as an indicator: it is an integrated expression of the history of the site and the nature of soils, drainage, permafrost, topography and small and large-scale climates. It may also indicate the nature and severity of pollution and other human disturbances.

The land-use map of the Purcell Mountains area is part of a series of maps of Alaskan areas of particular interest to the Bureau of Indian Affairs, the agency funding the mapping, and the Doyon Native Regional Corporation, within whose jurisdiction the map-area lies. They are essentially vegetation maps depicting broadly defined vegetation types at the relatively small scale on the originals of 1:250,000. Although limited in vegetation and other detail, these maps provide more information than any previous maps of the areas and are a step toward the production of more meaningful land use maps in Alaska.

b. Methods

The maps were drawn from Earth Resources Technology Satellite (ERTS) images. The reasons for this were (1) ERTS image availability, (2) the usefulness of ERTS imagery for mapping broadly defined vegetation types over large areas in a relatively short time and (3) lack of complete aerial photograph coverage. The land use classification adopted for this map series is the latest revision of a system being developed by the U. S. Geological Survey under the direction of James R. Anderson. Map units are identified at level II in this system in most cases.

The ERTS scenes used were numbers 1037-21240, 1057-21351, 1236-21303, 1273-21364 and 1345-21353 for the Purcell Mountains area. Images for mapping were photographic prints enlarged to a scale of 1:250,000.

Some of the scenes, printed in black and white, were obtained by the satellite in the late winter, when the landscape was generally snow-covered, but when plants taller than the snow pack were free of snow. In the forest zone of interior Alaska snow accumulation by late winter usually is around three feet. These scenes permitted determinations of vegetation structure, based on a gray scale continuum presumably related to plant cover. Areas of no plant cover or of vegetation too low to show above the snow appeared nearly white. Areas of some plant cover above the snow appeared somewhat gray. Areas of intermediate plant cover appeared grayer, and areas of closed vegetation, where no snow showed, were dark gray. Nearly white was interpreted as tundra or herbaceous rangeland, intermediate gray as shrub rangeland or open forest, and dark gray or black as closed forest, the latter in some cases containing large trees of a potentially commercial grade.

Other scenes, obtained in the summer, were printed in simulated color-infrared. These permitted several floristic distinctions, based on some knowledge of the infrared reflectance of high-cover species or species groups. For example, broad-leaved trees and shrubs reflect highly in the near-infrared and therefore appear bright red on this kind of imagery. Most needle-leaved species have low near-infrared reflectance and therefore appear dark gray. Intermediate gray colors seem to indicate ericaceous shrubs or open stands of needle-leaved species.

The winter and summer images were used together in making the vegetation and other land use distinctions expressed in the classification system. Interpretations were facilitated by physiographic information obtained from topographic maps, as there are relationships between vegetation and physiography. For example, wetlands occur in low-lying flat areas; broad-leaved forests and forest dominated by white spruce (Picea glauca) are the main forest types on east, south and west slopes, and upland bogs and black spruce (P. mariana) bog woodlands occur more frequently than the former on north slopes. All bogs except upland bogs with a major black spruce component are designated wetlands for present purposes. Flood plains in the vicinity of streams commonly are occupied by white spruce and balsam poplar (Populus balsamifera) vegetation types containing trees of commercial grade.

ORIGINAL PAGE IS
OF POOR QUALITY

Initially, most of the interpretations of spectral units on the imagery were made through comparisons with aerial photographs covering parts of the map areas. Alaska Forest Inventory photographs in black and white modified infrared were obtained from the U. S. Forest Service, and some small-scale color-infrared photography was obtained from the National Aeronautics and Space Administration and its summer 1974 U-2 aerial photography mission. In general, more information is available on aerial photographs than is necessary for establishing or validating the broad land use classes distinguished at levels I and II of the classification system.

The identification of vegetation containing trees of possible commercial timber grade required the recognition of forest vegetation, then estimations of composition and stature using the kinds of spectral and physiographic information described above. A quantitative definition of commercial timber is not intended. The commercial stands depicted on the maps are those in which the occurrence of a number of larger trees suitable for lumber production is likely. White spruce, balsam poplar and paper birch (Betula papyrifera) are the potentially commercial grade species.

The mechanics of mapping involved (1) tracing streams, lakes and other prominent landmarks onto a transparent plastic overlay of the base map, a U. S. Geological Survey topographic map, (2) positioning the overlay on an ERTS image according to these landmarks, (3) tracing spectral units identified to vegetation or land use classes onto the overlay, (4) positioning the base map over the overlay on a light table and (5) tracing the unit boundaries on the overlay onto the base map and labeling them.

A preliminary map for the Kaltag and Tanana areas was made in the laboratory by these methods, using all available control in the form of aerial photographs and written and oral information. These maps were used as a guide to a route of travel by light aircraft for field checking. Comparing the preliminary maps with certain parts of the mapped area confirmed the interpretations of the ERTS imagery in many cases, but showed also some faulty interpretations. This field work led to revised procedures and the more nearly accurate map presented here.

The Purcell Mountains area map was not field checked, but it is considered to be acceptably accurate because (1) high quality U-2 photography of a broad swath across the area was available for control and (2) it is the third map made in this series and therefore represents the cumulative experience of the preceding two mapping endeavors.

c. The Map

The map depicts 14 land use classes, most of which are vegetation types of rather broad definition. The distribution of vegetation containing trees of possible commercial grade is indicated with a "c" in the label and is further emphasized by crosshatching. The general composition of the vegetation types is as follows:

3 1. Rangeland, herbaceous. This class designates areas where the vegetation is dominated by graminoids, forbs and/or cryptogams. Low-growing shrubs may be present. Unlike unforested wetlands (6 2), which are somewhat similar physiognomically, these areas are well-drained. Hence they are different floristically, and they lack peat accumulation. Major species are blue joint grass (Calamagrostis canadensis), fireweed (Epilobium angustifolium), the fescue grass (Festuca altaica, squirreltail

ORIGINAL PAGE IS
OF POOR QUALITY

grass (Hordeum jubatum), and the wormwood Artemisia frigida. Several species of Cladonia probably occur as dominants in lichen rangelands in the Purcell Mountains area.

This vegetation is an early post-fire successional stage in some cases. Here, the immediate evidence of fire, charred plant material, is obscured by live plant cover. In other cases, particularly in lichen dominated stands, the vegetation is much older.

3 1 b. Same, following recent burn. Whereas the vegetation of class 3 1 may or may not be an early post-fire successional stage, the vegetation designated by 3 1 b is all of this kind, as is evidenced by an abundance of charred material. This material lends a blackness to the landscape which is readily seen on summer ERTS imagery. Since the live plants colonizing the burn area are not yet sufficiently abundant to obscure this material, it is concluded that the burn was recent, probably having occurred not more than two years prior to the obtaining of the imagery. Hence the burns depicted on these maps would have occurred in 1971, 1972 or 1973.

3 2. Rangeland, shrub-brushland (Scrub), (Fig. 1). Shrub rangeland is dominated by shrubs or young, shrub-sized individuals of tree species. Much of this vegetation in the map-areas is believed to be dominated by the latter, chiefly young aspen (Populus tremuloides) and paper birch in post-fire successional stands. Closer to the larger streams, however, shrub rangeland comprises willows (Salix spp.) and alders (Alnus spp.), usually as dominants in flood plain and point bar early successional vegetation. Shrub dominated areas in bogs are included in non-forested wetlands, and high elevation shrub tundra is covered by class 8. Shrub rangeland is important for wildlife, especially large game animals, because of the high proportion in it of browse food material.

ORIGINAL PAGE IS OF POOR QUALITY

3 2 b Same, following recent burn. This class designates areas of early post-fire successional vegetation dominated by shrubs, chiefly willows or, quite frequently, broad-leaved or needle-leaved tree seedlings. Charred vegetation and downed trees are abundant. These areas should be increasingly valuable as wildlife habitat over the next few years, and most would eventually succeed back to forest vegetation.

4 1. Forest, broad-leaved. Forested areas are identified by a 4, and broad-leaved forests by a 4 1. Here the major species are paper birch, aspen and balsam poplar. Birch is the most widespread, occurring throughout the range of broad-leaved forests. Aspen is also widespread, but occurs mostly on south and near south slopes of moderate steepness. Balsam poplar is relatively limited in distribution, large trees occurring as stand dominants only on old flood plains in the vicinity of major streams. In the Purcell Mountain map-area most broad-leaved forests comprise trees of small to intermediate size. Some of these forests may be important as potential sources of pulp timber.

4 1 c. Broad-leaved forest, commercial. Broad-leaved forest believed to contain large trees of timber grade are designated by a "c" and by cross-hatching. These forests are mostly on the old flood plains of the Koyukuk River and the principal species is balsam poplar. Some commercial broad-leaved forest stands on upland sites farther from the river are dominated by paper birch and some aspen.

4 2. Forest, needle-leaved. Needle-leaved, mostly evergreen forest dominated by white spruce and/or black spruce is widely distributed in the map area, but is considerably less important areally than broad-leaved

ORIGINAL PAGE IS
OF POOR QUALITY

forest. White spruce is the dominant needle-leaved species on upland sites of most slopes. North slope needle-leaved forests are more often characterized by black spruce in closed and open stands. Needle-leaved forests on low-lying flat areas away from major streams also are dominated more often by black spruce than white spruce, but here these forests are designated forested wetland.

4 2 c. Needle-leaved forest, commercial. White spruce is almost exclusive as the dominant in commercial needle-leaved forests. Such forests are limited to the older and larger flood plains, where white spruce forest usually follows broad-leaved forest as a late stage in vegetation succession.

White spruce of commercial size dominates in narrow gallery forests along the many smaller streams. These forests, although occurring widely, are too small areally to show on the maps. The few large trees in them and their scattered distribution and relative inaccessibility probably would preclude commercial exploitation.

4 3. Forested, mixed broad-leaved and needle-leaved. Most forest vegetation in the map-area is characterized by mixtures of broad-leaved and needle-leaved trees in various proportions. This is a reflection of widespread heterogeneity in a number of environmental and historical factors. Mixed forests generally are dominated by trees of intermediate size or, at higher elevations, by small trees. They may be valuable sources of pulp timber in some places. Some of this forest is open in nature, with low tree densities and correspondingly high shrub densities. Therefore it is also important as wildlife habitat.

4 3 c. Mixed forest, commercial. As mixed forest is the most frequent non-commercial forest type in the map-areas, it is also the areally most important commercial forest type. Like the other two commercial types, it also is limited to lower elevation areas near the Koyukuk River. Here the most important broad-leaved component is balsam poplar, but paper birch is widespread. Aspen is of some importance as a large tree on sites somewhat removed from the river. White spruce is the only important needle-leaved species, and in most cases this component considerably exceeds the others in frequency and volume (Fig. 2).

6 1. Wetland, forested. A "6" designates wetland, a broad class of vegetation and land use types generally having a soil water table at or near the surface most of the growing season. Wetlands in the map-areas generally are underlain by permafrost. A "6 1" designates wetland areas where the water table is just low enough and the permafrost just deep enough to allow some tree growth. This growth comprises black spruce and some paper birch. Trees are small to intermediate in size, and their density is low. Hence the vegetation is mostly open forest and, where tree density is low, woodland. Black spruce bog woodland, colloquially called muskeg, is the areally most important vegetation in this class. The bog components are shrub and dwarf-shrub layers and a thick cryptogam layer. Shrubs are several ericaceous species, shrub birch (Betula glandulosa) and some willows. The cryptogam layer is made up of several moss species, often with Sphagnum as the stratal dominant, and of lichens. Herbs are widespread but of relatively low density.

6 2. Wetland, non-forested. Some non-forested wetlands are similar

ORIGINAL PAGE IS
OF POOR QUALITY

to forested wetlands except for the lack of trees. Dwarf-shrub, herbaceous and cryptogam vegetation is dominant. The most important dwarf-shrubs are dwarf birch (Betula nana), lingonberry (Vaccinium vitis-idaea), blueberry (V. uliginosum), labrador tea (Ledum decumbens), crowberry (Empetrum nigrum), and several willows. The herbaceous component usually includes much cottongrass (Eriophorum spp.) or sedge (Carex spp.). The cryptogam component features a higher proportion of Sphagnum spp. than the equivalent forested wetland component.

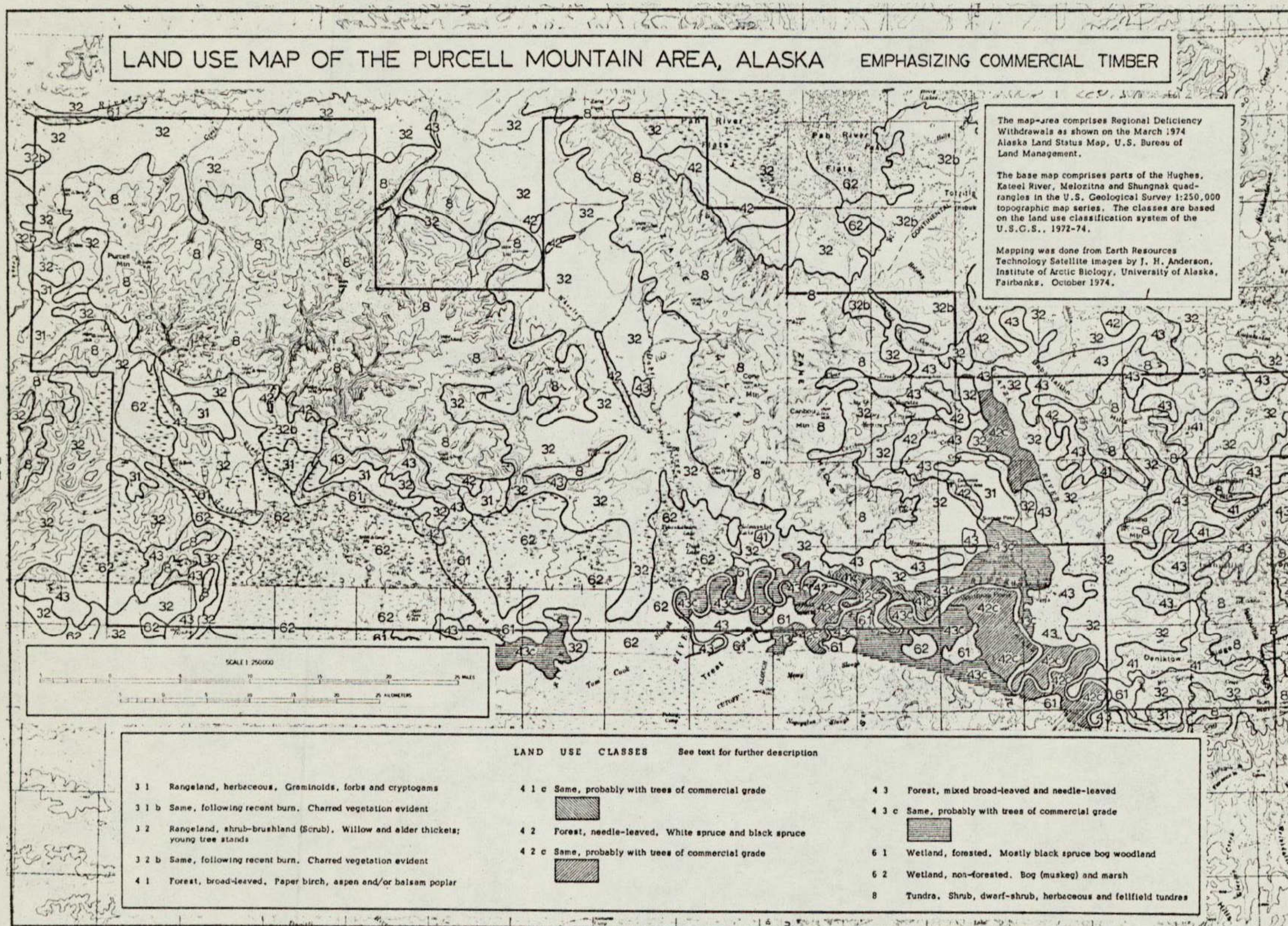
Non-forested wetlands with this general vegetation composition are bogs, where peat accumulation is significant and permafrost is near the surface. Bogs are important sources of wild berries.

