



**PROGRAMA DEL SATELITE TECNOLOGICO DE RECURSOS NATURALES**  
**SERVICIO GEOLOGICO DE BOLIVIA**

No.

TITLE OF INVESTIGATION      Earth Resources Technology Satellite  
Data Collection Project ERTS-A Bolivia

PRINCIPAL INVESTIGATOR:    Dr. Carlos E. Brockmann  
Yacimientos Petrolíferos Fiscales  
Bolivianos.  
Casilla 2729  
La Paz..

DATE:                            January 1973.

TYPE OF REPORT AND  
PERIOD COVERED                Type II Report for Period September 1972 -  
Januray 1973.

NAME AND ADDRESS OF  
NATIONAL SPONSORING  
AGENCY:                        Servicio Geológico de Bolivia  
Casilla 2729  
La Paz - Bolivia.

- - - - -



SERVICIO GEOLOGICO DE BOLIVIA  
PROGRAMA DEL SATELITE TECNOLOGICO DE RECURSOS NATURALES  
No.

- 1.- SR No. 0571
- 2.- II
- 3.-
- 4.- Earth Resources Technology Satellite  
Data Collection Project ERTS-A Bolivia
- 5.- January 18, 1973.
- 6.- September 1972  
January 1973.
- 7.- Dr. Carlos E. Brockmann
- 8.- 6
- 9.- Programa del Satélite Tecnológico  
de Recursos Naturales.
- 10.- 2
- 11.- George Ensor
- 12.- Servicio Geológico de Bolivia  
Casilla 2729  
La Paz - Bolivia.
- 13.-
- 14.- This report was prepared by the program director in collaboration  
with Engineer A. Fernández, was translated by Miss Beatriz Suárez  
and was reviewed by LTC John Furrer, Project Director, IAGS Bolivia.
- 15.- Abstract

The investigations of the last three months were not developed in their entirety due to the problems which occurred in the reproduction of images.

Nevertheless, certain phases of the program were initiated with excellent results. Notable were the results obtained in the investigations related to structural geology and vulcanism. The preliminary investigations concerning sils are interesting. No work was done in forestry due to the absence of forests on the Bolivian altiplano.



SERVICIO GEOLOGICO DE BOLIVIA  
PROGRAMA DEL SATELITE TECNOLOGICO DE RECURSOS NATURALES  
No.

P R E F A C E

The investigations of the last three months were related to work in regional geologic, tectonic and volcanic disciplines, in which tasks have already been performed using ERTS imagery interpretation. At present investigative work is beginning with relation to petroleum exploration and soil classification.

Work in the remaining disciplines will begin as soon as problems concerning the reproduction and enlargement of images received from N.A.S.A. are overcome.

It is worthwhile to point out that the work previously completed in tectonics has given excellent results in the mapping of transverse faults in the E-W direction, which were not identified in conventional aerial photographs.

These structural traces form strong alignments of regional character which reflect the basement control of quaternary cover.

Based upon the first results obtained, the ERTS I Satellite images are excellent for performing regional geologic and tectonic studies, due largely to the large area covered. Due to the same small scale, certain limitations are encountered in soil mapping.

Although the investigation is beginning to produce positive results in the areas indicated, it is desirable that N.A.S.A. provide better information to assist in the photographic processing of images, and that the images be sent more regularly, so as to allow planning of the work through the completion of the investigations.

In this report several comments are made relative to the dimensions of the diapositives, which are not as specified in the Users Manual.



SERVICIO GEOLOGICO DE BOLIVIA  
PROGRAMA DEL SATELITE TECNOLOGICO DE RECURSOS NATURALES

No. 4.-

1.0.- INTRODUCTION

On 20 November 1972, the first photographic images of the area requested in the test zone arrived for this program. The shipment consisted of 70 x 70 mm. negatives and in part in diapositives at a scale of 1:1.000.000. Later this first shipment was completed with 9.5 x 9.5 in. images. It is based upon these images that interpretation is being imitated.

2.0.- PROBLEMS ENCOUNTERED IN CARRYING OUT THE INVESTIGATION.

The fundamental problem which has developed in the progress of the program is that of enlarging the 70 x 70 mm. images to the 9.5 x 9.5 in. format (1:1.000.000 scale). To solve this problem tests were performed using different types of paper, exposure time, and development procedures. Perfectly reproduced images have not been obtained, as a result of which program progress is behind schedule.

