of airphoto evidence, it has long been suspected that some lakes in the Canadian Shield are related to mineralized zones. Out of hundreds of nearby lakes, one, two or a number of closely associated lakes may have an outline that is out of harmony with the surrounding lakes. These are generally accompanied by stress lines that radiate from the area giving rise to the concept of cones and intrusive and, of course, mineral replacements. When lakes occur at the loci of the stress lines, it leads to the conclusion that the rock was overstressed and weakened to an extent that it was readily excavated by erosion; its shape often ignores the major structural control and the direction of ice movement. The magnetometer, by showing invisible lines of force, ties these patterns together and confirms the fact that can't be seen in the photos—here are host rocks, even underwater; here is a locally intense high with a guaranteed magnetic replacement in a host rock.

Most mag maps do not show contours and obviously do not differentiate between many important structural and other features as do photographs—that substitute well enough in these cases for topography and also contain the essentials for rock identification. When one of these is laid upon the other, they complement each other and add up a grand total of unsuspected information.

There are several characteristics of the patterns formed by isomagnetic lines that are significant when coupled with airphoto interpretation. These are:

1. Shape.
2. Shape in relation to physical features of terrain.
3. Magnetic depressions within an anomaly.
4. Cross section at features, i.e., hills on hills.
5. Slope.
6. Slope in relation to relief and cover.
7. Peak or mesa features of "hill top."
8. Presence of "erosion contours" appears similar to contour maps of some dissected sedimentary rocks.

A final and most interesting development in this field is one designed to provide data that will give, in effect, three-dimensional magnetometer maps. Such data shows promise of being economically available in the future, and it will tend to eliminate the unstable datum, stabilize the accordian contours, and freeze the elusive magnetic scale.

KEYS FOR INTERPRETING VEGETATION FROM AIR PHOTOGRAPHS*

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AS USED in photogrammetry the purpose of a key is recognization or identification of objects on photographs. This pre-supposed that the user of the key can identify the object itself if he is to be able to recognize it on a photograph. If an interpreter cannot identify a birch tree when he sees it before him, it is very difficult to understand how he can possibly recognize it on a photograph.

It is well to recall that when any object is identified, the mental operation is what logicians would call a judgment. For instance, it may be said that "*A*" is the same or identical with the concept of "*B*." In other words, a type is in mind. When an object is seen, and effort is made to match that type and that

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object, a judgment is formed when it is said that "*A*" matches "*B*." To go a step further in logic it might be said that if "*B*" equals "*C*," and "*A*" equals "*B*," then "*A*" equals "*C*." This is a syllogism.

Morons, and it is believed even University Professors, always form the correct syllogism. Their mistakes are made commonly in the judgments when it is a question of deciding whether or not "*A*" matches "*B*."

If an object is recognized extemporaneously, it is a judgment. If, however, the action is systematic, or there is a methodical procedure for working through a series of judgments, then a key is being used. Many use a key mentally and are not aware of it. Others through much use, have acquired the knack of unconsciously using a key until it becomes a second nature or an acquired instinct.

Such identifications as are made, say by tea tasters or wine tasters, are examples of acquired instincts in the unconscious use of a key.

There are other types of keys. For instance, when a person hears a few bars of music and is able to identify the composer of the music by the style. Indispensable systematic keys are in use in all Universities and colleges—in mineralogy, in chemistry and in the biological sciences. By making many such keys, systematists or taxonomists have arrived at a systematic procedure for constructing keys. They usually tabulate the individual features which they recognize on each different object. From that tabulation or prospectus, a key is made.

In the case of identifying photographs, there are several features in use. They are often referred to as *contrast*, *tone*, *texture*, *pattern*, and so forth. If an object is not in contrast with its surroundings, to the extent of more than two per cent, it will not be recognizable. This figure is given by Middleton and it seems a fairly good working average. It is well to always keep this in mind.

