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DIFFERENTIATION OF SERPENTINITIC FROM NON-SERPENTINITIC ULTRAMAFIC ROCKS IN ERTS-I MSS IMAGERY

by
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The 1968 state geologic map of Maryland and all county maps covering the Maryland Piedmont lump all ultramafic rocks into a single unit, commonly designated serpentine, serpentinite, or ultramafic rocks. Recent field work in Baltimore County has shown that it is often possible to further differentiate this single unit into two units, namely serpentinite, and non-serpentinitic ultramafic rock. In the following discussion to avoid tedious repetition of such awkward terms, these will be shortened to "serp" and "non-serp" respectively.

The two principal serp masses in Baltimore County, Bare Hills, and Soldiers Delight, show up in ERTS-1 MSS imagery (color composite) as purplish splotches. The ultramafic rocks at Bare Hills are almost exclusively serp, but at Soldiers Delight the serp is partially surrounded by an envelope of non-serp and has a southeasterly extending tail some 15 miles long consisting only of non-serp. Purplish areas in ERTS-1 MSS imagery define only serp. Non-serp prints out red and cannot be distinguished from adjacent non-ultramafic rocks. The reason for this distinction between serp and non-serp lies in the observation that non-serp supports a vigorous hardwood flora whereas serp generally supports only stunted Virginia Pine interspersed with dense stands of greenbriar and bare patches of rocky ground.

The differentiation of serp from non-serp has a number of important applications. These are discussed under the four headings listed below:

Scientific

Non-serp is almost certainly the result of reaction between serp and clastic sediments during regional metamorphism. The relative volumes and areal distribution of serp and non-serp in the Piedmont give some measure of the movement of volatiles and mobile components during metamorphism.

Economic

The texture and mineralogy of serp make it an ideal material for use as crushed stone. Non-serp can be quarried locally for crushed stone, but it is so commonly chloritic as to be unsuitable for this purpose.

The numerous chromite operations that once flourished in the Maryland Piedmont were confined exclusively to serp. No important chromite deposits have ever been discovered in non-serp.

Agricultural land-use

The low concentration of plant nutrients and the high concentration of such toxic elements as nickel and chromium in serp, plus the extremely thin soil cover over serp make it a very poor choice for either cultivation or grazing. Non-serp is possessed of these qualities to a considerably lesser degree, and can generally be farmed, though probably not as successfully as non-ultramafic rock.

Non-agricultural land-use

The extremely thin soil cover over serp renders it generally unfit for extensive development. Well yields are commonly low, septic systems poorly operable, and construction requiring anything but very shallow excavation, very expensive due to the necessity of blasting. Non-serp does not pose as serious a problem in this regard, but is generally less ideal than non-ultramafic rocks.

Inspection of NASA high altitude, underflight, infrared imagery of the eastern Maryland Piedmont reveals that bedrock lithology and structure are enhanced only to the extent that land use is geologically dictated. For example, the Setters Formation, a thin, steeply dipping, highly quartzose unit, invariably underlies steep, narrow ridges covered by a thin stony soil. Such ridges are suitable neither for agriculture or grazing, nor for commercial or residential development; they are everywhere heavily forested and thus easily recognizable in infrared imagery. The Cockeysville Marble, a carbonate unit, underlies broad, fertile valleys that have been intensively developed and almost entirely deforested. The contact between the Setters and Cockeysville is thus marked by an extreme contrast in land use. This contrast is sharply defined in infrared imagery, and can be used to map the Setters-Cockeysville contact. The land use contrast between the Cockeysville and the Wissahickon Formation, a pelitic schist unit, though locally marked, is not generally as great, and is, therefore, a less faithful guide to the contact.

Several faults are known in the Baltimore area, but none show up in infrared imagery except the Texas fault. A Subdued west flanking escarpment follows the trace of the Texas fault and this feature in turn apparently influences land use sufficiently to define the fault trace.

WC:bp
Typed: 6/27/73
MMC 401
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