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Experiment to evaluate feasibility of utilizing SKYLAB-EREP remote sensing data for tectonic analysis of the Bighorn Mountains region, Wyoming-Montana

Quarterly Progress Report, July 1 - September 30, 1974

EREP #203393

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STATUS SUMMARY

Imagery received during period

a. S-190A, 70 mm. transparencies, SL-4
   1) Pass #85; Billings, Montana to South-central S. Dakota frames #140-151
   2) Pass #88; Beartooth Mountains, Montana to Pine Ridge, S. Dakota frames 239-252
   Note: Heavy bluish tint to S-190A color IR
b. S-190B, 4 1/2" x 4 1/2" transparencies, SL-4
   1) Pass #85 (color); frames 92-158 to 92-173
   2) Pass #88 (color IR); frames 93-120 to 93-137
c. S-192, 55-1 interim final product from SL-2, Pass #10 (over Bighorn Mtns.), channels #1-14 and 17-22.

Coverage Conditions

a. Pass #85: Heavy cloud cover over Billings, Montana, clearing to southeast. Clear to partly cloudy over northern Black Hills.
b. Pass #88: Heavy cloud cover over Beartooth Mountains, Bighorn Basin and Mountains. Clear to partly cloudy over Powder River Basin and southern Black Hills. Uniform, heavy snow cover in Powder River Basin, Black Hills and Bighorns. A summary of all data received to date from all missions is enclosed.

ACCOMPLISHMENTS FOR PERIOD

SL-4 Evaluation

Only a preliminary evaluation may be made of the SL-4 data, for the 9" x 9" enlargements have not yet been received. Due to the eastward drift of the ground track, Pass #85 covered only the northern Black Hills in the extreme northeastern portion of the study area. Pass #88 had drifted to where it passed directly over the Bighorn Mountains, but due to heavy cloud cover, was of minimal value in this area. Of significance on the S1-4 imagery is the heavy snow cover in the Powder River basin on Pass #88. It greatly enhances the low relief topography of the basin and emphasizes distinctive drainage patterns, which may be related to geologic structures. It compares favorably with and shows more detail in the southern Black Hills than on the smaller scale (particularly the S-190B) than a similar ERST-1 frame from December 1972. However, the deeper snow and higher sun angle of the SL-4 pass does not reveal as much topography south of the Black Hills as does the ERTS-1 winter scene.

Field work - Lehman

This past summer, several frames of imagery from SL-2, Pass #10 were evaluated by Research Assistant Lehman in the field investigation of Shell Canyon in the Bighorn Mountains. It was found that the scale, detail and variety of the Skylab imagery available was complementary to the lower altitude, conventional aerial photography used in the field mapping effort. The excellent stereo overlap, not available on ERTS imagery, made identification of regional geologic features much easier and more reliable. For example, several monoclinal features at the

ACCOMPLISHMENTS (cont.)

mouth of Shell Canyon, not readily identifiable on other small scale imagery, are easily defined and their relative relief seen when viewed stereoscopically on the Skylab imagery. The negative transparencies were found to be of greater value than the positives in viewing areas of higher elevations and more dense vegetation. These areas, usually dark shades of grey on the positive images, show up as light shades on the negatives, where textural and tonal contrasts are much more apparent.

SL-2/SL-3; S-192

Continued evaluation and geologic interpretations have been made from SL-2 and SL-3 imagery. The 9" x 9" format has been found to be particularly versatile for both field investigations and office work.

S-192, radiometrically corrected imagery has been requested over selected portions of the project area. It is hoped that this product will add to our interpretive efforts, especially in the longer wavelength region. Receipt of the S-192, Interim Final Product for Pass #10, gave us a sample of all channels available and their comparable quality.

ACTIVITIES PLANNED FOR NEXT QUARTER

Further correlation of the past summer's field checking, particularly in the Black Hills area is to be continued. Five students are participating in a small project utilizing frames 206, 207, and 208, pass #39, SL-3. These frames include the Owl Creek Mountains in which a considerable amount of structure and lithologic variety is visible. They are making geologic overlays of the S190A 9 x 9 color and color IR images. When completed their overlays (and interpretations) will be compared with ours to see to what degree we all agree. In addition they have available for comparison and help conventional high altitude black and white photography, and RB57 track (color IR) over part of the area (somewhat haze covered) and a low altitude color IR track obtained through the ERTS-1 project. The PI visited the area in June and took some ground photos of several of the structures.

