CONSIDERATIONS CONCERNING FUTURE SATELLITE EXPERIMENTS

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Considering future satellite systems, I believe there are three general areas of importance that will produce significant results. These three areas are (1) refinement of spectral data in the .4 to 2.5 um region, (2) systematic research in spatial resolution, and (3) better data for geologic structural studies. My bias in selection of these three areas is my primary interest in the application of remote sensing to mineral exploration. These three areas are clearly interrelated; therefore research in one will contribute to the other two.

The area of better data for structural studies is probably the simplest area of the three. Two types of data would clearly contribute in a major way to this problem, radar and stereoscopic data. The radar data should be available in digital format, but this is probably not critical for the stereoscopic data, which could be photographic. It is not clear to me that radar has any great advantage over steroscopic images or photographs in the visible and near infrared except in areas of cloud cover. Therefore I would place higher priority on steroscopic photographs or images.

The spatial resolution area is a more complex problem. Part of the complexity has to do with differing perceptions of the rationale for using satellites as opposed to aircraft systems.

In my opinion, the major rationale for using satellites is for synoptic coverage under essentially identical conditions. The importance of this is demonstrated in the large regional structures and subtle lithologic variations that have been easily observed with Landsat images.

The significant question is basically what new geologic insights might be derived from coarser resolution data that can only be obtained from satellite systems; as opposed to can satellite systems replace aircraft systems? An interesting example is the structural features being reported on by Ken Watson with HCMM 0.5 km resolution images. An underlying problem is that increased resolution increases the data volume geometrically; this significantly hinders one's ability to study large areas. Furthermore, the mixing rules are not well understood; so it is not a trivial matter of numerically degrading high resolution data to lower resolution data. Thus, systematic research is needed to access the utility of various spatial resolutions in order (1) to determine the trade-offs and (2) to access the utility of these differing perspectives.

The third area, refinement of spectral bands in the .4 to 2.5 um region is possibly the most beneficial area. The Landsat and TM data have resulted from and stimulated a tremendous increase in our knowledge of spectral properties. As a result of these data it is now possible to map geologic materials that were at best very difficult to differentiate in the past. New avenues of attack are now open in solution of such a broad spectrum of geologic problems that the full significance is just beginning to be accessed. However, significant spectral differences are possible using higher spectral resolution. Several important differences that should be practical to measure are the following: hematite/goethite/ferrihydrite, alumite/kaolinite/montmorillonite, carbonate, sulfates, and possibly ferrous absorption bands.

A part of the problem in accessing and refining present capability and future potential is the lack of well calibrated data. The problem of calibration is hindering present research in understanding the results that have been obtained and the problems that have been encountered. Calibration has the potential of significant refinement in potential and should be considered for future systems.

Finally, mineral stress in vegetation has been demonstrated by Bill Collins to produce a small shift on the infrared plateau near .7 um. This offers the potential for mapping mineralized areas in heavily vegetated terrains. Much research is needed on this problem. Important areas are the following: (1) is there an optimal season, (2) is there a species dependancy or is this a universal property of chlorophyll-bearing plants, (3) what exactly causes the phenomenon, (4) are there ways to map this phenomenon in image format, and (5) can such minor differences be detected from space or only from lower altitude aircraft? I believe this to be of critical importance because extensive land areas are covered with dense vegetation and are essentially unexplored for mineral deposits, and there is no reason to expect these areas to have less mineral potential than the more arid, better explored areas of the world.