morphic, not bedrock mapping, applications of airborne imagery. Two factors control the value of a particular image in a particular study—scale and type of imagery.

Small scale imagery, less than 1:40,000, is particularly useful in broad, regional studies of structural trends, regional drainage pattern analysis, and lineament mapping. The larger scale imagery is more useful in fracture trace studies, local drainage pattern and single channel feature studies, and local tonal anomaly studies. Large-scale imagery may, of course, be compiled into a mosaic.

A wide variety of image types are available today. The most commonly available are black and white photography with many possible filter combinations, black and white infrared photography, color and color infrared (false color) photography, and thermal infrared and radar imagery. These images have a large range in cost and applicability. As a tool of the photogeomorphologist, color aerial photography appears to be the most generally useful for a basic study. Black and white, and black and white infrared, photography are the least expensive and quite useful. The other types of imagery have special, and sometimes very useful, applications.

Of value in some cases is sequential imagery showing, for example, variations of vegetation throughout the year. Such time-dependent changes in terrestrial features may have significance in photogeomorphic exploration.

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RESPONSE OF STREAMS TO STRUCTURAL UPLIFT

Drainage anomalies over structural uplifts in regions of low relief (less than about 150 ft local relief) and unconsolidated rocks are of 2 types—drainage pattern anomalies and single-channel anomalies. Field studies and model investigations have revealed certain basic stream responses to local uplift. In areas of generally uniform regional slope, local reversals or marked divergences of drainage pattern from the regional slope are structurally significant. Radial drainage patterns (full 360° radial patterns) are always anomalous. Concentric drainage is due to the exposure of beds of different resistance and may, or may not, be present. If the unconsolidated material is uniform or very poorly bedded, the local shifting or deflection of drainage is significant, but in well-bedded rocks it may be merely homoclinal shifting downdip. Marked local, opposed drainage deflections are apparently due to almost continuous uplift favoring continuous lateral shifting rather than accelerated incision.

In unconsolidated rocks, the most important single-channel response to slight structural uplift is the local channel width-depth ratio. Changes in this ratio may be seen on aerial photographs. Such changes, however, may also be due to changes in lithology or in tributary streams. Decreases in gradient (such as upstream from a structure) result in increased channel width-depth ratio and increases in gradient decrease width-depth ratio. Meander compression or local changes in sinuosity may be due to structure or lithologic difference. Color aerial photography may aid in distinguishing structural and lithologic causes of single-channel features.

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SOUTHERN LABRADOR SEA—KEY TO MESOZOIC AND EARLY TERTIARY EVOLUTION OF NORTH ATLANTIC

Geophysical studies made in the southern Labrador Sea and related to the drilling of deep holes there, have given evidence of the change from a two-plate to a three-plate spreading geometry in the evolution of the North Atlantic and Labrador Sea. The change is dated at about 60–65 m.y. ago and can be recognized by the magnetic anomaly pattern and the basement topography.

By use of magnetic anomalies and fracture zones, the stages in the evolution of the North Atlantic can be described as follows.

1. 180 m.y. African plate started to separate from North American plate accompanied by shearing between Africa and Europe.
2. Between 180 m.y. and 80 m.y. Separation of European and North American plates along Greenland-Spain fracture zone gave rise to primitive Iceland basin and Rockall trough and separated Spain from the Grand Banks. Orphan Knoll, Porcupine Bank, Flemish Cap, and Galicia Bank were detached and displaced.
3. 150 m.y. to 80 m.y. Spain rotated counterclockwise about rotation pole in Paris to open Bay of Biscay.
4. 80 m.y. to 60 m.y. Spreading occurred between North American plate and plate comprising Greenland, Rockall plateau, and northwest Europe, to create Labrador Sea and North Atlantic.
5. 60 m.y. Rockall plateau separated from Greenland along new spreading axis on east side of primitive Iceland basin. Triple junction developed, and spreading axes and fracture zones shifted to accommodate new geometry.
6. 60 m.y. to 47 m.y. Simultaneous opening of Labrador Sea, Reykjanes Ridge, and North Atlantic.
7. 47 m.y. Greenland virtually stopped moving relative to North America, and Labrador Sea growth finished.
8. 47 m.y. to present. Reykjanes Ridge and North Atlantic grew as European plate separated from North America–Greenland plate.

Paleogeographic reconstructions have been made and their validity tested against the data obtained from drill sites on Leg 12 of the Deep Sea Drilling Project.

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TERTIARY LIMESTONE DIKES, OAMARU, NEW ZEALAND

Indurated calcarenite and calcilutite dikes cut vertically through lower Oligocene volcanic sediments in the Oamaru region, east coast, North Otago, South Island, New Zealand. Individual dikes extend more than 10 m vertically and can be followed for much greater distances along regular or irregular strike. Field relations and paleontologic data suggest the limestone dikes were filled from above; at least 2 younger Oligocene formations contributed debris. Most dikes comprise several sharply defined layers of differing texture, composition, or structure parallel with dike walls. Subhorizontal layering, with either grading or cross-stratification, is also present but less common. Most composite dikes are less than 10 cm thick, but they range up to 30 cm; many of the dikes pinch and swell along both strike and dip. Flow structures are well developed between 2 vertical layers exposed in strike section along one dike. Limestone filling the interstices of a pillow lava was apparently supplied through channels now preserved as dikes.

Some dike layers are well-sorted bioclastic sand, but most layers consist of calcareous mud, with varying