A second kind of vegetation in this class is marsh, with a water table at or above the surface and a thoroughly wet soil. Graminoids and bryophytes are dominants, sedges and several grass species being characteristic. In the map-areas, units labeled 6 2 located near small, slow-flowing streams and near ponds and lakes in flat areas are more often marsh than bog. Marsh areas are very important as waterfowl habitat.

7 2. Barrenland, mudflat. Barrenlands are areas which, for a variety of reasons, bear very little or no vegetation. Common types in the map-areas are river bars and active flood plains, but these are too small individually to show on the maps.

8. Tundra. Higher elevation areas, generally above approximately 1,500 ft in the Purcell Mountains area, are occupied by tundra. This is a broad landscape category characterized by at least four major physiognomic vegetation types: scrub, dwarf-scrub, meadow and fellfield. These types

ORIGINAL PAGE IS
OF POOR QUALITY



ORIGINAL PAGE IS
OF POOR QUALITY

Table 1. Townships with timber of possible commercial grade in the Purcell Mountains map-area and vicinity. Reference is to the Kateel River meridian and base line.

HUGHES QUADRANGLE

Township North	Range East
7	14
	15
	16
	17
8	16
	17
9	16

MELOZITNA QUADRANGLE

Township North	Range East
6	14
	15
	16
	17
7	14
	15
	16*
	17*

KATEEL RIVER QUADRANGLE

Township North	Range East
6	10
	11
	13
7	12
	13

SHUNGNAK QUADRANGLE

Township North	Range East
7	12*
	13*

*Townships so marked are duplicates on different quadrangles.
16 townships are listed here.

e. References

The following were consulted in preparing the Purcell Mountains area land use map and accompanying text. They would be useful sources of further information on the vegetation and related resources of this area and the mapping activities.

Anderson, D. M., W. K. Crowder, R. K. Haugen, T. L. Marlar, H. L. McKim and A. Petrone. 1973. An ERTS view of Alaska: Regional analysis of earth and water resources based on satellite imagery. Technical Report 241, U. S. Army Cold Regions Research and Engineering Laboratory, Hanover. 50 p + maps.

Anderson, J. H. 1973. Identification, definition and mapping of terrestrial ecosystems in interior Alaska. No. E74-10137, National Technical Information Service, Springfield. 16 p.

Hanson, H. C. 1951. Characteristics of some grassland, marsh and oh other plant communities in western Alaska. Ecological Monographs 21: 317-378.

Hutchison, O. K. 1967. Alaska's forest resource. Resource Bulletin PNW 19, U. S. Forest Service, Juneau. 74 p.

Küchler, A. W. 1967. Vegetation mapping. Ronald Press, New York. 472 p.

Viereck, L. A. 1973. Wildfire in the taiga of Alaska. Quaternary Research 3: 465-495.

Viereck, L. A. and E. L. Little, Jr. 1972. Alaska trees and shrubs. Agriculture Handbook No. 410, U. S. Forest Service. 265 p.

ORIGINAL PAGE IS OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

3. Evaluation and Mapping of Favorable Areas for Mineral Prospecting

a. Introduction

The withdrawal area considered in this report includes 66 townships in parts of the Melozitna, Shungnak, Hughes and Kateel River 1:250,000 quadrangles. Two highland areas, the Purcell Mountains and Zane Hills, dominate the area and are important in terms of potential mineral deposits within the withdrawal.

The regional geology of the northern part of the Yukon-Koyukuk province, within which this withdrawal lies, has been summarized by Patton (1973). The entire withdrawal (except for a few townships along the southern edge, and in the southeast corner) has been mapped on a scale of 1:250,000 (Patton, et al, 1968 Patton and Miller, 1966) and the igneous rocks of the Purcell Mountains and Zane Hills have been studied by Miller (1970, 1972). Finally, analytical data from stream and rock samples collected from the area have been presented and evaluated by Miller (1969) and Miller and Ferrians (1968) who also make recommendations regarding the location of favorable prospecting areas within the withdrawal. According to U. S. Geological Survey Open-file Report #546, "Overall, the block is considered to have a very high potential for both base and precious metals. The existing geologic and geochemical information is considered adequate for preliminary mineral resource potential evaluations (p. 51)."

In order to make certain all information developed since the publication of the above references is included in this study, a survey of the literature and a study of ERTS imagery of the withdrawal area have been made. Little additional data has been acquired in this manner.

ORIGINAL PAGE IS
OF POOR QUALITY

The evaluation which can be done from the available data should be sufficient for the needs of Doyon Company at this time, with respect to the possible occurrence of base and precious metal deposits in the area. However, as discussed below, the Zane Hills and Purcell Mountains are considered to have a high potential for uranium deposits, both as primary deposits in the igneous rocks of the highlands, and as sedimentary deposits in the surrounding basins. Unfortunately, with the exception of two areas in the southern Zane Hills, there is little information available regarding possible uranium occurrences in the withdrawal area.

One aspect of resource potential which may be a factor in this withdrawal is that of geothermal energy. Four hot spring areas are located within the withdrawal. One of these, a low temperature, low flow spring, is located just east of Purcell Mountain and is not associated with any other known potential resource. The others, however, may be a factor in choosing areas for selection, and are noted in the recommendations.

It is emphasized that this evaluation reflects only the information currently in the published literature. Thus, environments for the occurrence of base or precious metal deposits other than those shown in this report may exist. However, a more extensive sampling program in the area would almost certainly not rule out any of the prospecting areas outlined in this report, and would probably not add significantly to the number of townships recommended for withdrawal. The most favorable prospecting areas are probably shown by the available data, and it may be more advantageous to consider the use of these as bargaining levers for access to other areas through joint agreements with companies interested in prospecting in the withdrawal area, rather than to initiate further field work at this time.

b. General Geology

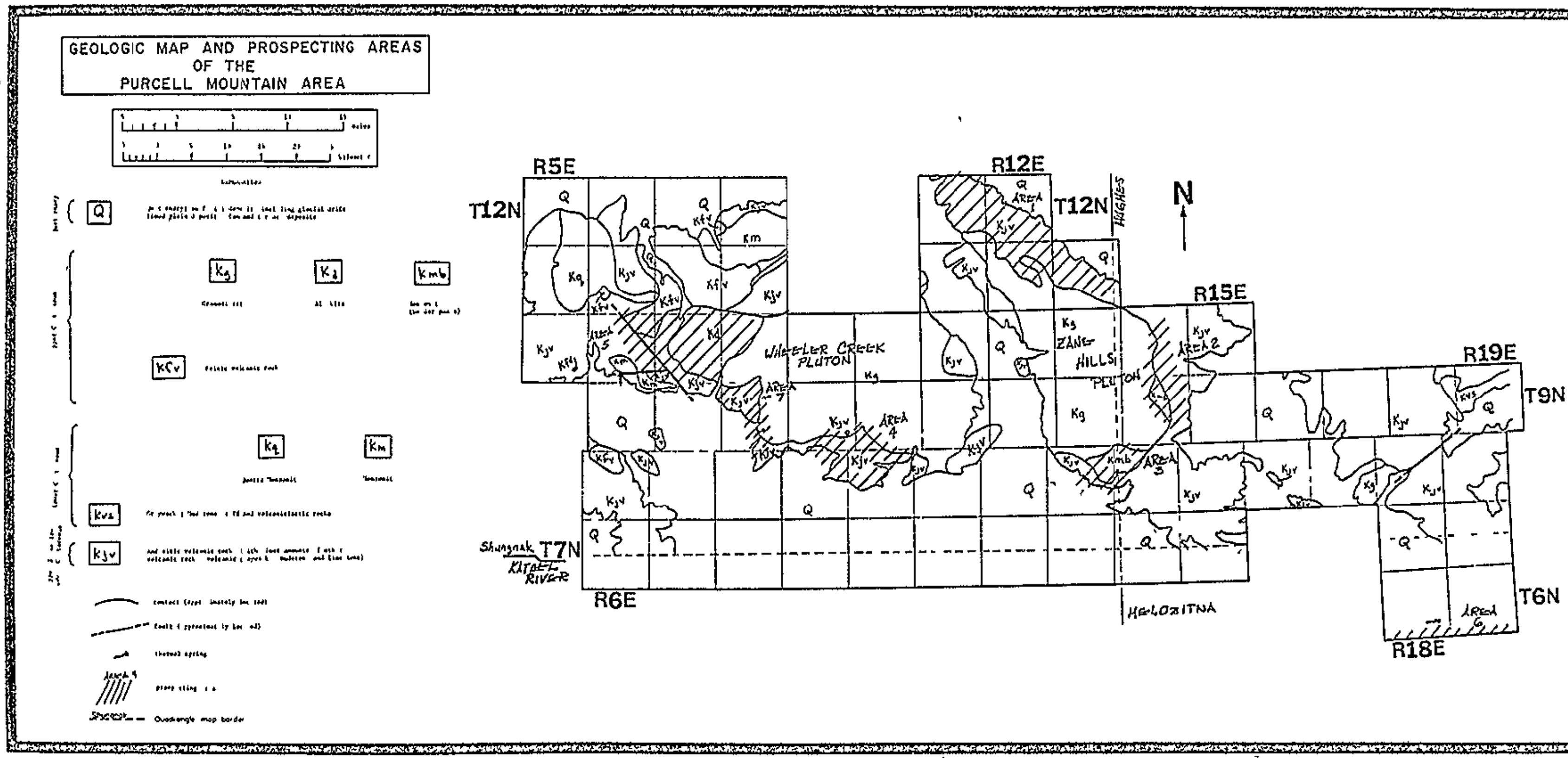
The geology of the withdrawal area is described in the papers referenced above, and is summarized in Miller and Ferrians (1968) from which the following discussion is largely drawn.

The oldest rocks in the area are a Late Jurassic-Early Cretaceous sequence of andesitic volcanics, with associated pyroclastic and volcaniclastic rocks and some fossiliferous limestones. These are overlain by interbedded volcanic graywackes and mudstones (both of which are comprised of fragments derived from the underlying volcanic rocks) and quartz conglomerates of late Early Cretaceous age.

Two episodes of intrusion of granodiorite, quartz monzonite and syenite into the volcanic and sedimentary section occurred in Late Cretaceous time. Between these in time, an episode of extrusion of quartz latite, latite and rhyoline took place in the Purcell Mountain area. The Zane Hills Pluton, which cores the Zane Hills, and the Wheeler Creek Pluton, which forms most of the core of the Purcell Mountains, were emplaced during the second intrusive episode. All of these intrusives are part of a belt of generally alkaline plutons, the Hogatza plutonic belt, which were emplaced in Late Cretaceous time along a line which extends from the Seward Peninsula eastward for about 200 miles to the Koyukuk River.

Contacts between the intrusives and the country rocks are generally sharp, discoidant and steeply dipping, except in the northern part of the Zane Hills Pluton and possibly in the southern and eastern parts of the Wheeler Creek pluton, where the contacts dip gently. These areas of gentle dip are probably near the roofs of the intrusives.

ORIGINAL PAGE IS
OF POOR QUALITY



Evaluation of the geochemical data indicates that the base and precious metal mineralization in the area occurs near or along the contact zones between the country rock and the igneous rocks emplaced during the second intrusive event i.e., the Zane Hills and Wheeler Creek Plutons.

Lowland areas close to the Purcell Mountain, Zane Hills and other upland areas within the withdrawal are underlain by glacial drift of undetermined thickness. The source of this drift was either in the Brooks Range to the north, or locally, small glaciers originating at higher elevations in the Purcell Mountains and Zane Hills. The lowlands in the southern part of the withdrawal, along the Koyukuk River, are underlain by fine-grained sediments deposited by both water and wind.

d. Prospecting Areas for Base and Precious Metals

As noted above, the roof zone of the Zane Hills Pluton appears to be exposed at the north end of Zane Hills. Stream sediment and rock samples, as well as examination of rocks in the field indicate that this is an extremely favorable area for prospecting (Miller and Ferrians, 1968, p. 6-8). Copper and molybdenum minerals were found in quartz veins cutting both metamorphosed and unmetamorphosed andesite, and in altered granodiorite at several locations. In addition, stream sediments containing anomalous values of copper were collected over a large area of the northern Zane Hills. The area within which these samples were taken is shown on the map (Area 1).

Two other locations in the Zane Hills were cited by Miller and Ferrians (1968) as good prospecting areas for base and precious metals. The first of these is along the southeastern border of the pluton near the headwaters of Clear and Bear Creeks (Area 2) and includes the Hogatza placer gold operations.

ORIGINAL PAGE IS
OF POOR QUALITY

Sample data indicate possible gold mineralization along the contact zone between the pluton and the country rock. In addition, anomalous values of silver, bismuth, copper and molybdenum have been found in veins cutting the pluton, the andesitic country rocks and a quartz monzonite body which forms a border phase of the pluton. Finally, the quartz monzonite also shows anomalous radioactivity, with about 5 to 6 times the normal uranium content for rocks of this type. There is, however, no known area locally in which the radioactive materials are concentrated in commercial quantities.

The second additional prospecting area in the Zane Hills (Area 3) is associated with another quartz monzonite body along the southern border of the Zane Hills Pluton. The occurrence of radioactive minerals in this area is similar to that described above. In addition, rock samples from two localities show anomalous values of silver, gold, tungsten, bismuth, copper and lead.

The stream sediment sample data from the remainder of the border of the Zane Hills Pluton do not indicate any anomalies of base or precious metals and no indication of the presence of these has been reported from within the pluton. However, the general distribution of sample values does indicate that the contact between the pluton and the country rock is a favorable environment for mineralization, so that it is likely that other mineral occurrences are present in the area which might be discovered by further sampling.

Only one sample showing anomalously high values of any metallic element has been found along the margin of the Wheeler Creek Pluton. This was an isolated stream sediment sample from the southeast border of the pluton which showed high values of lead and silver. The geologic map indicates that

ORIGINAL PAGE IS
OF POOR QUALITY

the stream from which the sample was collected drains an area which is probably near the roof of the pluton (Area 4) and thus may represent the same environment as the mineralized area in the northern Zane Hills. The remainder of the samples from the pluton boundary, and the pluton itself, shown no anomalous occurrences of base and precious metals.

The most favorable prospecting area in the Purcell Mountains is located just south of Purcell Mountain (Area 5). In this area, numberous felsic dikes containing disseminated pyrite occur in the andesite and quartz latite bedrock. In addition, northeast trending quartz veins with local segregations of lead-silver and copper minerals occur in clusters in an area 6-1/2 long by 1-1/2 miles wide along a zone of faults and lineaments which strike northwest. Both these occurrences are just west of Wheeler Creek Pluton, and radioactive ages from the area indicate that they may be related to this intrusive episode. Thus, the area between the known surface occurrences and the boundary of the Wheeler Creek Pluton should be of interest.