SKYLAB-2 Imagery Inventory

I. S-190A Multispectral Camera
   A. Pass #6; Billings, Mont. to the Badlands, S. Dakota
      1. 70 mm black & white Positives; frames #104-118
         (no 70 mm color or color IR)
      2. 9" x 9" Positives and Negatives (black and white only)
         a) frames #104-118 (black & white)
         b) frames #112-126 (color/color IR)
      3. Cloud cover minimal
      4. Stereo overlap; 60%

   B. Pass #10; Beartooth Mountains, Mont. to NW Nebraska
      1. 70 mm black and white Positives; frames #203-222
         (no 70 mm color or color IR)
      2. 70 mm Negatives (produced from positives); frames #210-214
      3. 9" x 9" Positives and Negatives (black and white only)
         a) frames #203-222 (black and white)
         b) frames #220-239 (color/color IR)
      4. Cloud cover >50%: frames #203, 218; >80% frames #219-222
      5. Stereo overlap; 60%

II. S-190B Earth Terrain Camera
   A. Pass #6 (color)
      1. Frames #81-146 thru 81-164
         4 1/2" x 4 1/2" and 9" x 9" transparencies)
      2. Cloud cover minimal
      3. Stereo overlap; 60%

   B. Pass #10 (Black and White)
      1. Frames 82-136 thru 82-158 (4 1/2" x 4 1/2" and 9" x 9" and
         transparencies)
      2. Negatives
         a) 9" x 9"; all frames
         b) 4 1/2" x 4 1/2"; frames 82-143 thru 82-148
      3. Cloud cover >50%; frames 141, 142, 154; >80%; frames 155-158
      4. Stereo overlap; 60%

III. S-192 Multispectral Scanner
   A. Passes #6 and 10
   B. Channels #2, 7, 11
   C. Pass #10; 55-1 Interim Final Product; Channels #1-14 and 17-22

SKYLAB-3 Imagery Inventory

I. S-190A Multispectral Camera
   A. Pass #37; S. Idaho to Yellowstone Lake
      1. 70 mm Positives; frames #150-153
      2. 9" x 9" Positives and Negatives; frams #149-153
      3. Cloud cover >40%; frames #152, 153
      4. Stereo overlap; 15%

   B. Pass #39; Great Salt Lake to Black Hills
      1. 70 mm Positives; frames #203-215
      2. 9" x 9" Positives and Negatives; frames #203-215
      3. Cloud cover >40%; frames #206, 208-210, 213-215
      4. Stereo overlap; 60%

II. S-190B Earth Terrain Camera
   A. Pass #37 (Color)
      1. Frames 86-332 thru 86-341 (4 1/2" x 4 1/2" only)
      2. Cloud cover >25%; frames #334, 335
      3. Stereo overlap; 10%
      4. Frames 332, 333 dark (underexposed?)
      5. Film advance reversed

   B. Pass #39 (Color)
      1. Frames 88-014 thru 88-023 (4 1/2" x 4 1/2" only)
      2. Cloud cover >50%; frames #017, 019, 022, 023
      3. Stereo overlap - 10%
      4. Film advance reversed

III. S-192 Multispectral Scanner
   A. Pass #39

   B. Channels #2, 7, 11

SKYLAB-4 Imagery Inventory

I. S-190A Multispectral Camera
   A. Pass #85; S. Montana to Black Hills
      1. 70 mm Positives; frames #140-151
      2. Cloud cover >50%; frames #140-144
      3. Stereo overlap; 60%

   B. Pass #88; Beartooth Mtns. to Powder River Basin
      1. 70 mm Positives; frames #239-252
      2. Cloud cover >50%; frames 239-246
      3. Heavy snow cover
      4. Stereo overlap; 60%

II. S-190B Earth Terrain Camera
   A. Pass #85 (Color)
      1. Frames #92-158 thru 92-173 (4 1/2" x 4 1/2" only)
      2. Cloud cover >50%; frames 92-158 thru 92-162
      3. Stereo overlap; 60%
      4. Bluish tint to imagery
      5. Film advance reversed

   B. Pass #88 (Color IR)
      1. Frames 93-120 thru 93-137 (4 1/2" x 4 1/2" only)
      2. Cloud cover >50%; frames 93-120 thru 93-130
      3. Heavy snow cover
      4. Stereo overlap; 60%
      5. Greenish tint to imagery
      6. Film advance reversed

III. S-192 Multispectral Scanner
   A. Passes #85, 88 and 92
   B. Channels #2, 7, and 11