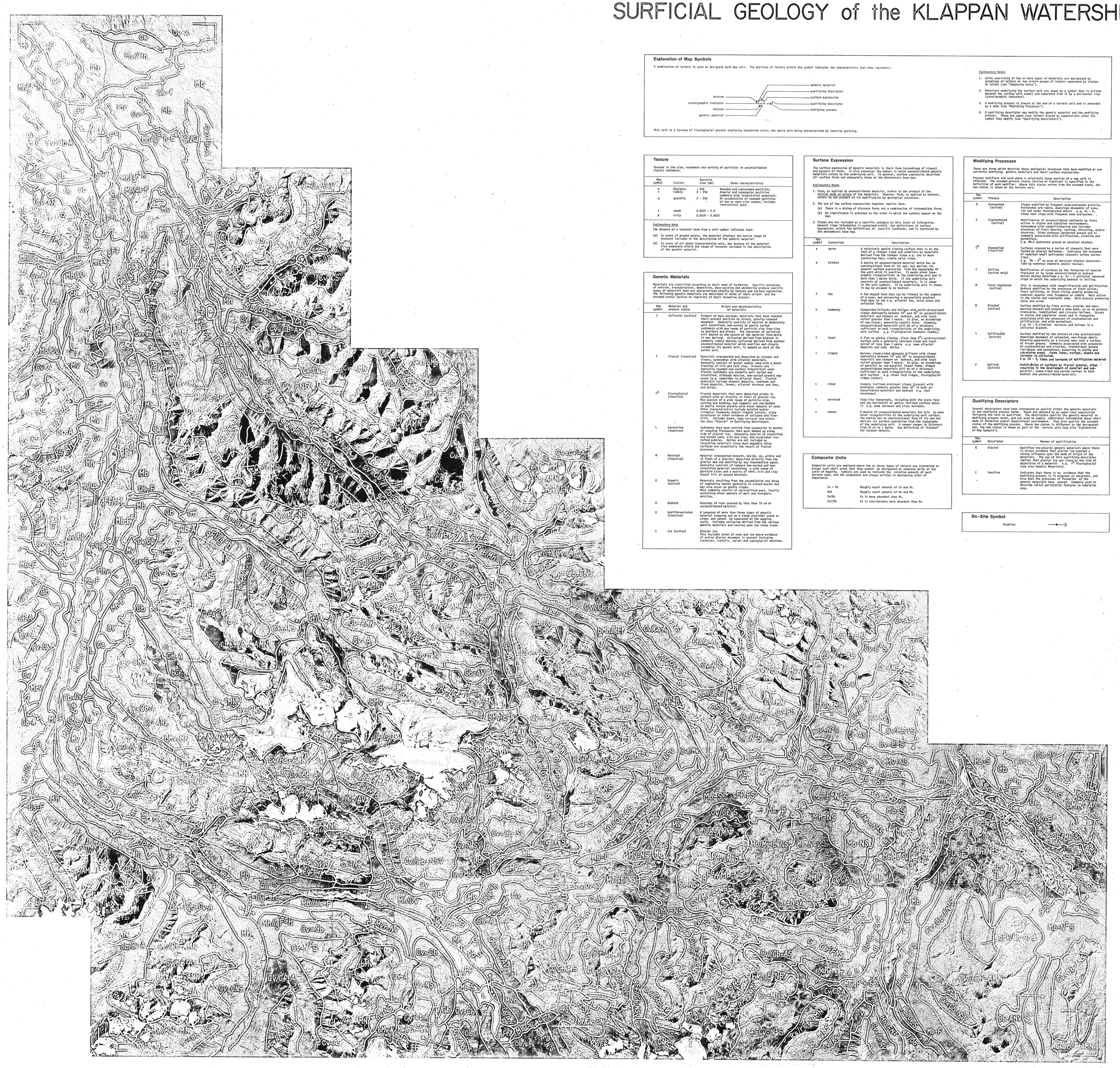
Figure 2

SURFICIAL GEOLOGY of the KLAPPAN WATERSHED



Explanation of Map Symbols

A combination of letters is used to designate each map unit. The position of letters within the symbol indicates the characteristic that they represent:-

texture — stratigraphic indicator — texture — genetic material

genetic material — qualifying descriptor — surface expression — qualifying descriptor — modifying process

This unit is a terrace of fluvioglacial gravels overlying lacustrine silts; the whole unit being characterized by inactive gullying.