Finally, Miller and Ferrians (1968, p. 6) note the occurrence of scattered copper mineralization in the vicinity of Sun Mountain at the southeast corner of the withdrawal (Area 6). The limited data on the geology of the area suggests that it is worthy of additional investigation. However, only the southern half of each of two townships which are open to selection are of interest as prospecting areas (T6N, R18, 19 E, Melozitna quadrangle).

e. Uranium Prospecting Areas

As noted in the introduction, there is no information in the literature regarding occurrences of uranium in the withdrawal area, with the exception of those in the southern Zane Hills described in the last section. However,

ORIGINAL ... OF POOR ...

the nature of the rocks which core the Purcell Mountains and Zane Hills is such that these plutons are likely to be important prospecting areas for uranium. In alkaline igneous rocks such as these, uranium forms common accessory minerals which are usually dispersed throughout the rock. However, occasional segregations of these minerals into commercial size deposits do occur. Areas of anomalous radioactivity have been discovered in other plutons of the Hogatza plutonic belt by airborne scintillometer surveys, which may reflect the development of such segregations in the pluton-cored highlands. Unfortunately, there is no information available regarding field checks of these anomalies, and there is no indication that any such surveys have been conducted in the Purcell Mountains or Zane Hills.

There is also the possibility that uranium which is eroded from highland areas can be redeposited in the adjacent lowlands to form commercial deposits, but again, no studies to date indicate that this has occurred with this area.

Recently, a major discovery of uranium was reported in South Africa (von Backstrom, 1970) in which the host rock is a variety of granitic rock called "alaskite." Rocks of this type have thus become of particular interest in uranium prospecting. Note that a large area of alaskite has been mapped at the west end of the Wheeler Creek Pluton in the Purcell Mountains, and that most of this body lies within one of the townships of prospecting area #5 (last section). A sediment sample from a stream draining this area shown anomolous values of niobium, lanthanum and zirconium, elements which commonly occur in uranium minerals, which implies that this body merits further investigation. Miller (1970) reports the presence of numerous alaskite dikes, of varying size, scattered throughout the plutons of the Zane Hills and Purcell Mountains.

In summary, the geology of the Zane Hills and Purcell Mountains indicates a high potential for the occurrence of uranium deposits, but there is little information available upon which to choose areas for selection for uranium potential. However, if some of the base and precious metal prospecting areas described above are selected, then at least part of the areas of interest for uranium will be under the control of Doyon Co.

f. Discussion and Recommendations

A total of six areas have been indicated above as of interest for prospecting for base and precious metals. Some priorities can be established for selection of these. However, problems will be encountered in cases where the prospecting area is located near townships corners, so that up to four townships are required in order to obtain the entire prospecting area.

One additional area, shown as Area 7 on the map, is included for consideration for selection. There are several reasons why this should be done. The geologic maps and ERTS imagery indicate that the roof zone extends into the area, and that a possible north-south fault through the area offsets the contact zone. These factors imply a favorable environment for mineralization. Only one stream sediment sample is available from a stream which crosses the contact zone of the pluton, but it contains high values of niobium, zirconium and lanthanum which, as noted above, are commonly associated with uranium in igneous rocks. In addition, slightly higher than average values of copper and molybdenum are also present in this sample. Finally, there is a hot spring locality within this area, which may indicate some potential for future development as a geothermal energy source, or other commercial venture

ORIGINAL PAGE IS
OF POOR QUALITY

As noted in the introduction, information available is adequate for deciding upon selections for base and precious metals. Accordingly, it is recommended that Area 1 and 5 be given highest priority for selection. Both are covered by adequate sample data to indicate that they are highly favorable prospecting areas. Area 1 is in parts of four townships (T12N, R12E, T12N, R11E; T11N, R12E; T11N, R13E) and can probably be covered by taking two complete townships and one-half of each of two adjacent townships. In the case of Area 5, it is recommended that two complete townships (T10N, R6E; T10N, R7E) be selected, in order to include the alaskite intrusive body for uranium potential as described above. Note that a hot spring locality is also included in this area.

Second priority is given to Areas 2 and 3. Sample data indicate potential for both base and precious metals and uranium. Four townships are required to cover both areas (T10N, R14E; T9N, R14E; T8N, R13E; T8N, R14E). These are recommended.

Area 4 appears to be in a favorable geologic environment for base and precious metal prospecting, although only one sample is available. However, the area lies at the intersection of four townships, with only a small fraction in each. It may be possible to acquire the area by selecting one township, and parts of the adjacent three townships. Townships involved are T8N, R9E; T8N, R10E; T9N, R9E; T9N, R10E.

Area 6 (southern one-half of each of T6N, R18E, and T6N, R19E) is of interest only because of its proximity to a favorable prospecting area at Sun Mountain, just to the southeast of the withdrawal area. Also, there are hot springs of unknown temperature and flow within this area. However, unless

ORIGINAL PAGE IS
OF POOR QUALITY

there is interest in timber or other commodities in one of these townships, they can be eliminated from consideration.

Area 7 which consists of T9N, R8E, has favorable geology for base and precious metal deposits, and one sample showing indications of uranium. In addition, a few hot springs are also present within the area. It is recommended that this township be selected.

ORIGINAL PAGE IS
OF POOR QUALITY

g. References

Alaskan Geology Branch, U.S.G.S., 1972, The status of mineral resource information on the major land withdrawals of the Alaska Native Claims Settlement Act of 1971: U.S. Geol. Survey open-file report #546, 164 p.

Miller, T.P., 1969, Results of stream sediment sampling in the northern Melozitna, the Hughes and the southern Shungnak Quadrangles, west central Alaska: U.S. Geol. Survey Open-file report, 53 p.

Miller, T. P., 1970, Petrology of the plutonic rocks of west-central Alaska: U.S. Geol. Survey Open-file report, 132 p.

Miller, T. P., 1972, Potassium rich alkaline intrusive rocks of western Alaska: Bull. Geol. Soc. America, V83, p 2111.

Miller, T. P., and Ferrians, O. J., Jr., 1968, Suggested areas for prospecting in the central Koyukuk River Region, Alaska: U.S. Geol. Survey Circular 570, 12 p.

Patton. W. W. , Jr., 1973, Reconnaissance Geology of the northern Yukon-Koyukuk Province, Alaska: U.S. Geol. Survey Prof. Paper 774-A, p A1-A17.

Patton, W. W., Jr., and Miller, T. P., 1966, Regional geologic map of the Hughes quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-459.

Patton, W. W., Jr., Miller, T. P., and Tailleur, I. L., 1968, Regional geologic map of the Shungnak and southern part of the Ambler River quadrangles, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-554.

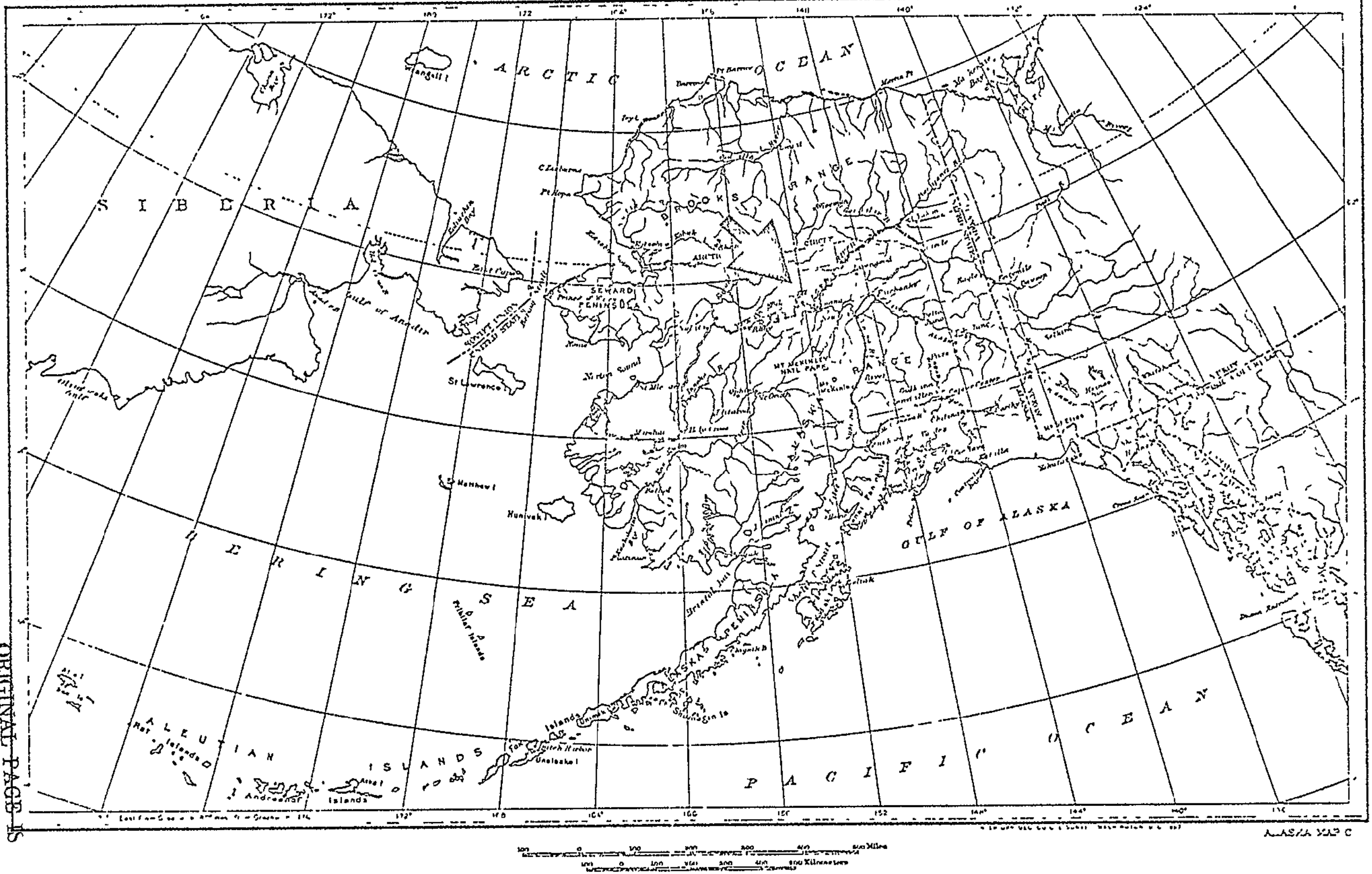
von Backström, J. W., 1970, The Rössing uranium deposit near Swakopmund, South West Africa; in Proc. Conf. Uranium Exploration Geology; Int. Atomic Energy Agency, Vienna, 1970, p 143-150.

C. THE TANANA SELECTION AREA

This selection area, located around the town of Tanana (see map) is one of the least remote withdrawn areas. Although there are no roads within the area, extension of roads from Tanana would probably be no great problem on the north side of the Yukon. Other areas could be easily reached by ice bridge during winter. The airfield at Tanana is sufficient for large multi-engine transports. The Alaska Railroad at Nenana is easily accessible by barge on the Yukon and Tanana Rivers.

The selection area is large, 66 townships, and contains a considerable amount of forested lands which could be selected for timber potential. While the potential for mineralization, other than placer deposits, appears to be low to moderate.

ORIGINAL PAGE IS
OF POOR QUALITY



ALASKA MAP C

FOR SALE BY U S GEOLOGICAL SURVEY FEDERAL CENTER DENVER COLORADO OR WASHINGTON 25 D C

74

ORIGINAL PAGE IS
OF POOR QUALITY

Summary Recommendations

a. Summary of Recommendations for Forest Products Potential

In many respects, among the selection areas, the Tanana selection area offers the greatest opportunity in terms of potential forest products resource recovery. The primary requirement is, of course, the availability of large trees of a type used for wood products. It appears that this requirement is met and the potential could be expanded if forest products from some adjacent land could be utilized. The secondary requirement is met by the proximity of this area to transportation systems. A third requirement, the availability of labor, is probably met in the Tanana selection area more than in any other selection area.

The land use map contained in this report shows the individual sections which should be considered in terms of potential forest products. We recommend that if Doyon, Ltd. decides to base land selections on the basis of forest product potential, that this area be given first priority. Further, we recommend that the extent of possible commercial forest extending to the south of this selection area be considered in this decision process. Last we recommend that a commercial forester be consulted to determine the feasibility of economical recovery of forest products from this area.

b. Summary of Recommendations for Mineral Prospecting

Little geologic or geochemical information is available for this withdrawal, and the only known mineral deposits are a few gold placers, with minor amounts of tin associated. Bedrock geology is generally complex, and exposures are poor, particularly in the area south of the Yukon River.

Summarizing, from U.S.G.S. open-file report #546, parts of the withdrawal (particularly that north of the Yukon River) has low to moderate potential for mineral deposits. A program of airborne geophysical surveys, stream sediment sampling and ground reconnaissance would be required in order to identify the areas of highest potential for purposes of selection. However, at present, there is no basis for recommending particular townships for selection for mineral deposits.

2. Land Use Map of the Tanana Area

a. Introduction

ORIGINAL PAGE IS OF POOR QUALITY

Land use maps of Alaskan areas are of increasing importance with the current widespread rush into land disposition and resource exploitation. Such maps provide a spatial and possibly a quantitative inventory of selected resources and som basis for sensible planning. Land use maps may help in organizing activities compatible with (1) a natural environmental integrity and hence with regeneration potentials and esthetic qualities and (2) the rational and long-range needs of the exploiter.

Land use maps for locations where little land use by man has begun are particularly important. These tend to emphasize vegetation, the most visible and functionally important component of most ecosystems. Vegetation may provide material resources, principally food and timber; wildlife habitat; and cultural and recreational values. Vegetation is also important as an indicator: it is an integrated expression of the history of the site and the nature of soils, drainage, permafrost, topography and small- and large-scale climates. It may also indicate the nature and severity of pollution and other human disturbances.

The land use map of the Tanana area is part of a series of maps of Alaskan areas of particular interest to the Bureau of Indian Affairs, the agency funding the mapping, and the Doyon Native Regional Corporation, within whose jurisdiction the map-areas lie. They are essentially vegetation maps depicting broadly defined vegetation types at the relatively small scale, on the originals of 1:250,000. Although limited in vegetation and other detail, these maps provide more information than any previous maps of the areas and are a step toward the production of more meaningful land use maps in Alaska.

b. Methods

The maps were drawn from Earth Resources Technology Satellite (ERTS) images. The reasons for this were (1) ERTS image availability (2) the usefulness of ERTS imagery for mapping broadly defined vegetation types over large areas in a relatively short time and (3) lack of complete aerial photograph coverage. The land use classification adopted for this map series is the latest revision of a system being developed by the U. S. Geological Survey under the direction of James R. Anderson. Map units are identified at level II in this system in most cases.

The ERTS scenes used were numbers 1037-21240, 1251-21135, 1252-21193, 1341-21130 and 1613-21192. Images for mapping were photographic prints enlarged to a scale of 1:250,000.

