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PHOTOGEOLOGIC COLOR ANALYSIS AN EFFECTIVE SUPPLEMENT TO MINERAL EXPLORATION

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INTRODUCTION

The early-day prospector and today's mineral exploration geologist have always utilized fault intersections and color "shows" as basic exploration guides in the search for ore deposits. In recent years the application of photogeologic structural interpretation techniques utilizing conventional black and white aerial photography has become a widely accepted mapping procedure which has greatly expanded the scope of regional mineral exploration. However, the difficulty in economically producing quality color aerial photography on a quantity basis has, up to now, restricted the aerial camera from effectively recording tell-tale color "shows" simultaneously with structural intelligence.

The recent development of the versatile Aero-Neg color system, technically known as Kodak's special Ektachrome MS Aerographic film type SO-151, has proven to be a solution to this problem. The availability of this unique system and its proper application has given a much broader dimension and range to the aerial camera as a tool in the detection and assessment of potential mineral prospects. The mineral exploration photogeologist, employing Aero-Neg color photography, can now reliably observe and record anomalous color produced by various alteration effects, an ability denied him by black and white photography. Furthermore, he now has the added advantage of viewing a more natural, and sharper rendition of the terrain being studied; thus, significantly expanding his interpretative capabilities.

The two 1:12,000 scale photographs displayed here are produced from the same negative. Although the black and white rendition on the right bears the geologic annotations, the actual photogeologic interpretation was performed stereoscopically on color Aero-Neg photographs and the information then transferred in order to permit a more unobstructed view of the color image.

GEOLOGY

The area covered by the aerial photographs is a portion of the Grizzly Peak Stock, a late Tertiary quartz monzonite intruded into older Tertiary sediments and volcanics, about five miles south of Ophir, Colorado, in the San Juan Mountains. The area photographed is entirely above timber line and bears the scars of recent alpine glaciation. Relief differential is approximately 2,000' with Grizzly Peak attaining an elevation of 13,752'.

The Grizzly Peak intrusive itself displays little color. The quartz monzonite on outcrop is gray to pinkish-gray, while the country rock, the middle to late Tertiary San Juan formation manifests brilliant variations of yellow, purple, green and red coloration through alteration zones. The San Juan formation is principally tuffaceous sandstone; in part conglomeritic, tuff breccia and quartz latite, and in this area is about 750' thick. Upper portions of the *underlying Telluride conglomerate have limited exposure within the mapped area.. The Telluride conglomerate is red to light gray arkosic conglomerate and sandstone and where better exposed, is often a massive cliff former.

The high angle intrusive contact is sharply defined and the lack of dynamic folding or arching of the San Juan formation in proximity to the contact suggests either that the intrusive was of an insipid nature, stoping and consuming the country rock as it moved or that the so-called intrusive contact is in reality a true fault contact.