Explanatory Notes

1. Units consisting of two or more types of materials are designated by groupings of letters or two or more groups of letters separated by slashes or colons (see "Composite Units").
2. Materials underlying the surface unit are shown by a symbol that is written in brackets after the unit symbol and separated from it by a horizontal line (stratigraphic indicator).
3. A modifying process is placed at the end of a terrain unit and is preceded by a dash (see "Modifying Processes").
4. A qualifying descriptor may modify the genetic material and the modifying process. These are upper case letters placed as superscripts after the symbol they modify (see "Qualifying Descriptors").

Texture

Texture is the size, roundness and sorting of particles in unconsolidated clastic sediments.

Map symbol	Texture	Particle size (mm)	Other characteristics
b	bouldery	> 256	Rounded and subangular particles.
r	rubbly	2 - 256	Angular and subangular particles commonly with interstitial materials.
g	gravelly	2 - 256	An accumulation of rounded particles of two or more size ranges; includes interstitial sand.
s	sandy	0.0625 - 2.0	
ƒ	silty	0.0039 - 0.0625	

Explanatory Note

The absence of a textural term from a unit symbol indicates that:

(a) In areas of ground access, the material dtsplays the entire range of textures included in the description of the genetic material.

(b) In areas of air photo interpretation only, the texture of the material lies somewhere within the range of textures included in the description of the genetic material.

Genetic Materials

Materials are classified according to their mode of formation. Specific processes of erosion, transportation, deposition, mass-wasting and weathering produce specific types of materials that are characterized chiefly by texture and surface expression. The following genetic materials are described in terms of their origin and the assumed status (active or inactive) of their formative process.

Map symbol	Material and process status	Origin and characteristics of materials
C	Colluvial (active)	Product of mass wastage; materials that have reached their present position by direct, gravity-induced movement. Generally consists of native to moderately well stratified, materials poorly sorted sediments with any range of particle size from clay to boulders and blocks. The character of colluvium will depend on the nature of the material from which it is derived and the process of transport. Includes commonly rubbly whereas colluvium derived from another unconsolidated material which overlies and closely resembles its parent unit, is mapped as part of the parent unit.
F	Fluvial (inactive)	Materials transported and deposited by streams and rivers; synonymous with alluvial materials. Generally consist of gravel and/or sand with a minor fraction of silt and rare clay. Gravels are commonly stratified and/or mixed with sand and sand. Fluvial sediments are normally well sorted and stratified, although massive, non-sorted gravels may occur (e.g. sometimes in alluvial fans). Fluvial materials include channel deposits, overbank and floodplain deposits, levees, alluvial terraces and fans, and deltas.
F^G	Fluvioglacial (inactive)	Fluvial materials that were deposited either in contact with or directly in front of glacier ice. Generally consist of native to moderately well sorting and bedding, but commonly are non-bedded in poorly sorted gravels with minor amounts of sand. Other characteristics include settled and/or irregular (hummocky and/or ridged) terrain, slump structures or other evidence of collapse and flow-tills. Includes kames, kame terraces and eskers. See also "Glacial" in Qualifying Descriptors.
L	Lacustrine (inactive)	Sediments that have settled from suspension in bodies of standing freshwater that were deemed so long as the glacial lake. Generally consist of stratified and sorted silts and clays containing ice-rafted pebbles. Deltas are not included as lacustrine materials since most mappable delta surfaces are essentially the result of fluvial processes.
M	Morainal (inactive)	Material transported beneath, beside, on, within and in front of a glacier; deposited directly from the glacier and not modified by any intermediate agent. Generally consists of compact non-sorted and non-stratified mixtures of materials of a wide range of particle sizes and a matrix of sand, silt and clay (basal till or ground moraine).
O	Organic (active)	Materials resulting from the accumulation and decay of organic substances. Occur in closed basins but may also occur on gentle slope. Most commonly consist of unstratified peat, locally containing minor amounts of marl and inorganic detritus.
R	Bedrock	Outcrops of rock covered by less than 10 cm of unconsolidated material.
U	Undifferentiated (inactive)	A sequence of more than three types of genetic material cropping out on a steep erosional scarp or slope, and cannot be separated at the mapping scale. Includes colluvium derived from the various genetic materials and resting upon the steep slope.
I	Ice (active)	Glacier ice. Note: Includes areas of snow and ice where evidence of active glacier movement is present including crevasses, icefalls, ogives and supraglacial moraines.