Some of the scenes, printed in black and white, were obtained by the satellite in the late winter, when the landscape was generally snow-covered, but when plants taller than the snow pack were free of snow. In the forest zone of interior Alaska snow accumulation by late winter usually is around three feet. These scenes permitted determinations of vegetation structure, based on a gray scale continuum presumably related to plant cover. Areas of no plant cover or of vegetation two low to show above the snow appeared nearly white. Areas of some plant cover above the snow appeared somewhat gray. Areas of intermediate plant cover appeared grayer, and areas of closed vegetation where no snow showed, were dark gray. Nearly white was interpreted as tundra or herbaceous rangeland, intermediate gray

ORIGINAL PAGE IS OF POOR QUALITY

as shrub rangeland or open forest, and dark gray or black as closed forest, the latter in some cases containing large trees of a potentially commercial grade.

Other scenes, obtained in the summer, were printed in simulated color-infrared. These permitted several floristic distinctions, based on some knowledge of the infrared reflectance of high-cover species or species groups. For example, broad-leaved trees and shrubs reflect highly in the near-infrared and therefore appear bright red on this kind of imagery. Most needle-leaved species have low near-infrared reflectance and therefore appear dark gray. Intermediate gray colors seem to indicate ericaceous shrubs or open stands of needle-leaved species.

The winter and summer images were used together in making the vegetation and other land use distinctions expressed in the classification system. Interpretations were facilitated by physiographic information obtained from topographic maps, as there are relationships between vegetation and physiography. For example, wetlands occur in low-lying flat areas; broad-leaved forests and forest dominated by white spruce (Picea glauca) are the main forest types on east, south and west slopes; and upland bogs and black spruce (P. mariana) bog woodlands occur more frequently than the former on north slopes. All bogs except upland bogs with a major black spruce component are designated wetlands for present purposes. Flood plains in the vicinity of streams commonly are occupied by white spruce and balsam poplar (Populus balsamifera) vegetation types containing trees of commercial grade.

ORIGINAL PAGE IS
OF POOR QUALITY

Initially, most of the interpretations of spectral units on the imagery were made through comparisons with aerial photographs covering parts of the map areas. Alaska Forest Inventory photographs in black and white modified infrared were obtained from the U. S. Forest Service, and some small-scale color-infrared photography was obtained from the National Aeronautics and Space Administration and its summer 1974 U-2 aerial photography mission. In general, more information is available on aerial photographs than is necessary for establishing or validating the broad land use classes distinguished at levels I and II of the classification system.

The identification of vegetation containing trees of possible commercial timber grade required the recognition of forest vegetation, then estimations of composition and stature using the kinds of spectral and physiographic information described above. A quantitative definition of commercial timber is not intended. The commercial stands depicted on the maps are those in which the occurrence of a number of larger trees suitable for lumber production is likely. White spruce, balsam poplar and paper birch (Betula papyrifera) are the potentially commercial grade species.

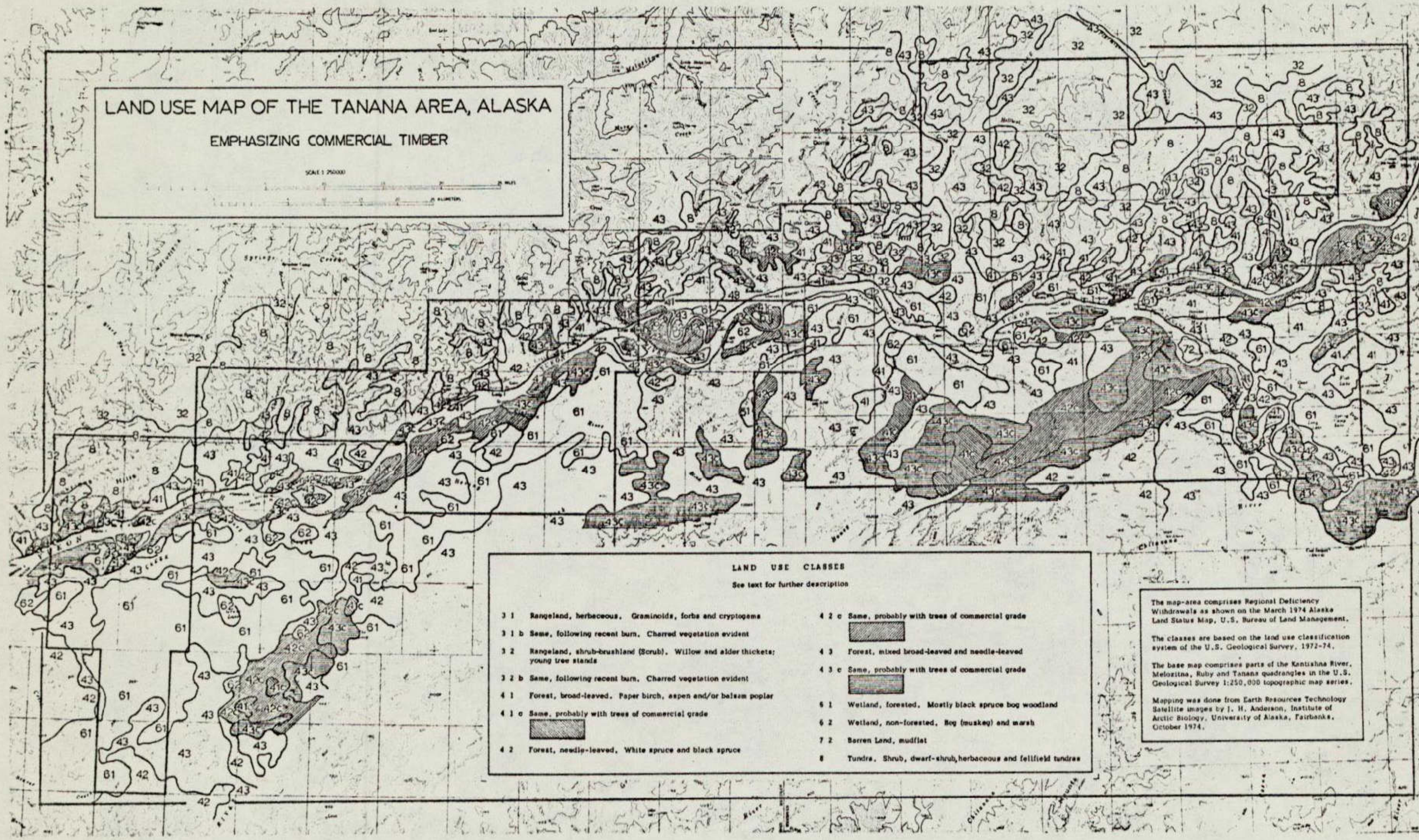
The mechanics of mapping involved (1) tracing streams, lakes and other prominent landmarks onto a transparent plastic overlay of the base map, a U. S. Geological Survey topographic map, (2) positioning the overlay on an ERTS image according to these landmarks, (3) tracing spectral units identified to vegetation or land use classes onto the overlay, (4) positioning the base map over the overlay on a light table and (5) tracing the unit boundaries on the overlay onto the base map and labeling them.

A preliminary map for the Tanana area was made in the laboratory by these methods, using all available control in the form of aerial photographs and written and oral information. This map was used as a guide to a route of travel by light aircraft for field checking. Comparing the preliminary map with certain parts of the mapped area confirmed the interpretations of the ERTS imagery in many cases, but showed also some faulty interpretations. This field work led to the revised and more nearly accurate map presented here.

c. The Map

The map depicts 14 land use classes, most of which are vegetation types of rather broad definition. The distribution of vegetation containing trees of possible commercial grade is indicated with a "c" in the label and is further emphasized by crosshatching. The general composition of the vegetation types is as follows:

3 1. Rangeland, herbaceous. This class designates areas where the vegetation is dominated by graminoids, forbs, and/or cryptogams. Low-growing shrubs may be present. Unlike unforested wetlands (6 2), which are somewhat similar physiognomically, these areas are well-drained. Hence they are different floristically, and they lack peat accumulation. Major species are blue joint grass (Calamagrostis canadensis), fireweed (Epilobium angustifolium), the fescue grass Festuca altaica, squirreltail grass (Hordeum jubatum), and the wormwood Artemisia frigida.



ORIGINAL PAGE IS
OF POOR QUALITY

3 2 b Same, following recent burn. This class designates areas of early post-fire successional vegetation dominated by shrubs, chiefly willows or, quite frequently, broad-leaved or needle-leaved tree seedlings. Charred vegetation and downed trees are abundant. These areas should be increasingly valuable as wildlife habitat over the next few years, and most would eventually succeed back to forest vegetation.

4 1. Forest, broad-leaved. Forested areas are identified by a 4, and broad-leaved forests by a 4 1. Here the major species are paper birch, aspen and balsam poplar. Birch is the most widespread, occurring throughout the range of broad-leaved forests. Aspen is also widespread, but occurs mostly on south and near south slopes of moderate steepness. Balsam poplar is relatively limited in distribution, large trees occurring as stand dominants only on old flood plains in the vicinity of major streams. In the Tanana and Purcell Mountain map-areas most broad-leaved forests comprise trees of small to intermediate size. Some of these forests may be important as potential sources of pulp timber.

4 1 c. Broad-leaved forest, commercial. Broad-leaved forest believed to contain large trees of timber grade are designated by a "c" and by cross-hatching. These forests are mostly on the old flood plains of the Yukon and Tanana Rivers, and the principal species is balsam poplar.
Some commercial broad-leaved forest stands on upland sites farther from the river are dominated by paper birch and some aspen.

4 2. Forest, needle-leaved. Needle-leaved, mostly evergreen forest dominated by white spruce and/or black spruce is widely distributed in the map-areas, but is considerably less important areally than broad-leaved

forest. White spruce is the dominant needle-leaved species on upland sites of most slopes. North slope needle-leaved forests are more often characterized by black spruce in closed and open stands. Needle-leaved forests on low-lying flat areas away from major streams also are dominated more often by black spruce than white spruce, but here these forests are designated forested wetland.

4 2 c. Needle-leaved forest, commercial. White spruce is almost exclusive as the dominant in commercial needle-leaved forests. Such forests are limited to the older and larger flood plains, where white spruce forest usually follows broad-leaved forest as a late stage in vegetation succession.

White spruce of commercial size dominates in narrow gallery forests along the many smaller streams. These forests, although occurring widely, are too small areally to show on the maps. The few large trees in them and their scattered distribution and relative inaccessibility probably would preclude commercial exploitation.

4 3. Forested, mixed broad-leaved and needle-leaved. Most forest vegetation in the map-areas is characterized by mixtures of broad-leaved and needle-leaved trees in various proportions. This is a reflection of widespread heterogeneity in a number of environmental and historical factors. Mixed forests generally are dominated by trees of intermediate size or, at higher elevations, by small trees. They may be valuable sources of pulp timber in some places. Some of this forest is open in nature, with low tree densities and correspondingly high shrub densities. Therefore it is also important as wildlife habitat.

4 3 c. Mixed forest, commercial. As mixed forest is the most frequent non-commercial forest type in the map-areas, it is also the areally most important commercial forest type. Like the other two commercial types, it also is limited to lower elevation areas near the Yukon, Tanana and Koyukuk Rivers. Here the most important broad-leaved component is balsam poplar, but paper birch is widespread. Aspen is of some importance as a large tree on sites somewhat removed from the river. White spruce is the only important needle-leaved species, and in most cases this component considerably exceeds the others in frequency and volume (Fig. 2).

6 1. Wetland, forested. A "6" designates wetland, a broad class of vegetation and land use types generally having a soil water table at or near the surface most of the growing season. Wetlands in the map-areas generally are underlain by permafrost. A "6 1" designates wetland areas where the water table is just low enough and the permafrost just deep enough to allow some tree growth. This growth comprises black spruce and some paper birch. Trees are small to intermediate in size, and their density is low. Hence the vegetation is mostly open forest and, where tree density is low, woodland. Black spruce bog woodland, colloquially called muskeg, is the areally most important vegetation in this class. The bog components are shrub and dwarf-shrub layers and a thick cryptogam layer. Shrubs are several ericaceous species, shrub birch (Betula glandulosa) and some willows. The cryptogam layer is made up of several moss species, often with Sphagnum as the stratal dominant, and of lichens. Herbs are widespread but of relatively low density.

6 2. Wetland, non-forested. Some non-forested wetlands are similar

to forested wetlands except for the lack of trees. Dwarf-shrub, herbaceous and cryptogam vegetation is dominant. The most important dwarf-shrubs are dwarf birch (Betula nana), lingonberry (Vaccinium vitis-idaea), blueberry (V. uliginosum), labrador tea (Ledum decumbens), crowberry (Empetrum nigrum), and several willows. The herbaceous component usually includes much cottongrass (Eriophorum spp.) or sedge (Carex spp.). The cryptogam component features a higher proportion of Sphagnum spp. than the equivalent forested wetland component.

Non-forested wetlands with this general vegetation composition are bogs, where peat accumulation is significant and permafrost is near the surface. Bogs are important sources of wild berries.

A second kind of vegetation in this class is marsh, with a water table at or above the surface and a thoroughly wet soil. Graminoids and bryophytes are dominants, sedges and several grass species being characteristic. In the map-areas, units labeled 6 2 located near small, slow-flowing streams and near ponds and lakes in flat areas are more often marsh than bog. Marsh areas are very important as waterfowl habitat.

7 2. Barrenland, mudflat. Barrenlands are areas which, for a variety of reasons, bear very little or no vegetation. Common types in the map-areas are river bars and active flood plains, but these are too small individually to show on the maps. In the lower Tanana River, however, there is a large island composed of recently deposited silt (Fig. 3). Although scattered plants occur here, the surface is probably too unstable physiographically for vegetation development to occur.

8. Tundra. Higher elevation areas, generally above approximately

2,000 ft. in the Tanana area are occupied by tundra. This is a broad landscape category characterized by at least four major physiognomic vegetation types: scrub, dwarf-scrub, meadow and fellfield. These types were not distinguished in the map-areas. Much of the tundra zone is important as habitat for caribou, moose, sheep, bear and many birds.

d. Application Example

An example of a use to which maps of this kind can be put is the compilation of townships within which stands of commercial timber occur. These are listed in the following tables.

Table 1. Townships with timber of possible commercial grade in the Tanana map-area and vicinity. Reference is to the Kateel River (E) and Umiat (W) meridians and the Kateel River (S) and Fairbanks (N) base lines.

KANTISHNA RIVER QUADRANGLE

Township North	Range West
1	18
	19
2	19
	20
	22
	23
	24
	25
	26
	27

MELOZITNA QUADRANGLE

Township South	Range East
3	28
4	25
	26
	27
	28
5	23
	24
	25
	26
	28
	29

RUBY QUADRANGLE

Township South	Range East
6	21
	22
	23
	27
	28
7	18
	19

RUBY QUADRANGLE, continued

Township South	Range East
7	20
	21
8	22
	23

TANANA QUADRANGLE

Township North	Range West
2	20*
	21
	22*
	23*
	24*
	25*
3	19
	20
	21
	22
	23
	24
	25
	26
	27
4	19
	20
	21
	22
	23
	24
	27
5	23
	24
	25
	26
	27
	28

*Townships so marked are duplicates on different quadrangles.
55 townships are listed here.

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

c. References

The following were consulted in preparing the Tanana area land use map and accompanying text. They would be useful sources of further information on the vegetation and related resources of this area and the mapping activities.

