N86-11642

A COMPARISON OF AIS DATA WITH OTHER AIRCRAFT AND GROUND DATA FOR THE GEOBOTANICAL DISCRIMINATION OF ROCK TYPES IN SOUTHWEST OREGON

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ABSTRACT

The use of remote sensing techniques for the geobotanical discrimination of rock types is predicated upon a number of factors. These include an understanding of vegetation response to environmental (especially geochemical) conditions, the establishment of correlations between those vegetation factors and environmental factors, and the use of appropriate remote sensing techniques to discriminate the vegetation.

INTRODUCTION

It has been previously reported (Mouat, 1982) that vegetation can be grouped into three basic categories: 1) Structural, which includes density, plant morphology and structure, phenology, and chlorosis; 2) Taxonomic, which includes indicator species as well as vegetation composition and its distribution; and 3) Spectral, which includes the manner in which vegetation interacts with electromagnetic energy and is usually a function of the other two factors.

This research has been directed toward an understanding of the utility of various sensing systems for discriminating rock types in the Josephine Ophiolite of southwest Oregon (Figure 1). Previous research has involved extensive use of Landsat MSS data for separating

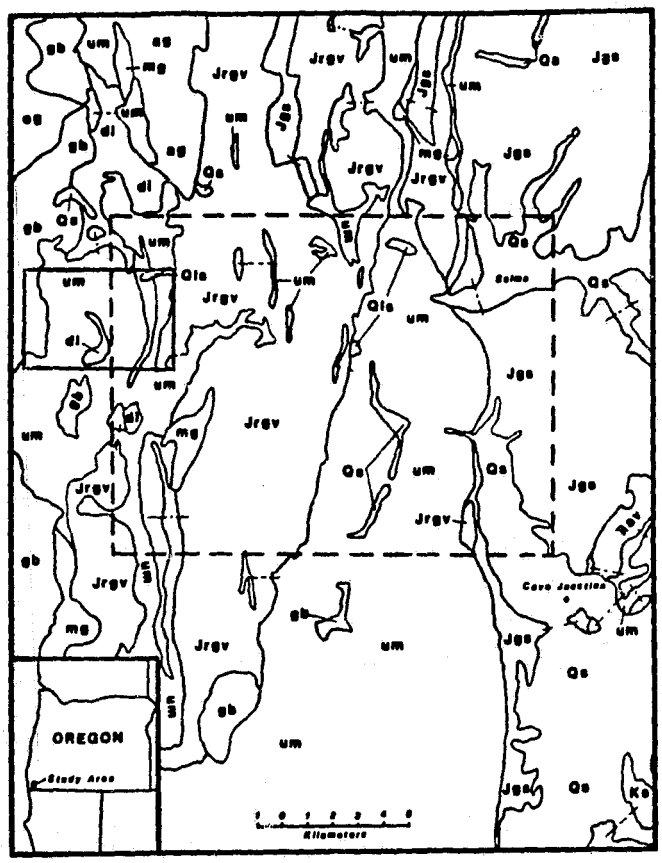

Figure 1. Location and general geology of the Study Area. Area of the AIS flightlines is in solid line. Area studied by Mouat et al. (1982) and Morrissey et al. (1984) in dashed line.

LEGEND

Qs	Quaternary sediments	ag	Gneissic amphibolite
Qls	Landslide deposits	di	Quartz diorite
Ks	Marine sedimentary rock	gb	Gabbro
Jgs	Metasedimentary rock	mg	Metagabbro
Jrgv	Metavolcanic rock	og	Olivine gabbro
Jav	Metasedimentary rock	um	Ultramafics

(Morrissey et al., 1984)

unserpentinized peridotite ("harzburgite"), serpentinized peridotite, and sheeted dikes (Harding and Bird, 1984). Vegetation was an important component of that study. Mouat et al. (1982) and Morrissey et al. (1984) reported on the use of simulated thematic mapper imagery for separating general rock types on the basis of associated vegetation. More recently, this author, Nancy Milton, and Mel Podwysocki (both of the U.S.G.S.) have been undertaking ground-based spectroradiometric work and comparing that data with Airborne Imaging Spectrometer (AIS) data.

METHODS AND RESULTS

Five AIS flight lines were flown on July 27, 1984 in a portion of the Josephine Ophiolite (figure 2.). The grating position was in the rock mode between approximately 1150nm and 2350nm. The pixel size was somewhat less than 10 meters; thus, the flight line widths were approximately 300m. Although strong winds and rugged terrain with few discernable landmarks resulted in some crabbing and line displacement, it was felt that most important lithologic and vegetation targets were adequately imaged. These included a variety of rock types within the ophiolitic assemblage and their associated vegetation types. Exceptions included an area of relatively level, unvegetated dunite (a nearly pure olivine as contrasted to harzburgite), and a densely (100% crown closure) vegetated gabbroic intrusive. Ground-based spectroradiometric measurements (with the U.S.G.S. GERS II instrument) were acquired on July 27 and 28. Forty-three of these measurements were obtained.

