Appalachian Folds, Lateral Ramps, and Basement Faults: A Modern Engineering Problem?

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Field studies and analysis of radar data have shown that cross-strike faulting in the central and southern Appalachians has affected geologic structures at the surface. These basement faults appear to have been active through much of geologic time. Indeed, more than 45 percent of modern earthquakes occur along these narrow zones here termed "lateral ramps." Because of this seismic activity, these lateral ramps are likely to be zones that are prone to slope failure. The engineer should be aware of the presence of such zones and the higher landslide potential along them.

Field studies combined with analysis of recently acquired side-looking airborne radar (SLAR) data and proprietary seismic reflection profiles for the central and southern Appalachians have shown that cross-strike basement faulting affects geologic structures at the surface. The effects are (a) abrupt changes in fold wavelength and fold plunge along strike in the Valley and Ridge Province; (b) conspicuous discontinuities in the Blue Ridge Province; and (c) the presence of long, straight river segments in the Piedmont and Coastal Plain Provinces.

The basement faults have been active throughout much of geologic time. This interpretation is substantiated by subsurface data that show active growth faulting from Precambrian through at least Ordovician times. Further evidence consists of coincident Precambrian highs and east-west border faults that cross the Mesozoic basins. Continued activity is supported by the observation that between 35 and 50 percent of historic seismicity is directly coincident with these cross-strike basement faults and their associated lateral ramps. These lateral ramps are zones in which different stratigraphic levels are connected by ramp faults that rise or fall along the strike of the Appalachian mountain chain.

More intense Alleghenian folding and faulting and continued post-Alleghenian fault movements associated with the lateral ramps have made these localities areas of slope instabilities and therefore prone to slope failure. Mapping by Arthur P. Schultz *(1)* and recently by C. Scott Southworth and Schultz *(2, 3)* has shown that large (several square kilometers) blocks have broken away from the ridgetops and slid downslope by either catastrophic landslide or slower creep. Most of these displaced blocks and landslides occur in an area geographically close to the location of lateral ramps mapped in the field or observed on radar data (Figure 1).

As recently as the spring of 1985, a landslide buried part of Highway 250 in central Virginia along the Highland County lateral ramp, and occurrences of this type should be expected in the future.

It behooves the engineer to be aware of such zones of potential slope instability and active seismicity in the planning of major structures such as highways and dams. Efforts should be made to avoid these areas if possible or to plan structures to accommodate the possibility of slope failure or seismic activity.

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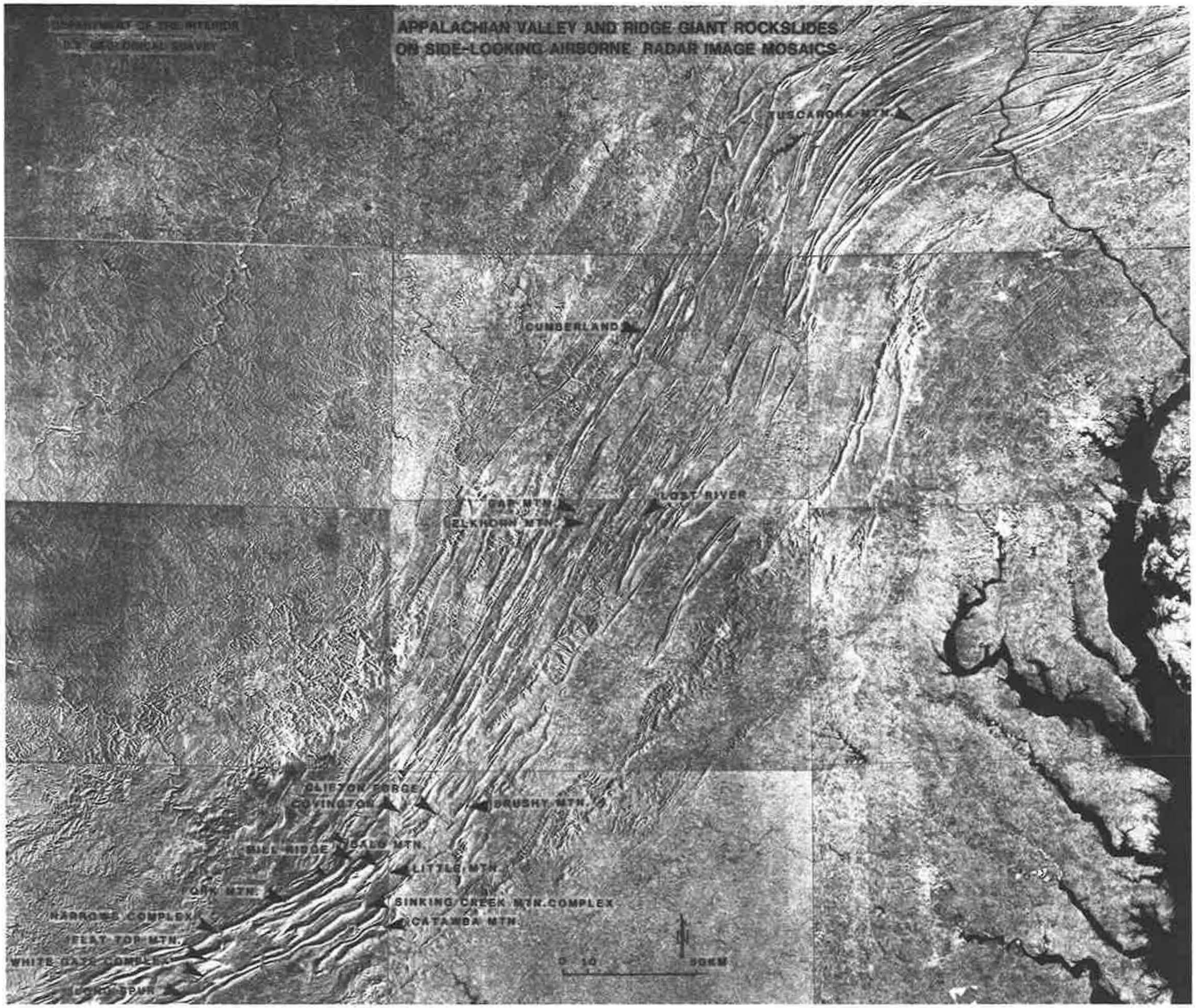

FIGURE 1 Radar image of part of the central and southern Appalachian Valley and Ridge Province showing areas of giant rockslides from Southworth and Schultz *(3)*.