In this connection color photography has one advantage over black and white. When black and white pictures are taken and developed, that is the end of increasing contrast on that photograph. The degree of contrast cannot be changed to any great extent by any means presently known. On the other hand, in the case of color photography, and if there is any contrast in color between the object and its surroundings, it is possible to increase that contrast enormously and to the extent that it is often possible to identify objects previously unrecognized without this means. In the operation of the O'Neill-Nagel "light table"[1] various types of color filters are used. If a filter can be made which corresponds very closely with the spectro-photometric curve of the object sought, as registered on the color transparency, and if there is any difference between that object and the color of its background, then the contrast can be increased greatly so that extremely small objects that would be missed otherwise, can be recognized in this way.

Some of the practical superiority of color film lies in the fact that it is possible to take a sample of what is being studied, and by observing it with the proper colored light, minute objects can be brought out that would otherwise be almost impossible of recognition.

For recognizing the kind of vegetation, "pattern" is possibly the most obvious, and sometimes, the most useful character. Biologists and botanists think of pattern as regards vegetation in terms of zonation, such as seen around a pond, where in water a few feet deep there is a concentric ring of water-lilies, then another concentric ring of marsh grass and sedges, then still another concentric ring of alder-bushes, and finally a zone of trees. Such a concentric pattern in the Chesapeake Bay repeats itself over and over again.

There is, however, a great need for some sort of a terminology in photo

[1] PHOTOGRAMMETRIC ENGINEERING, Vol. XVIII, No. 1, p. 134.

interpretation to which all might agree. For this purpose it is believed that new terms need not be invented, but that those that have been adopted by architects and by designers are adequate. There are several excellent books on the subject, in which can be found a name for almost any shaped pattern.

As regards the identification of patterns, it is sometimes possible to identify objects where each one individually is too small to be visible, but by being in a recognizable pattern, they may be identified as a pattern. It has actually been done in certain cases. Two kinds of a pattern detector are now being made. The astronomers have sought for such a thing in studying pictures of the stars.

It seems unnecessary to say very much about tone, because densitometers and many published tone-scales of different degrees of grayness are well known.

Texture is very commonly used as a distinguishing character in keys. It might be well to remember that this word originally comes from the Latin verb, "to weave." When fine patterns, i.e. textures, are being considered it is well to remember that textiles might very well be used when seeking to define different types of textures and to place them on some kind of a basis where the meaning would be clear to everybody.

In this connection a set of textiles distributed by the Cotton-Textile Institute has been used as a standard, so that when any texture is encountered there is a textile which can be used to match it. When it is said that a certain vegetation resembles chenille or any other fabric, the texture on the photograph is being referred to a standard term set up by this Institute.

For example, on an air photograph taken in the tropical Pacific area, there might be a stand of Nipa palms, on scale of about 1:20,000. It will have essentially the same texture as that of a cat-tail marsh in the Chesapeake area on a scale of 1:2,400. It is hoped that the cause for this similarity of texture can be found by analyzing such problems into their elements. Sandpaper, as another instance, will give a sort of a pebbly appearance on a photograph. Cottage cheese and all kinds of things can be taken as standards of texture, but they are not really very well standardized in most cases and do not serve as well as textiles.

Any more or less standardized product such as a grade of sandpaper has a standardized size of particle that can be used. It is possible to find a fabric closely resembling vegetation or a field in cultivation as shown on an air photograph.

It is hoped that further studies in this direction can be made. For instance, it is known that white fabrics are not as good as dyed fabrics as standards for texture.

As regards terms for describing shape, particularly for leaf shapes, it is well to remember that many of these terms have been defined as far back as Linnaeus in 1753, in *Philosophica-Botanica*, and later in *Terminologie*, in three volumes, by Bischof.

Any kind of an outline on a plane surface can be defined very well by following such a terminology as this, as well as similar ones used by architects and designers.

It will be well to set up a set of accepted definitions which are already in use in such professions as engineering, architecture, textiles and botany.