Anderson, D. M., W. K. Crowder, R. K. Haugen, T. L. Marlar, H. L. McKim and A. Petrone. 1973. An ERTS view of Alaska: Regional analysis of earth and water resources based on satellite imagery. Technical Report 241, U.S Army Cold Regions Research and Engineering Laboratory, Hanover. 50 p + maps.

Anderson, J. H. 1973. Identification, definition and mapping of terrestrial ecosystems in interior Alaska. No. E74-10137, National Technical Information Service, Springfield. 16 p.

Hanson, H. C. 1951. Characteristics of some grassland, marsh and other plant communities in western Alaska. Ecological Monographs 21: 317-378.

Hutchison, O. K. 1967. Alaska's forest resource. Resource Bulletin PNW 19, U.S. Forest Service, Juneau. 74 p.

Küchler, A. W. 1967. Vegetation mapping. Ronald Press, New York. 472 p.

Viereck, L. A. 1973. Wildfire in the taiga of Alaska. Quaternary Research 3: 465-495.

Viereck, L. A. and E. L. Little, Jr. 1972. Alaska trees and shrubs. Agriculture Handbook No. 410, U. S Forest Service. 265 p.

D. THE NORTH AND SOUTH FORK, KUSKOKWIM RIVER AREAS

ORIGINAL PAGE IS
OF POOR QUALITY

Summary Recommendations

a. Summary of Recommendations for Forest Products Potential

This selection area probably ranks third behind the Tanana and Kaltag selection areas in terms of forest product potential. Although our aerial reconnaissance verified the existence of extensive stands of large trees, the trees did appear to be smaller in general than those in the other selection areas. The area is rather remote and it would appear that the best transportation available for timber and other products would be down the Kuskokwim River to Bethel. However, the navagability of the Kuskokwim in this region is not know to us but is very likely somewhat limited. Extensive labor or support facilities are not available in this selection area. We have indicated the areas containing apparently commercial-sized trees on our land use map. However, we strongly recommend that a commercial forester be consulted before these areas are selected on the basis of forest product potential.

b. Summary of Recommendations for Mineral Prospecting

This selection area was considered to be of somewhat low potential value in terms of mineral prospecting. Therefore, by agreement, other selection areas appearing to have low forest product potential were analysed in terms of prospecting areas and not forest products while this area was not considered in terms of prospecting areas.

2. Land-Use Map of the North and South Fork of the Kuskokwim River Areas

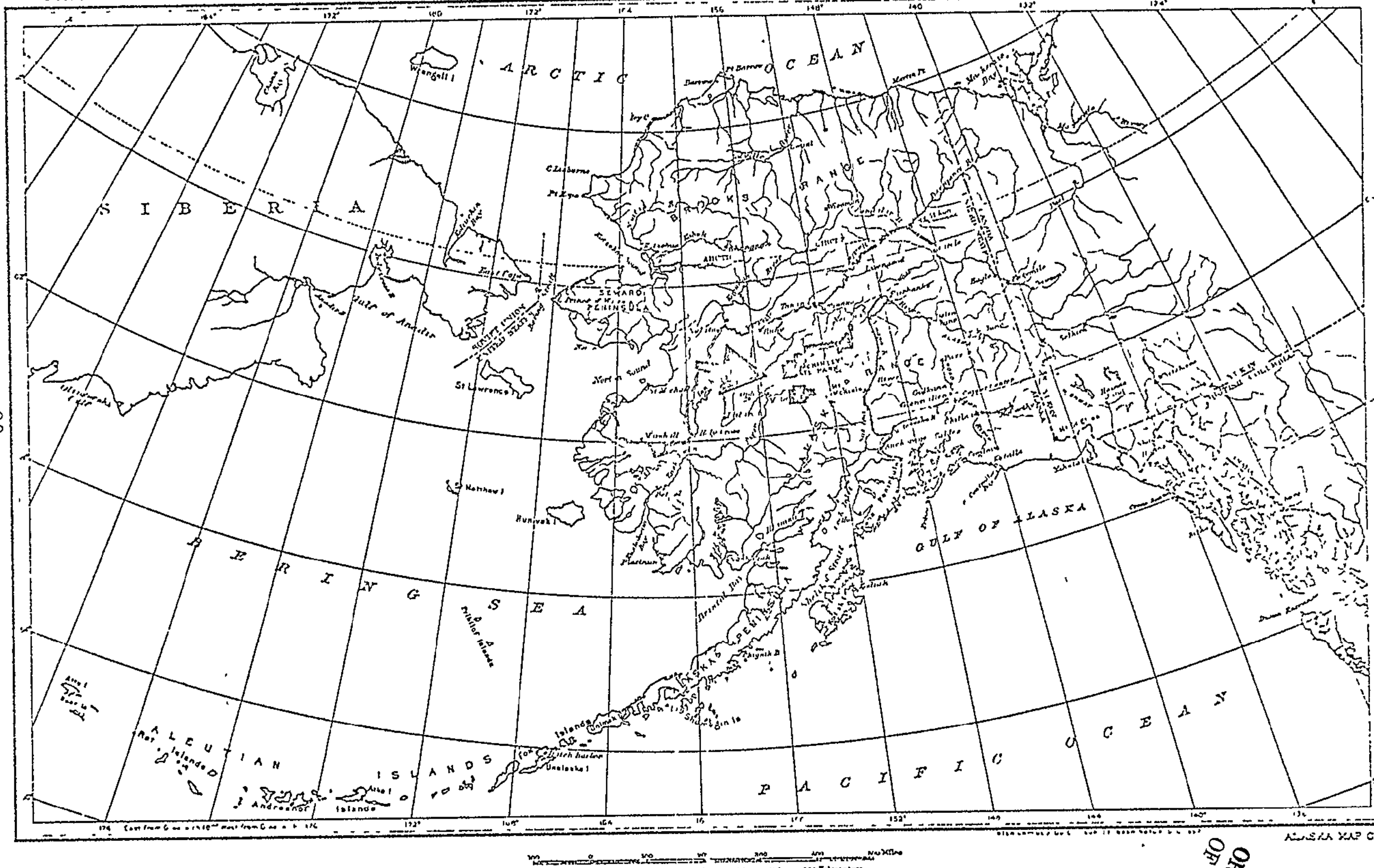
a. Introduction

Land use maps of Alaskan areas are of increasing importance with the current widespread rush into land disposition and resource exploitation. Such maps provide a spatial, and possibly a basis for a quantitative inventory of selected resources, and they may serve as a guide in sensible planning. Land use maps may help in organizing activities compatible with (1) a natural environmental integrity and hence with regeneration potentials and esthetic qualities and (2) the rational and long-range needs of the exploiter.

Land use maps where little land use by man has begun are particularly important as guides in the initial stages of development. These tend to emphasize vegetation the most visible and functionally important component of most ecosystems. Vegetation is a material resource in terms of food and timber; it is the primary feature of wildlife habitats and it is essential for out-of-doors cultural, recreational and scientific activities. Vegetation is also important as an indicator: it is an integrated expression of the history of the site and the nature of soils, drainage, permafrost, topography and small- and large-scale climates. It may also indicate the nature and severity of pollution and other human disturbances.

The land use maps of the North Fork and South Fork Kuskokwim River areas are the fourth and fifth in a series of maps of Alaskan areas of particular interest to the Bureau of Indian Affairs, the agency funding the

ORIGINAL PAGE IS
OF POOR QUALITY



ALASKA MAP C

FOR SALE BY U S GEOLOGICAL SURVEY FEDERAL CENTER, DENVER, COLORADO OR WASHINGTON 25, D C

ORIGINAL PAGE IS OF POOR QUALITY

mapping, and the Doyon Native Regional Corporation, within whose jurisdiction the map-areas lie. They are essentially vegetation maps depicting broadly-defined vegetation types at the scale, on the originals, of 1:250,000. Although botanically coarse and of small scale, these maps provide more information, especially spatial, than any previous maps of the areas and are a step toward the production of more meaningful land use maps in Alaska.

b. Methods

The maps were drawn from Earth Resources Technology Satellite (ERTS) images. The reasons for this were (1) ERTS image availability, (2) the usefulness of ERTS imagery for mapping broadly-defined vegetation types over large areas in a relatively short time and (3) lack of complete aerial photograph coverage. The land use classification adopted for this map series is a system being developed by the U. S. Geological Survey under the direction of James R. Anderson. Map units are identified at level II in this system in most cases.

The ERTS scenes used were numbers 1342-21191, 1358-21073, 1593-21084, 1593-21090 and 1610-21024 for the North Fork area and 1358-21075 and 1574-21034 for the South Fork area. Images for mapping were 16"x 20" photographic enlargement prints at a scale of approximately 1:250,000.

Some of the scenes, printed in black and white, were obtained by the satellite in the late winter, when the landscape was generally snow-covered, but when plants taller than the snow pack were free of snow. In the forest zone of interior Alaska snow accumulation by late winter usually is about one meter. This accounts for recrystallization and compaction. Actual snowfall in late winter is normally infrequent and light. These scenes

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

permitted estimations of vegetation structure based on a gray scale continuum presumably related to plant height and cover. White and very light gray were interpreted as indicating areas of no vegetation, sparse vegetation, or vegetation too low to show above the snow. Light gray was believed to indicate areas of low, somewhat open plant cover or of taller but sparse cover. Intermediate gray was interpreted as indicating areas of closed vegetation of low to intermediate height or of taller but somewhat open vegetation. Dark gray was believed to indicate tall, closed vegetation. Much of the map-areas have considerable topographic relief, and in late winter the sun angle is low. Therefore the gray scale continuum is strongly affected by slope angle and aspect, and this had constantly to be evaluated in interpreting the shades of gray.

Other scenes, obtained in the summer, were printed in color infrared. These permitted several coarse floristic distinctions based on some knowledge of the infrared reflectance of high-cover species or species groups. For example, broad-leaved trees and shrubs reflect highly in the near-infrared and therefore appear bright red on this kind of imagery. Most needle-leaved species have low near-infrared reflectance and therefore appear dark gray. Intermediate gray colors seem to indicate ericaceous shrubs or open stands of needle-leaved species.

Information from the winter and summer images together was used in making vegetation distinctions to the extent that the latter may be expressed by the adopted classification system. Interpretations were also based on physiographic information obtained from topographic maps, as there are general relationships between vegetation and physiography. For example,

ORIGINAL PAGE IS
OF POOR QUALITY

wetlands occur in low-lying flat areas; broad-leaved forests and forest dominated by white spruce (Picea glauca) are the main forest types on east, south and west slopes, and upland bogs and black spruce (P. mariana) bog woodlands occur on many north slopes. All bogs except upland bogs with a major black spruce component are designated wetlands for present purposes. Flood plains in the vicinity of streams commonly are occupied by white spruce and balsam poplar (Populus balsamifera) vegetation types containing trees of commercial grade.

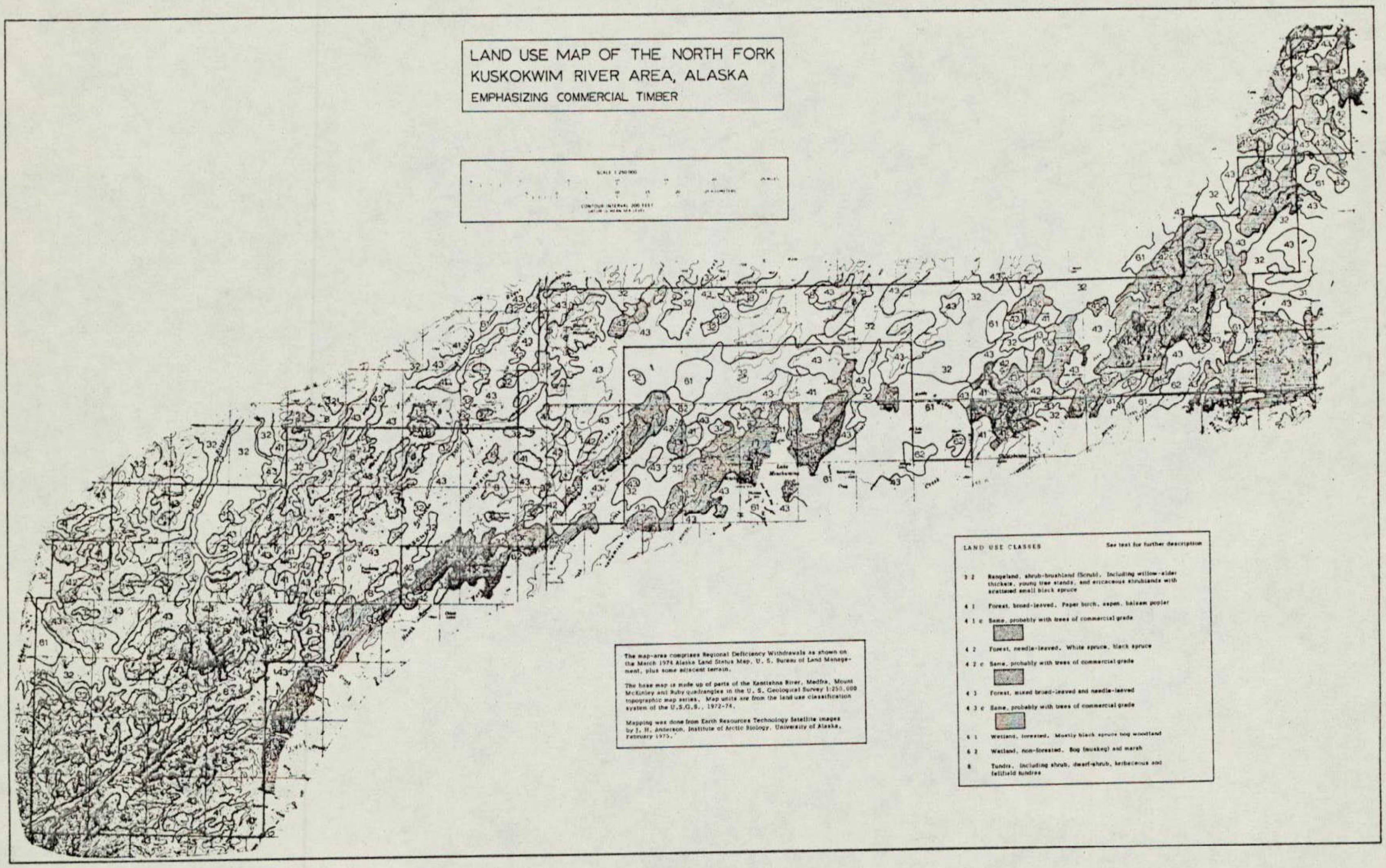
Initially, most of the identifications of spectral units on the imagery were made through comparisons with aerial photographs covering parts of the map-areas. Alaska Forest Inventory photographs in black and white modified infrared were obtained from the U. S. Forest Service, and some small-scale color-infrared photography was obtained from the National Aeronautics and Space Administration and its summer 1974 U-2 aerial photography mission. In general, more information is available on aerial photographs than is necessary for establishing or validating the broad land use classes distinguished at levels I and II of the U.S.G.S. classification system.

The identification of vegetation containing trees of possible commercial timber grade required first the identification of forest vegetation, then an estimation of composition and stature using the kinds of spectral and physiographic information described above. A quantitative definition of commercial timber is not intended. The commercial stands depicted on the maps are those in which the occurrence of a number of larger trees suitable for lumber production appears likely. White spruce, balsam poplar and paper birch (Betula papyrifera) are the potentially commercial species. In poplar, and especially in birch forests, pulp potential rather than lumber is probably the more frequent basis of commercial importance. The designation of commercial forest deals with only what seems to be there and not with accessibility or any other aspect of exploitation.