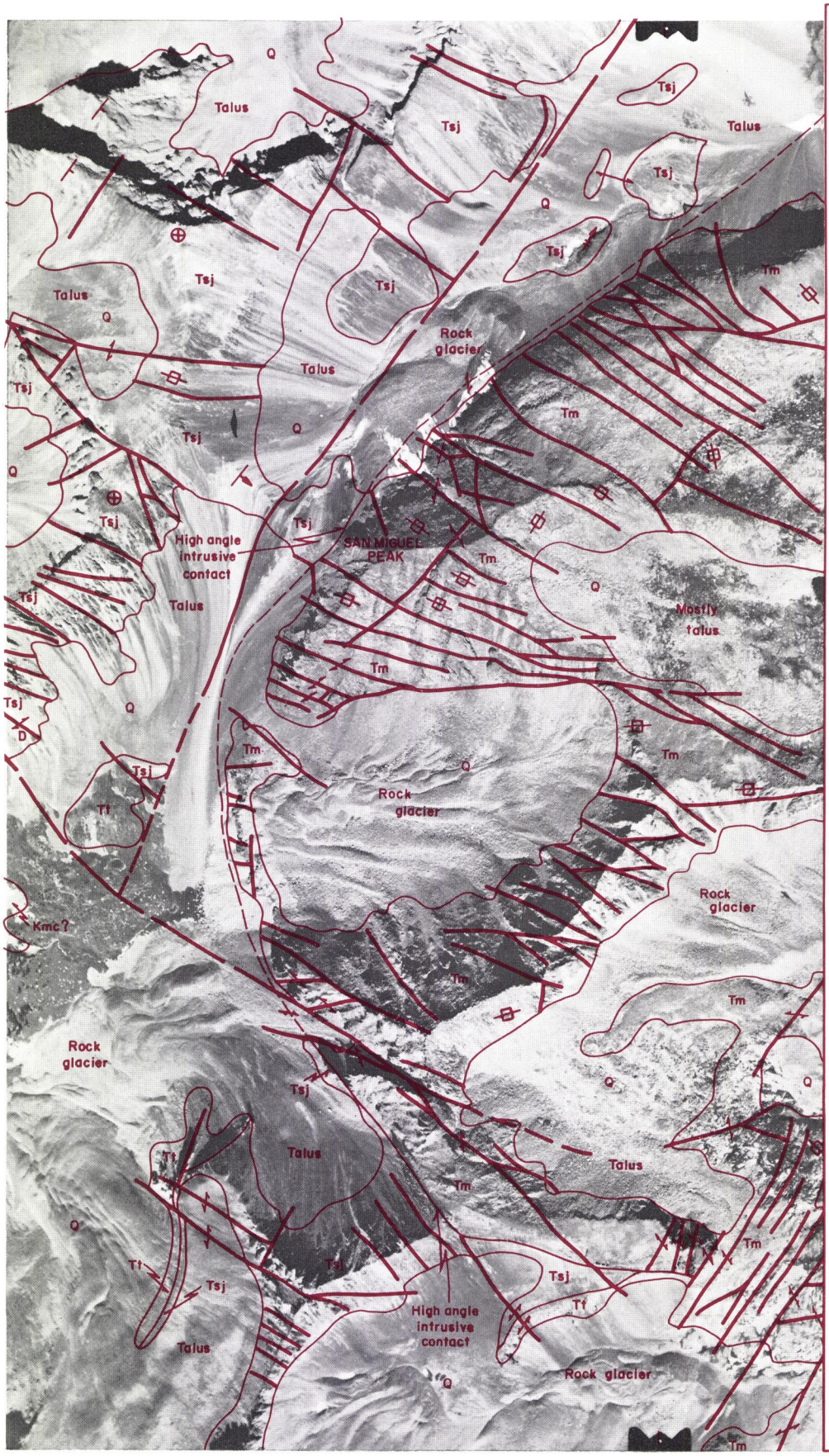
The depicted color anomaly analysis merely delineates other than normal formational or rock type color expression without classification as to color, color intensity, origin or significance. The anomalous coloration thus detected and outlined may then be subsequently studied on the ground as to mode of origin, chemistry and possible relationship to subsurface ore deposits. The following chart from Bateman's "Economic Mineral Deposits" lists some diagnostic cropping colors of certain metals.

MINERAL OR METAL	CROPPING COLORS	OXIDIZED COMPOUNDS
Iron sulphides	Yellows, browns, maroons, reds	Goethite, hematite, limonite, sulphates
Manganese	Black	Manganese oxides, wad
Copper	Green, blues	Carbonates, silicates, sulphates, oxides, native
Cobalt	Black, brilliant pink	Oxides, "bloom" (erythrite)
Nickel	Greens	Nickel "bloom" (annabergite), granierite
Molybdenite	Bright Yellows	Wulfenite, molybdite
Silver	Waxy greenish	Chlorides, etc., native
Arsenic	Orange, yellows	Oxides
Bismuth	Yellow	Bismite
Cadmium (in zinc)	Light yellow	Cadmium oxide

Much of the yellow, purple and red color displayed in the tuffaceous sandstones of the San Juan formation results generally from the decomposition of introduced impregnated pyrite to iron oxide. Evidence of bleaching and what appears to be localized sericitization are also observable on the color photograph.

Note that the analysis excludes from consideration talus and other mantle debris and delineates only bedrock coloration.


ANOMALOUS COLOR DELINEATION



AREAL GEOLOGIC AND STRUCTURAL INTERPRETATION of a portion of the GRIZZLY PEAK STOCK

LEGEND

QUATERNARY	Q	Surficial mantle cover
TERTIARY	Tm	Grizzly Peak quartz monzonite intrusive stock
	Tsj	San Juan formation
	Tt	Telluride conglomerate
CRETACEOUS	Kmc	Mancos shale

GEOLOGIC SYMBOLS

- Horizontal bed
- Dip component 3°- 10°
- Structural attitude 0° - 3°
- Structural attitude magnitude of dip cannot be determined
- Fracture set orientation
- Contact
- Fault and/or fracture
- Inferred fault

SCALE

1 inch = 1000 feet

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