The AIS imagery was analyzed with the IBM PC-XT image processing system developed at the Stanford Remote Sensing Laboratory. Algorithms useful for AIS image processing as of April 1, 1985 included destriping,

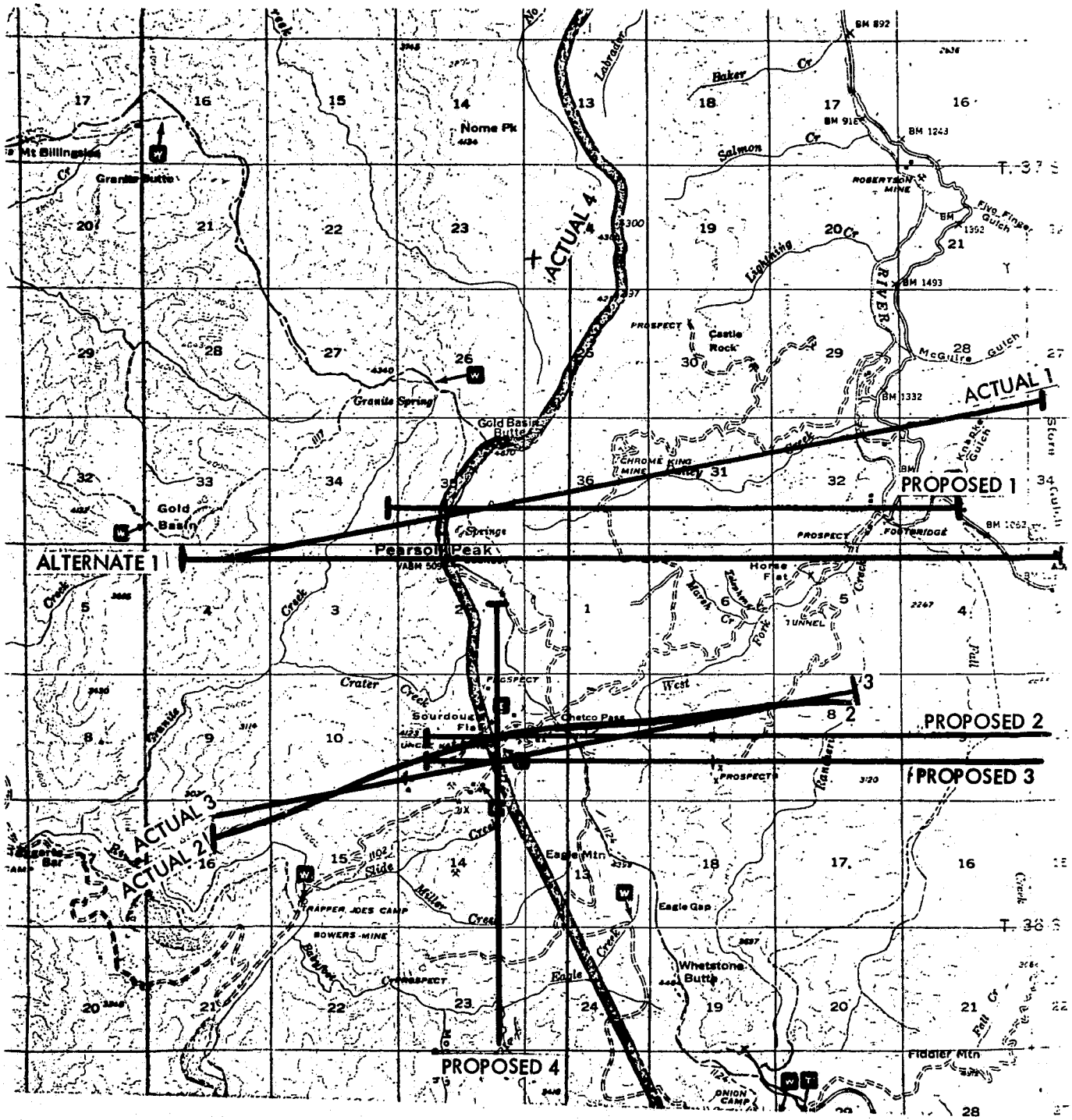

Figure 2. Proposed and alternate AIS flight lines within the southwest Oregon Study Area.

a log residual correction, a multi-channel display, and two spectral representations: graphic and color bar. While the log residual corrections appear to have had some problems (and are being reworked), the others worked satisfactorily. Our spectral representations have successfully spectrally discriminated bare serpentinized harzburgite and nickel laterite, as well as the vegetation growing on those parent materials and also on metavolcanics.

ON-GOING PLANS

Continuing work by the investigators involves characterizing vegetation composition and density within the study area, differentiating lithologies on the basis of direct discrimination and through geobotanic inference and applying additional algorithms developed at Stanford and elsewhere to maximize the use of the AIS. It is also hoped that the ground-based spectroradiometric measurements will help us relate the AIS data to reflectance. The NS001 data acquired at the time of overflight and an August 1984 TM scene will be correlated with the AIS data.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the essential input of Nancy Milton and Mel Podwysocki to this investigation. In addition, Ron Lyon and Kai Lanz provided invaluable support and assistance with the image processing. Finally, Bob Frenkel and Chris Kiilsgaard of Oregon State University provided earlier detailed ground characterization of the vegetation within the study area.

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