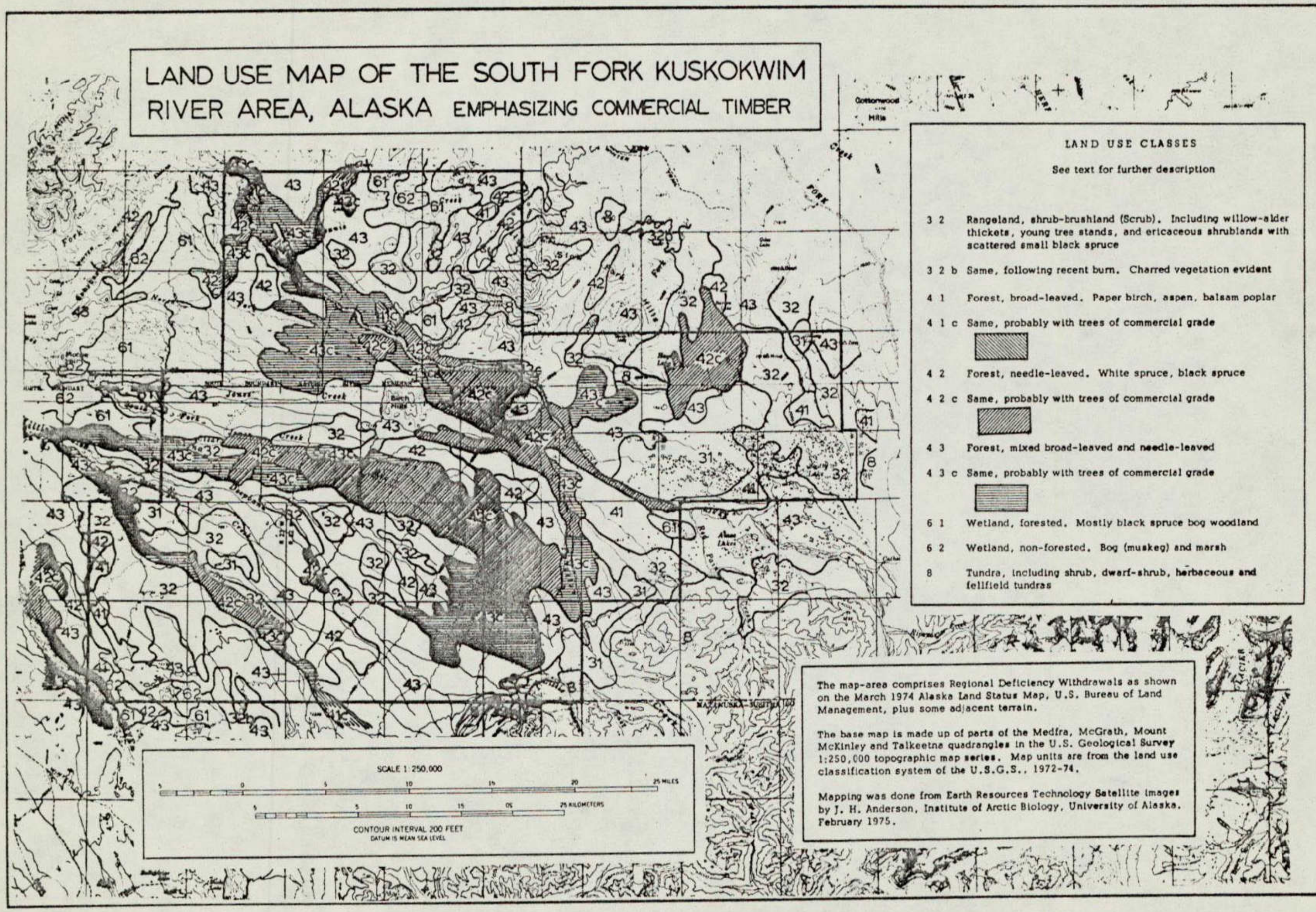
The mechanics of mapping involved (1) tracing streams, lakes and other prominent landmarks onto a transparent plastic overlay of the base map, a U. S. Geological Survey topographic map, (2) positioning the overlay on an ERTS image according to these landmarks, (3) tracing spectral units identified to vegetation or land use classes onto the overlay, (4) positioning the base map over the overlay on a light table and (5) tracing the unit boundaries on the overlay onto the base map and labeling them. Activity 3 is the critical one. Realistic interpretations can be made only by a vegetation scientist familiar with the nature of the vegetation in the map-area or in similar areas, as well as with the capabilities of the imagery and with vegetation mapping techniques.

Preliminary maps were drawn in the laboratory, and these were used as guides to a route of travel by light aircraft for field checking. This flight was made on February 27, when the landscape featured a snowpack, and on a day which was mostly overcast. Whereas these conditions sound unfavorable for aerial vegetation observations, the broadly-defined vegetation types of the adopted classification system, types defined largely by gross structure and species composition of the highest-cover plant layer and on general physiography, could be identified when flying as low and slowly as was safe. This flight led to the refined interpretations presented here.

ORIGINAL PAGE IS
OF POOR QUALITY



ORIGINAL PAGE IS
OF POOR QUALITY



ORIGINAL PAGE IS
OF POOR QUALITY

c. The Maps

The maps depict 11 land use classes comprising vegetation types of broad definition. The distribution of vegetation containing trees of possible commercial grade is indicated with a "c" in the label and is further emphasized by crosshatching. The vegetation types and their general composition are as follows:

3 2. Rangeland, shrub-brushland (Scrub). Shrub rangeland is dominated by shrubs and/or shrub-sized individuals of tree species. Some of this vegetation in the map-areas is dominated by the latter, chiefly young aspen (Populus tremuloides) and paper birch in post-fire successional stands. Closer to the larger streams shrub rangeland may feature willows (Salix spp.) and alders (Alnus spp.), usually as dominants in flood plain and point bar early successional vegetation. Shrub-dominated areas in bogs are included in non-forested wetlands, and high elevation shrub tundra is covered by class 8. The most prevalent phenomenon in this category is the kind of vegetation dominated by medium-height ericaceous shrubs and shrub birch (Betula glandulosa) and featuring in addition an open or sparse layer of small but old black spruce trees. This is a major expression of the vegetation often called taiga. It was decided to classify this, phytocenologically a scrub with scattered trees, as shrub rangeland because (1) it occurs in uplands rather than the flatter lowlands where forested wetlands are recognized, even though permafrost may restrict drainage as much as in wetlands and (2) the tree layer is not tall nor dense enough to qualify it as forest. This kind of vegetation inter-

ORIGINAL PAGE IS
OF POOR QUALITY

grades extensively with forested wetland and needle-leaved forest. Shrub rangeland is important for wildlife, especially large game animals, because of the high proportion in it of browse food material. There is also abundant cover for smaller animals and birds here.

3 2 b. Same, following recent burn. This class designates areas of early post-fire successional vegetation of shrubs, chiefly willows or, quite frequently, broad-leaved or needle-leaved tree seedlings. Charred vegetation and downed trees are abundant and the blackness of this is visible on the imagery. These areas should be increasingly valuable as wildlife habitat over the next few years, and most would eventually succeed back to forest vegetation.

4 1. Forest, broad-leaved. Forested areas are identified by a 4, and broad-leaved forests by a 4 1. Here the major species are paper birch, aspen and balsam poplar. Birch is the most widespread, occurring throughout the range of broad-leaved forests. Aspen is also widespread, but occurs mostly on south and near-south slopes of moderate steepness. Balsam poplar is relatively limited in distribution, large trees occurring as stand dominants only on old flood plains in the vicinity of major streams. Most trees are of small to intermediate sizes.

4 1 c. Broad-leaved forest, commercial. Broad-leaved or hardwood forests believed to contain trees of pulp or timber grade are designated by a "c" and by crosshatching. The only hardwood forests with timber potential occur as small and scattered stands on abandoned, but not really old flood plain sites adjacent to the largest streams. Here the principal species is balsam poplar. The commercial forests mapped in upland areas are dominated

ORIGINAL PAGE IS
OF POOR QUALITY

by paper birch, in closed stands of medium-sized to medium-large trees. An admixture of individuals or small stands of aspen occurs in some places. These forests were designated commercial because the woody material in them seemed sufficiently abundant for pulp production.

4 2. Forest, needle-leaved. Needle-leaved, mostly evergreen forest dominated by white spruce and/or black spruce is widely distributed in the map-areas. White spruce is the dominant species in needle-leaved forests on upland sites of most slopes. North slope needle-leaved forests are more often characterized by black spruce in closed and open stands. Needle-leaved forests on low-lying flat areas away from major streams also are dominated more often by black spruce than white spruce, but these are designated forested wetland.

4 2 c. Needle-leaved forest, commercial. White spruce is almost exclusive as the dominant in commercial needle-leaved forests. Such forests are limited to the flood plains, where white spruce forest with large trees usually follows broad-leaved forest as a later stage in vegetation succession.

White spruce of commercial size dominates in narrow gallery forests along the many smaller streams. These forests, although occurring widely, are too small areally to show on the maps.

4 3. Forest, mixed broad-leaved and needle-leaved. Much of the forest vegetation in the map-areas is characterized by mixtures of broad-leaved and needle-leaved trees in various proportions. This is a reflection of widespread heterogeneity in a number of environmental and historical factors. Mixed forests generally are dominated by trees of intermediate size or, at higher elevations, by small trees. Some of these forests are open in nature, with low tree densities and correspondingly high shrub

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

densities. This kind of mixed forest is important as wildlife habitat.

4 3 c. Mixed forest, commercial. As mixed forest is the most frequent non-commercial forest type in the map-areas, it is also the areally most important commercial forest type. Like the other two commercial types, it also is limited to flood plains and lower-elevation uplands nearer the main streams. Here the most important broad-leaved component is paper birch. Aspen and balsam poplar occur as larger trees only infrequently. White spruce is the important needle-leaved species, and in most cases this component is the only one of timber value in commercial mixed forest.

6 1. Wetland, forested. A "6" designates wetland, a broad class of vegetation and land use types generally having a soil water table at or near the surface most of the growing season. Wetlands in the map-areas generally are underlain by permafrost. A "6 1 designates wetland areas where the water table is just low enough and the permafrost just deep enough or the soil drainage just mobile enough to allow some tree growth. This growth comprises black spruce and some paper birch. Trees are small to intermediate in size, and their density is low. Hence the vegetation is mostly open forest and, where tree density is low, woodland. Black spruce bog woodland, colloquially called muskeg, is the areally most important vegetation in this class. The bog components are shrub and dwarf-shrub layers and a thick cryptogam layer. Shrubs are several ericaceous species, shrub birch and some willows. The cryptogam layer is made up of several moss species, often with <u>Sphagnum</u> as the stratal dominant, and of lichens. Herbs are widespread but of relatively low density.

6 2. Wetland, non-forested. Some non-forested wetlands are similar to forested wetlands except for the lack of trees. Dwarf-shrub, herbaceous and cryptogam vegetation is dominant. The most important dwarf-shrubs are several willows, dwarf birch (Betula nana) and the ericaceous species, lingonberry (Vaccinium vitis-idaea), blueberry (V. uliginosum), labrador tea (Ledum decumbens) and crowberry (Empetrum nigrum). The herbaceous component usually includes much cottongrass (Eriophorum spp.) or sedge (Carex spp.). The cryptogam layer features a higher proportion of Sphagnum spp. than the equivalent forested wetland component.

Non-forested wetlands with this general vegetation composition are bogs, where there may be peat accumulation and where permafrost is near the surface. Bogs are important sources of wild berries.

A second kind of vegetation in this class is marsh, with a water table at or above the surface and a thoroughly wet soil. Graminoids and bryophytes are dominants, sedges and several grass species being characteristic. In the map-areas, units labeled 6 2 located near small, slow-flowing streams and near ponds and lakes in flat areas are more often marsh than bog. Marsh areas are important as waterfowl habitat.

8. Tundra. Higher elevation areas generally above approximately 2,000 ft are occupied by tundra. This is a broad landscape category characterized by at least four major physiognomic vegetation types: scrub, dwarf-scrub, meadow and fellfield. These types were not distinguished in the map-areas. Much of the tundra zone is important as habitat for caribou, moose, sheep, bears and many birds.

ORIGINAL PAGE IS
OF POOR QUALITY

d. Example of Application for Land Selection

An example of a use to which maps of this kind can be put is the compilation of townships within which stands of commercial timber occure. These are listed in the following tables.

ORIGINAL PAGE IS
OF POOR QUALITY

Table 1 Townships with timber of possible commercial grade in the South Fork map-area and vicinity.

MC GRATH QUADRANGLE
(Seward base and meridian)

Township North	Range West
30	22
	24
31	20*
	21
	22
	23
	24
	25
32	20
	21
	22
	23
	24
	25
33	20
	21
	22
	23
	24
	25
34	20
	21

ORIGINAL PAGE IS
OF POOR QUALITY

TALKEETNA QUADRANGLE
(Seward base and meridian)

Township North	Range West
31	19
	20*
32	19
	20*
33	19
	20*

MEDFRA QUADRANGLE
(Kateel River base and meridian)

Township South	Range East
26	28
	29
27	27
	28
	29
28	27
	28
	29
	30
	31
29	28
	29
	30
	31

MT. MCKINLEY QUADRANGLE
(Fairbanks base and meridian)

Township South	Range West
21	27
22	26
	27
	28

TALKEETNA QUADRANGLE
(Fairbanks base and meridian)

Township South	Range West
22	27*
	28*

*Townships so marked are duplicates on different quadrangles
48 townships are listed here

Table 2: Townships with timber of possible commercial grade in the North Fork map-area and vicinity.

MEDFRA QUADRANGLE
(Kateel River base and meridian)

Township South	Range East
19	28
	29
	30
20	27
	28
	29
	30
21	27
	28
22	26
	27
23	25
	26
24	25
	26

MT MCKINLEY QUADRANGLE
(Fairbanks base and meridian)

Township South	Range West
11	15
	16
	17
	18
	19
	20
	22
	23
	24
	25
	26
	27
12	23
	24
	25
	26
	27
	28
13	26
	27
	28

KANTISHNA RIVER QUADRANGLE
(Fairbanks base and meridian)

Township South	Range West
4	13
	14
	15
5	13
	14
	15
6	13
	14
	15
7	14
	15
8	15
	16
	17
9	14
	15
	16
	17
	18
	19
	20
	26
	27
10	14
	15
	16
	17
	18
	19
	20
	22
	23
	24
	26

70 townships listed here

E. WITHDRAWAL 3-C SELECTION AREA CHANDALAR - WISEMAN

1. Summary of Recommendations

a. Summary of Recommendations for Forest Products Potential

The 3-C selection area contains little potential for commercial exploitation of forest products potential and consequently this analysis was not performed.

b. Summary of Recommendations for Mineral Prospecting

This entire selection area is heavily mineralized and certainly some areas of it could be selected on that basis alone. However, this technique would not necessarily guarantee the acquisition of commercial mineral deposits. In order of priority we recommend: (1) that a very detailed geochemical survey of the area be conducted and the results be evaluated for the selection process, (2) if that is not possible we have outlined a smaller scale geochemical survey to be carried out and (3) if no other data is obtained, on the basis of the data available to us, it appears that the following sections or parts of sections should be selected:

T33N, R7, 8 W

T31N, R7, 8, 9W

T27N, R10W

W 1/2, T27N, R9W

T32N, R7, 8, 9W

T30N, R7W

S 1/2, T28N, R10W

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

2. Evaluation of Mineralization Potential of Withdrawal 3-C

a. Introduction

The withdrawal considered here consists of 23 townships in the western half of the Chandalar 1:250,000 scale quadrangle, and 3 townships just west of the village of Wiseman in the adjacent Wiseman quadrangle. The area between the two blocks is part of the TAPS corridor.