3.0.- WORK COMPLETED

3.1.- CARTOGRAPHY

Since at present no RBV images have been received no cartographic work has been completed. Nevertheless, investigations will begin soon in this specialty, using MSS imagery. Negative results may be obtained due to differences in dimensions of the images received (1065-14091-4-5-6-7, 1065-14094-4-5-6-7, 1065-4-5-6-7, 1010-14033-4-5-6-7, 1010-14035-4-5-6-7, 1010-14035-4-5-6-7 and 1010-14042-4-5-6-7.), as compared to those specified in figure 3-6, SISTEM CORRECT PRODUCT DIMENSIONS - DATA USERS HANDBOOK (SEE CHART No. 1)

3.2.- GEOLOGY

C H A R T    N o . 1

SYSTEM CORRECTED PRODUCT DIMENSION			IMAGES RECEIVED			
Dimension Code	D E S C R I P T I O N	Enlarged 9.5 Inch (MSS)	D E S C R I P T I O N	Enlarged 9.5 Inch (MSS)	+	-
A	Film Width	240	Film Width	240		
B	Nominal Image Size (Cross Track)	185.3	Nominal Image Size (Cross Track)	185		
C	Nominal Image Size (In Track)	178.5	Nominal Image Size (In Track)	182		
D	Wrating Area (Cross Track)	202.2	Wrating Area (Cross Track)	209		
E	Wrating Area (In Track)	190.4	Wrating Area (In Track)	190		
F	Annotation Block Length	175.3	Annotation Block Length	173		2.3
G	Registration Mark Separation (Cross Track)	197.5	Registration Mark (CT)	198.5	001.0	
H	Registration Mark Separation (In Track)	200.5	Registration Mark Sep (IT)	204.5	004.0	

-5-

-----



SERVICIO GEOLOGICO DE BOLIVIA  
PROGRAMA DEL SATELITE TECNOLOGICO DE RECURSOS NATURALES  
No. 5.-

3.2.1.- REGIONAL GEOLOGY

In this initial phase, ERTS images are being interpreted for the purpose of evaluating the information extracted from the various bands.

The work will be submitted when completed.

3.2.2.- TECTONICS

The first interpretations from the tectonic point of view have been carried out, and the principal faults and alignments observed in images 1010-14033-4-5-6-7 have been mapped and verified on the ground. The report on the results of this study was forwarded to N.A.S.A.

3.2.3.- STUDIES IN THE MINERAL ZONES OF BOLIVIA

Because of the difficulties noted in para 2.0 no investigation in this area has been completed to date.

3.2.4.- ALUVIAL MINERAL DEPOSITS

The same problem was encountered as described in the preceding paragraph.

3.2.5.- PETROLEUM EXPLORATION

Investigations in this specialty were recently initiated, and results are anticipated in the next few days.

3.2.6.- VOLCANO SURVEYS

Work concerning vulcanism has been performed, and a report has been forwarded to N.A.S.A.

3.2.7.- LITHOLOGIC MAPS

No work has been performed because of the same problem described in para 2.0.

3.3.0.- AGRONOMY



## SERVICIO GEOLOGICO DE BOLIVIA

### PROGRAMA DEL SATELITE TECNOLOGICO DE RECURSOS NATURALES

NO. 6.-

#### 3.3.1.- SOIL CLASSIFICATION AND MAPPING

Work began in the mapping of large groups of soils and the study is under development.

#### 3.3.2.- LAND CLASSIFICATION

Work in this area will begin upon completion of the studies in para 3.3.1.

#### 3.3.3.- SALINE SOILS AND DRAINAGE SURVEY.

This work will also begin upon completion of the studies in para 3.3.1.

#### 3.3.4.- SOIL EROSION MAPS

This investigation also depends upon completion of the studies in para 3.3.1.

#### 3.3.5.- TIMBER SURVEY AND CLASSIFICATION

Studies corresponding to the subject will begin once images of forested areas are received. Present images cover the Bolivian altiplano which is totally devoid of forests.

#### 3.3.6.- ECOLOGICAL MAP

This work is in its initial stages.

#### 3.4.0.- HYDROLOGY

##### 3.4.1.- GEOMORPHOLOGY OF DRAINAGE BASINS.

Investigation in this sector will begin once the problems - described in para 2.0 are overcome.

##### 3.4.2.- DETERMINATION OF HYDROLOGY BASINS AND SUB-BASINS

The situation is as described for 3.4.1.

##### 3.4.3.- MAP OF THE DRAINAGE PATTERN

Preliminary work has begun in this area



## SERVICIO GEOLOGICO DE BOLIVIA

### PROGRAMA DEL SATELITE TECNOLOGICO DE RECURSOS NATURALES No. 7.-

#### 3.4.4.- MAP OF ZONES OF HYDROGRAPHIC POTENTIAL

Studies have not been performed due to difficulties described in para 2.0.

#### 3.4.5.- GLACIER MAP

Investigations with respect to the mapping of glaciers show considerable promise based upon the preliminary investigations. Nevertheless, it is necessary to have well processed images, since in the eastern sector of the cordillera of the Andes are sulphur areas with very high reflectivity, very similar to that of snow.

#### 3.4.6.- FLOOD ASSESSMENT MAPPING

No related phenomenon has been examined.

#### 4.0.0.- SUMMARY OF WORK PROGRAMMED

It is estimated that the problems which developed in the enlargement of the images will be resolved within the next few days, since the information provided in the "ERTS INVESTIGATORS BULLETIN No. 13", gives instruction on the type of paper, development time, etc., which, according to the latest tests provide satisfactory results. Therefore, it is felt that the various working groups can begin their investigations in the course of the next few days, which will also permit the preparation of a new program of data analysis. This will be sent as soon as possible so as to comply with the agreement reached with N.A.S.A.

jdp.