The eastern part of the withdrawal is discussed in U. S. Geological Survey Open-File report #546, but the western block was not covered. Geologic and geochemical data were considered to be adequate for a preliminary resource appraisal to be made for the eastern block at the time that Open-File report #546 was prepared. A search of the literature has shown that the same quality of information has since become available for the western block as well.

Evaluation of the available information for making recommendations for land selection presents a problem which requires some explanation. That is, the use of the phrase "data. . .adequate for preliminary resource appraisal" can be misleading. As used in Open-File report #546, the data leads to the conclusion that the entire eastern block of the withdrawal has "high mineral resource potential". It does not, however, imply that the information is adequate to identify townships which have a higher potential for mineral deposits than others. In fact, based upon the occurrance of scattered gold placer deposits, and the limited number of available geochemical samples (approximately 1 per 75 to 100 square miles within the withdrawal) the conclusion must be reached that the entire area is worthy of careful study. However, an extensive program of geochemical investigation

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ALASKA

ALASKA MAP C

FOR SALE BY U S GEOLOGICAL SURVEY FEDERAL CENTER DENVER, COLORADO OR WASHINGTON 25 D C

ORIGINAL PAGE IS
OF POOR QUALITY

such as that done by A. S. & R. Co. in the 40-Mile area, would be required in order to reliably establish an order of priority for selection for mineral resource potential.

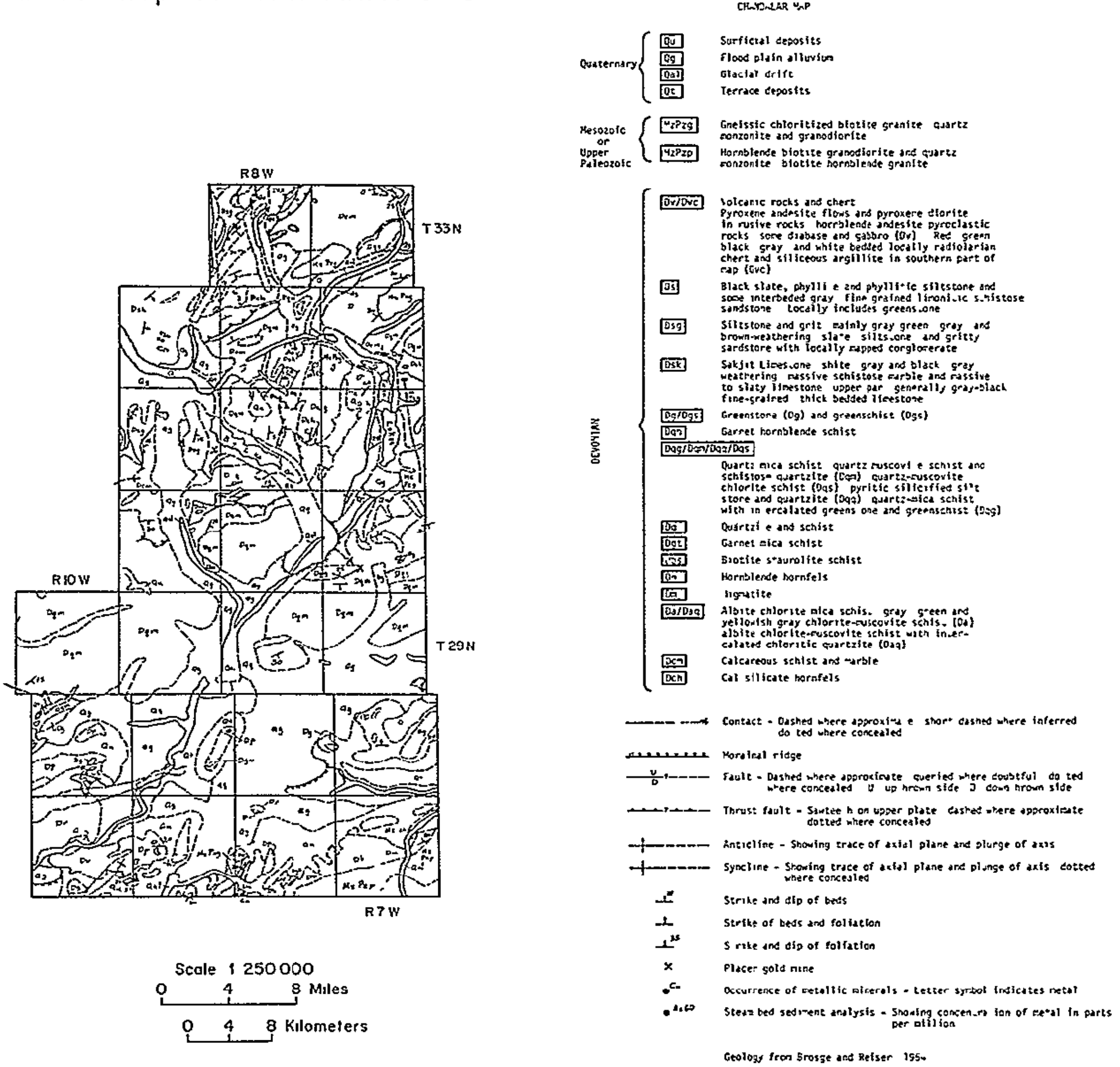
In view of these limitations, the approach adopted in formulating the recommendations given below was to use the available data to attempt to identify areas which are likely to be of greatest interest for prospecting in future. Selection of these would then provide a basis for second party arrangements through which access to other townships could be obtained. However, the most favorable townships are clustered in the northern part of the withdrawal, and do not provide good coverage of the entire withdrawal area. Thus, additional townships are recommended to cover the southern part of the withdrawal. The potential of these is considered to be higher than most of the remaining ones, but not as great as those in the northern part.

b. General Geology and Mineralization

The geology of the Chandalar quadrangle has been mapped by Brosgé and Reiser (1964), while that of the relevant part of the Wiseman quadrangle is from Brosgé and Reiser (1971). Because the geology of the part of the withdrawal area in the Chandalar quadrangle is rather complicated, a tracing of the original map, with the township grid of the withdrawal superimposed, has been submitted as part of this report.

The general geology of the eastern block is summarized in Open-File report #546, from which the following description is adapted. Three identifiable belts of rock cross the area in a generally east-west direction. From south to north, these are (see map):

Base Map of Withdrawal 3-C



ORIGINAL PAGE IS
OF POOR QUALITY

1) A zone of rocks of Paleozoic and Mesozoic Age, including low grade metamorphic rocks, volcanic and intrusive rocks with some pyroclastics interbedded with chert (Units Dv, Dvc, Dp, Dgw, and Dbs of the geologic map),

2) A zone of greenschist facies rocks of predominately Paleozoic age (units Dqm, Dqg, Dqs and Dqq)

3) A zone of less metamorphosed carbonates and clastic rocks of Devonian age (units Dsk, Dcm, Dca, Dch).

Mesozoic granitic rocks have been intruded into zones 2 and 3, and have altered the country rocks significantly in some areas. Unit Dch, for example, was formed by thermal alteration of part of the carbonate section. Such areas are of great interest for prospecting. Mafic igneous rocks, part of which are volcanic, also occur in all three zones (unit Dg, and part of unit Dqg and possibly Dgs). The western block is entirely within zone 3.

From the geologic maps, it is apparent that the mining activity in the area east of Chandalar Lake is concentrated in the rocks of zone 2, while that at Wiseman is in zone 3. Gold is the only metal which has been produced. Note that lode mining in both districts was confined to a few small operations (one is possibly presently active in the Chandalar area) with the bulk of the production coming from placers. A few placers within the withdrawal area were also mined, but production was probably minor. Their possible importance to the area is that base metals tend to be associated with the gold at Wiseman and Chandalar, so that, by implication, the presence of gold placers within the withdrawal, may indicate the presence of other metals. There is simply no basis for evaluating this possibility.

As noted in the introduction, the available geochemical data for the withdrawal area is very limited, and the density of data is no greater in adjacent areas. Thus, generalizations about associations of mineralization with specific rock types cannot be made with confidence.

c. Discussion and Recommendations

In the absence of any data with which to identify mineralized zones and associate them with specific geologic environments, it would obviously be desirable to conduct a geochemical survey of the area prior to selection. Note that a simple reconnaissance sampling program is not likely to be of great value because, from all indications, there will be shows of mineralization throughout the area. Instead, as pointed out above, a more comprehensive project is needed. Assuming that this cannot be accomplished in the time prior to selection, it would be possible to design a sampling program of a reconnaissance nature to test some of the more favorable geologic environments, such as alteration zones around some of the intrusive rocks, and those rock units which gave good sample values outside the withdrawal area. Such a program would probably require up to 1000 samples, and would involve a significant investment in planning time. As a result, pending a decision to adopt this alternative, no recommendation for the conduct of a geochemical survey are offered here.

It is possible to identify geologic environments which are likely to be of strong interest for prospecting, and base selection upon these. In particular, three areas can be identified as promising by these criteria:

1) The northern 8 townships of the eastern block (T. 33 N., R. 7 & 8 W., T. 32 N., R. 7, 8 & 9 W., T. 31 N., R. 7, 8, & 9 W.) are underlain by a

variety of rock types, which have been intruded by granites, and extensively altered over large areas. The limited geochemical data from these townships and adjacent areas outside the withdrawal show good values from a variety of environments within this terrain. Brosgé and Reiser (1972) note that numerous claims were recently filed in the area underlain by these rocks, and this was done by a major mining company which indicates that the geologic data are favorable.

2) T. 30 N., R. 7 W. includes an area of rock types (greenstone and greenschist of unit Dqg) which are often associated with stratiform copper deposits. A sample containing copper mineralization was collected from these rocks just east of the township boundary outside the withdrawal.

3) Along the southern margin of the withdrawal in the rocks of zone 1, copper mineralization has been identified at three localities within the withdrawal area, and another further east along the strike of the zone. Unfortunately, the areas where these rocks are exposed through the overlying alluvium are scattered, but selection of a combination of T. 27 N., R. 10 W., the southern one-half of T. 28 N., R. 10 W., and the western one-half of T. 27 N., R. 9 W. would include a good sample of the environments associated with these rocks.

Unfortunately, with the available data, it is not possible to establish an order of priorities within the townships named above.

In order of priority, the recommendations for this withdrawal are:

1) Conduct a detailed geochemical survey of the area and evaluate the results prior to selection.

2) Conduct a reconnaissance geochemical survey as outlined above.

3) Select the townships noted. That is:

T. 33 N., R. 7, 8 W.

T. 32 N., R. 7, 8, 9 W.

T. 31 N., R. 7, 8, 9 W.

T. 30 N., R. 7 W.

T. 27 N., R. 10 W.

S 1/2, T. 28 N., R. 10 W.

W 1/2, T. 27 N., R. 9 W.

d. References Cited

Brosge', W. P. and Reiser, H. N., 1964, Geologic Map and Section of the Chandalar Quadrangle, Alaska. U. S. Geological Survey Map I-375.

______, 1971, Preliminary bedrock geologic map, Wiseman and east Survey Pass Quadrangles: U. S. Geological Survey Open-File Report #479

______, 1972, Geochemical reconnaissance in the Wiseman and Chandalar districts and adjacent region, southern Brooks Range, Alaska: U. S. Geological Survey Prof. Paper 709

F. WITHDRAWAL 5-D SELECTION AREA

1. Summary of Recommendations

a. Summary of Recommendations for Forest Products Potential

The 5-D selection area contains little potential for commercial exploitation of forest products potential and consequently this analysis was not performed.

b. Summary of Recommendations for Mineral Prospecting

To the best of our knowledge, there is no geochemical data indicating the presence of mineralization of any type within this withdrawal area. We strongly recommend that a reconnaissance survey be carried out as outlined in this report because there is currently no basis for selection of lands within this withdrawal area.

ORIGINAL PAGE IS
OF POOR QUALITY

2. Evaluation of Mineralization Potential of Withdrawal

a. Introduction

This withdrawal consists of 18 full townships and parts of five others located in a narrow strip extending from Indian Mountain to the Alatna Hills.

In the discussion of this area in U.S. Geological Survey Open-File Report #546, it is pointed out that only the area south of the Koyukuk River is considered to have potential for mineral deposits. Accordingly, the area north of the river will not be considered.

b. General Geology

The geology of the part of this withdrawal south of the Koyukuk River is similar to that of the Purcell Mountain-Zane Hills withdrawal which was covered in an earlier report. A geologic map is shown in the accompanying plate.

The surface rocks are predominately graywackes and mudstone of Cretaceous age, which in turn are underlain by a sequence of andesitic volcanic rocks with associated pyroclastic and volcaniclastic rocks, and some fossiliferous limestones. Both these units have been intruded by plutons of granodiotite and quartz monzonite which form the cores of Indian Mountain and Mt. George. Associated with these are swarms of dikes and sills (largely unmapped) which surround the plutons.

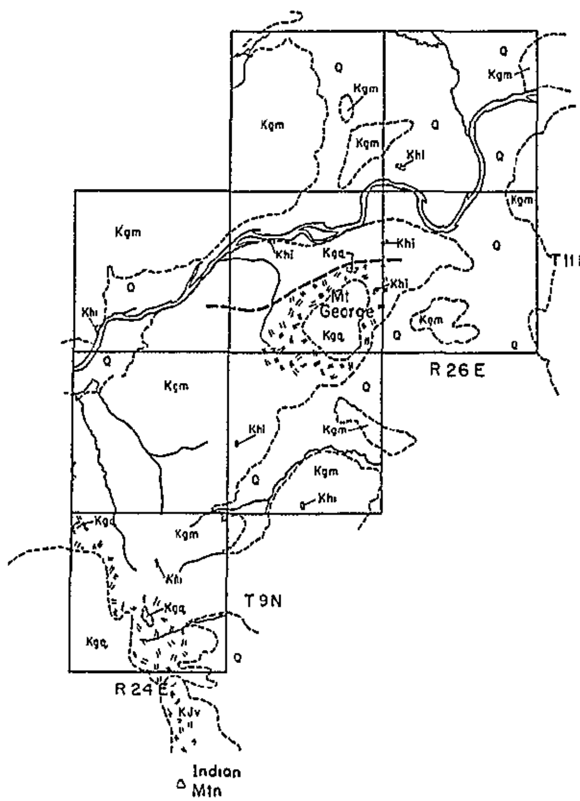
Geochemical data are available from the area south and southwest of the withdrawal but only two samples were collected from within the withdrawal (Miller, 1969, Miller & Ferrians, 1968). Both are from the Fish Creek area, just north of Indian Mountain, and neither contains any significant show of base or precious metals, nor of elements which might

ALASKA MAP E

FOR SALE BY U S GEOLOGICAL SURVEY FEDERAL CENTER DENVER COLORADO OR WASHINGTON 25 D C

ORIGINAL PAGE IS OF POOR QUALITY

Geologic Map of the Southern Part of Withdrawal 5-D



EXPLANATION

QUATERNARY — Q — *Undifferentiated glacial, eolian and alluvial deposits*

CRETACEOUS
- Kgq — Granodiorite and Quartz monzonite
- Khi — Hypabyssal intrusive rocks occur in swarms around Indian Mountain and Mt George plutons (most unmapped)
- Kgm — Graywacke and Mudstone

UPPER JURASSIC and LOWER CRETACEOUS — KJv — Andesitic volcanic rocks

Contact, approximate or inferred

Fault, approximate or inferred

Zone of thermal metamorphism

Geology from Patton and Miller, 1966

Scale 1:250 000

0 5 10 Miles

0 5 10 Kilometers

ORIGINAL PAGE IS OF POOR QUALITY

indicate the presence of these. Thus, there is no geochemical data indicating the presence of mineralization of any type within this withdrawal area.

c. Discussion and Recommendations

In the Purcell Mountain-Zane Hills area, occurrances of base and precious metals were found to be concentrated primarily along the contacts between the plutons and the adjacent country rock, with the heaviest mineralization over the tops of the plutons. In addition, there was some evidence to indicate that parts of the plutons were of interest for uranium prospecting.

Because of the similarity of rock types and relationships between the Purcell Mountain-Zane Hills area and the withdrawal under consideration, it is likely that the conclusions above apply equally well to both areas. However, there are no geochemical data to verify occurrances and it was concluded in Open-File Report #546 that such information was required before a preliminary appraisal can be given.

It is recommended that such a survey be conducted on a reconnaissance basis, emphasizing the contact zones between the igneous plutons and country rock of the Indian Mountain pluton in T. 9 N., R. 24 E., and the pluton at Mt. George centered in T. 11 N., R. 25 E. Some sampling should also be done along the fault north of Mt. George, and a few stream samples should also be collected from the terrain between the plutons which is affected by the dike and sill swarms. Sampling of stream sediments only will be adequate for most of the area, but rock samples should be collected where indications of mineralization are observed. A total of 100 to 150 samples should be adequate for evaluation purposes.

ORIGINAL PAGE IS
OF POOR QUALITY

d. References Cited

Miller, T. P., 1969, Results of stream sediment sampling in the northern Melozitna, the Hughes, and the southern Shungnak quandrangles, west-central Alaska: U. S. Geological Survey Open File report, 53 p.

______, and Ferrians, O. J. Jr., 1968, Suggested areas for prospecting in the central Koyukuk River region, Alaska: U. S. Geological Survey Circ. 510.

Patten, W. W. Jr., and Miller, T. P., 1966, Regional geologic map of the Hughes quandrangle, Alaska: U. S. Geological Survey Misc. Geol. Inv. Map I-459, scale 1:250,000.

G. WITHDRAWAL 5-H SELECTION AREA

1. Summary of Recommendations

a. Summary of Recommendations for Forest Products Potential

The 5-H withdrawal area contains marginal potential for resource recovery based on forest products. Consequently this analysis was not performed.

b. Summary of Recommendations for Mineral Prospecting

The entire area listed below is regarded to have high mineral potential. If no further reconnaissance surveys are carried out we recommend that the following sections be selected:

T15N, R17, 18, 19W

T14N, R18, 19, 20W

T13N, R19, 20W

ORIGINAL PAGE IS
OF POOR QUALITY

2. Evaluation of Mineral Potential of Withdrawal 5-II

a. Introduction

This withdrawal consists of 24 townships centered approximately 60 miles north of Tanana and south of the headwaters of the Kanuti River. The area is covered by parts of the Bettles and Tanana 1:250,000 scale quadrangle maps.

Geologic mapping of the block has been done on a scale of 1:250,000. However, only that part in the Bettles quadrangle is available (Patton and Miller, 1973a). The remainder in the Tanana Quadrangle (Chapman and Yeend, unpub.) will apparently be published when the entire quadrangle is completely mapped.

Geochemical data (primarily stream sediment samples) covering the part of the withdrawal in the Bettles Quadrangle are available (Patton and Miller, 1973b), but the sampling was not extended into the Tanana Quadrangle.

The result is that there is adequate drata for preliminary resource evaluation of the part of the withdrawal in the Bettles Quadrangle, but no data for the Tanana Quadrangle.

Based upon the distribution of rock types, the western part of the block is considered to be of low potential (U. S. Geological Survey Open-File Report #546) and is thus eliminated from further consideration.

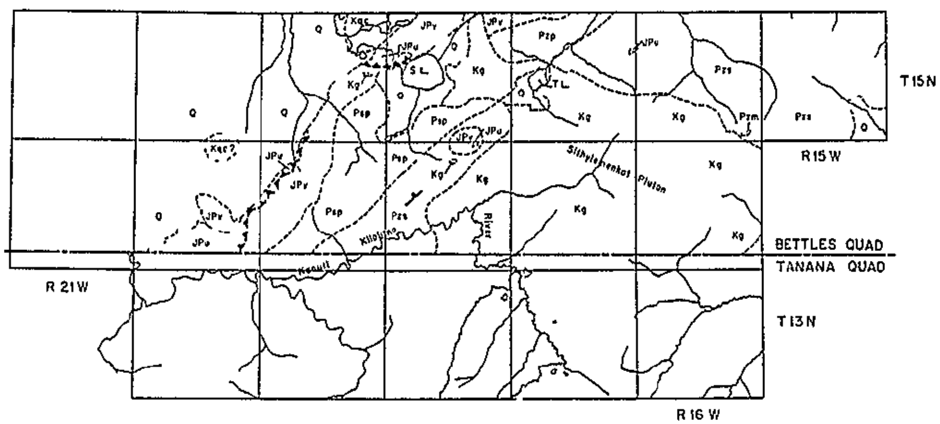
b. General Geology and Mineralization

A map of the eastern part of the withdrawal area, with the available geologic information drawn in is shown in Figure 1. Briefly, the oldest rocks in the area are a sequence of schists and phylites of probable Paleozoic age. These are overlain and partically intruded by mafic volcanic and intrusive rocks (unit JPv of Permian to Jurassic age) which are predominately pillow

FOR SALE BY U S GEOLOGICAL SURVEY FEDERAL CENTER DENVER COLORADO OR WASHINGTON 25 D C

ORIGINAL PAGE IS
OF POOR QUALITY

Base Map of the Eastern Part of Withdrawal 5-H



FYPLANATION

QUATERNARY	Q	Undifferentiated glacial, eolan and alluvial deposits
CRETACEOUS	Kgc	Quartz-Pebble Conglomerate
	Kg	granite rocks
JURASSIC (?) TRIASSIC (?) PERMIAN	JPu / JPv	Mafic volcanic and instrusive rocks (JPv), mainly pillow basalt, diabase and gabbro ultramafic rocks (JPu) - serpentinized peridotite and dunite
DEVONIAN or UPPER PALEOZOIC	Pzp	Phyllite-dark gray to black with many small, unmapped mafic intrusives
	Pzm	Marble, altered near contacts with granitic rocks
PALEOZOIC and PRECAMBRIAN(?)	Pzs	Pelitic schist altered near contact with granitic rocks, many small unmapped mafic intrusives

Contact, approximate, inferred or indefinite

Thrust fault approximate or inferred
Barbs on upper plate

S L Sithylemenkat Lake

T L Tokusatatquaten Lake

Geology from Patton and Miller, 1973a

Scale 1:250 000
0 5 10 Miles
0 5 10 Kilometers

ORIGINAL PAGE IS
OF POOR QUALITY

basalts, diabase, and gabbro, with lesser amounts of basaltic and andesitic volcanoclastic rocks, chert and cherty mudstone. Associated with these is a unit of ultramafic rocks (unit JPu) consisting of serpentinized peridotite and dunite. Finally, this entire sequence has been intruded by a large granitic pluton of Cretaceous age, which consists of quartz monzonite with lesser amounts of granodiorite and monzonite.

Geochemical data are available as sediment samples from drainages north and east of Tokasatquaten Lake, from the smaller drainages along the boundary of the upland which trends southwest from near Sithylemkat Lake, and from the headwaters of Kanuti Kilolitna River. Within these areas, the data are adequate for geochemical anomalies to be associated with the geology. Patton and Miller (1973b) identified the following anomalies:

1) Tin, beryllium and lead from streams draining the Sithylemenhat Pluton. Note that these occurrances had previously been observed by Herreid (1969).

2) Minor amounts of gold in these same areas.

3) High values of chromium and nickel from samples taken near the ultramafic intrusive rocks.

c. Discussion and Recommendations

From the geologic and geochemical data it is clear that the areas of greatest interest are those in which the ultramafic rocks are found. Most of the mapped outcrop of these rocks is on the upper plate of a northwest dipping thrust fault which has raised them over the mafic volcanic and intrusive rocks. The extent of the ultramafics down-dip under the sediments filling the adjacent basin cannot be determined. Further, two large bodies of ultramafics have been mapped

ORIGINAL PAGE IS
OF POOR QUALITY

within the adjacent metasedimentary section, and it is likely that additional mapping would show many smaller bodies scattered throughout the part of the area occupied by these rocks. Thus, the entire area must be regarded as having a high potential for the occurrance of chromium and nickel deposits. Further, part of the metasedimentary section adjacent to the granitic pluton is a likely area for the deposition of mineral deposits. However, the sample data is inconclusive in this regard, although some favorable data are available.

It is recommended that the townships listed below be selected:

T. 15 N.,	R. 17, 18, 19 W.
T. 14 N.,	R. 18, 19, 20 W.
T. 13 N.,	R. 19, 20 W.

These will provide coverage of the entire belt of ultramafic and mafic rocks available for selection, as well as the metasedimentary section including the contact zone with the pluton.

ORIGINAL PAGE IS
OF POOR QUALITY

d. References Cited

Herreid, G., 1969, Geology and geochemistry of the Sithylemenkat Lake Lake area, Bettles Quadrangle, Alaska. Alaska Division Mines and Geology Geol. Report No. 35, 22 p.

Patton, W. W. Jr., and Miller, T. P., 1973a, Bedrock geologic map of Bettles and southern part of Wiseman quadrangles, Alaska: U. S. Geological Survey Map MF-492.

______, 1973b, Analyses of stream sediment samples from the Bettles and the southern part of Wiseman quadrangles, Alaska: U. S. Geological Survey Open-file report 562.

ORIGINAL PAGE IS
OF POOR QUALITY

APPENDIX D

LIST OF PUBLICATIONS

supported in part by Grant NGL 02-001-092

Anderson, J. H. and A. E. Belon, A new vegetation map of the Western Seward Peninsula, Alaska, Based on ERTS-1 Imagery, Scientific Report on NASA Contract NAS 5-21833, Institute of Arctic Biology and Geophysical Institute, University of Alaska, 1973.

Belon, A. E. and J. M. Miller, An interdisciplinary feasibility study of the applications of ERTS-1 data to a survey of the Alaskan environment - Task 1, Report on NASA contract NAS5-21833, Geophysical Institute, University of Alaska, 1973.

Belon, A. E. and J. M. Miller, Applications of remote sensing data to the Alaskan environment, Annual Report on NASA Grant NGL 02-001-092, Geophysical Institute, University of Alaska, 1973.

Belon, A. E. and J. M. Miller, Remote sensing by satellite - application to the Alaska environment and resources, 1972-73 Annual Report, p. 127, University of Alaska, Geophysical Institute, 1973.

Miller, J. M. and A. E. Belon, Alaska and the super eye, Alaska Magazine, Vol. 39, No. 9, p. 34, September 1973.

Miller, J. M., Environmental surveys in Alaska based upon ERTS data, Summary of Results, Third Earth Resources Technology Satellite-1 Symposium, Vol. II, p. 12, NASA/GSFC Report SP-356, 1973.

Miller, J. M. and A. E. Belon, The University of Alaska ERTS program, Presented at the 24th Alaska Science Conference, "Climate of the Arctic", Fairbanks, Alaska, 1973.

Miller, John M. and Albert E. Belon, A Multidisciplinary survey for the Management of Alaskan resources utilizing ERTS imagery, Symposium on Significant Results obtained from ERTS-1, Vol. II - Summary of Results, p. 39, NASA/GSFC Report X-650-73-127, 1973.

Stringer, W. J., Remote sensing of Alaskan archaeological village sites, A preliminary report, Presented at the 24th Alaskan Science Conference, Fairbanks, Alaska, 1973.

Stringer, W. J., Shore-fast ice in vicinity of Harrison Bay, The Northern Engineer, Vol. 5, No. 4, Winter 73/74.

Belon, A. E. and J. M. Miller, Applications of ERTS data to resources surveys of Alaska, Proceedings of the Third ERTS-1 Symposium, NASA/GSFC, Vol. I (B), 1899-1907, NASA report SP-351, 1974.

Belon, A. E. and J. M. Miller, Applications of remote sensing data to the Alaskan environment, Report on NASA Grant NGL 02-001-092, Geophysical Institute, University of Alaska, 1974.

Belon, Albert E. and John M. Miller, The role of satellite remote-sensing in Alaska's future, Proceedings of the Alaska Survey and Mapping Convention, Anchorage, 1974.

Miller, J. M. and A. E. Belon, A summary of ERTS data application in Alaska, Proceedings of Ninth International Symposium on Remote Sensing of the Environment, Vol. III, University of Michigan, 2113-2138, 1974.

Stringer, W. J., Feasibility study for locating archaeological village sites by satellite remote sensing techniques. Final report, ERTS-1 project GSFC no. 110-14, October 17, 1974.

Stringer, W. J. Remote sensing activities at the Arctic Environmental Information and Data Center. Presented at the 9th Annual Alaskan Surveying and Mapping Convention, Anchorage, Alaska, February 1974.

Stringer, W. J., The morphology of Beaufort Sea shore-fast ice, Proceedings of the Symposium on Beaufort Sea Coast and Shelf Research, Arctic Institute of North America, 165-172, 1974.

Belon, A. E., J. M. Miller and W. J. Stringer, Environmental assessment of resource development in the Alaskan coastal zone based on LANDSAT imagery, Proceedings of the NASA Earth Resources Survey Symposium, Vol. II-B, 242-260, NASA report TMX-58168, 1975.

Cannon, P. J., The application of radar imagery to specific problems of interior Alaska, Proceedings of the NASA Earth Resources Survey Symposium, Vol. I-B, 761-768, NASA report TMX-58168, 1975.

Holmgren, B., Benson, C. S., and Weller, G. A study of the breakup on the arctic slope of Alaska by ground, aircraft, and satellite observations; Proceedings of the 24th Alaska Science Conference, "Climate in the Arctic", 358-366, Geophysical Institute, Fairbanks, Alaska, 1975.

LaPerriere, Alaskan resources, current development, traditional cultural values, and the role of Landsat data in current and future land-use management planning; Proceedings of the NASA Earth Resources Survey Symposium, Vol. I-C, 1603-1608, NASA report TMX-58168, 1975.

Stringer, W. J. and S. A. Barrett, Katie's Floeberg, Northern Engineer, Vol. 7, No. 1, Spring 1975.

Stringer, W. J., J. M. Miller, A. E. Belon, L. H. Shapiro and J. H. Anderson, Applications of satellite remote-sensing to land selection and management, Proceedings of the NASA Earth Resources Survey Symposium, Vol. I (C), 1785-1795, NASA report TM X-58168, 1975.