Surface Expression

The surface expression of genetic materials is their form (assemblage of slopes) and pattern of forms. It also expresses the manner in which unconsolidated genetic materials relate to the underlying unit. In general, surface expression describes all surface forms not adequately shown on the photomosaic base map.

Explanatory Notes

1. Forms, as applied to unconsolidated deposits, refers to the product of the initial mode of origin of the materials. However, form, as applied to bedrock, refers to the product of its modification by geological processes.
2. The use of two surface expressions together implies that:
   (a) There is a mixing of discrete forms not a combination of intermediate forms.
   (b) No significance is attached to the order in which the symbols appear on the map.
3. Slopes are not included as a specific category at this level of information. General slope information is contained within the definitions of surface expression, within the definitions of specific landforms, and is expressed by the photomosaic base map.

Map symbol	Expression	Description
a	apron	A relatively gentle sloping surface that is at the foot of a steeper slope and underlain by materials derived from the steeper slope e.g. two or more coalescing fans; simple talus slope.
b	blanket	A mantle of unconsolidated material which has no constructional form of its own, but derives its surface expression from the topography of the unit which it overlies. It masks minor topographic irregularities in the underlying unit and is more than 1 metre thick. If the underlying unit consists of unconsolidated materials, it is shown, if its surface is similar to the underlying unit to shown, it may be assumed to be bedrock.
f	fan	A fan-shaped form that can be likened to the segment of a cone, and possesses a perceptible gradient outward from the apex e.g. alluvial fan, talus cones and colluvial fans.
h	hummocky	Steep-sided hillocks and hollows with multi-directional slopes dominantly between 10° and 35° on unconsolidated materials and steeper on bedrock, and with local relief greater than 1 metre. In plan, an assemblage of irregular or subcircular forms. Hummocks in unconsolidated materials will be of a thickness sufficient to mask irregularities of the underlying unit surface e.g. fluvioglacial hummocks (kames).
l	level	A flat or gently sloping (less than 5°) unidirectional surface with a generally constant slope and local relief of less than 1 metre e.g. some alluvial deposits and some deltas.
r	ridged	Narrow, steep-sided elongate hillocks with slopes dominantly between 10° and 35° in unconsolidated materials and steeper on bedrock, and with local relief greater than 1 metre. In plan, an assemblage of parallel or sub-parallel linear forms. Ridged unconsolidated materials will be of a thickness sufficient to mask irregularities of the underlying unit surface e.g. minor rock ridges, fluvioglacial ridges (eskers).
s	steep	Steeply inclined erosional slopes (scarps) with gradients commonly greater than 35° in both unconsolidated materials and bedrock e.g. rock escarpment.
t	terraced	Step-like topography, including both the scarp face and the horizontal or gently inclined surface above it e.g. kame terraces and river terraces.
v	veneer	A mantle of unconsolidated materials too thin to mask irregularities of the underlying unit. Unlike a blanket the mantle has no constructional form of its own but derives its surface expression from the topography of the underlying unit. A veneer ranges in thickness from 10 cm to 1 metre. See definition of "blanket" for further details.

Composite Units

Composite units are employed where two or three types of terrain are intermixed or occur in such a way that they cannot be designated as separate units at the scale of mapping. Symbols are used to indicate the relative amounts of each terrain type, and the components are always written in decreasing order of importance:

Cv = Rs	Roughly equal amounts of Cv and Rs.
Mvb	Roughly equal amounts of Mv and Mb.
Cv/Rs	Cv is more abundant than Rs.
Cv//Rs	Cv is considerably more abundant than Rs.

Modifying Processes

These are terms which describe those geological processes that have modified or are currently modifying genetic materials and their surface expressions.

Process modifiers are used where a relatively large portion of a map unit is affected. The assumed process status (active or inactive) is specified in the definition of each modifier. Where this status varies from the assumed state, the new status is shown on the terrain unit.

Map symbol	Process	Description
A	Avalanched (active)	Slopes modified by frequent snow-avalanche activity. Avalanches are rapid downslope movements of snow, ice and other incorporated debris e.g. Rs - A_s steep rock slope with frequent snow avalanches.
C	Cryoturbated (active)	Modification of unconsolidated sediments by frost heave, creep, and other cryoturbation processes. Synonymous with congelifluction and includes processes of frost heaving, sorting, thrusting, and/or churning. Often produces patterned ground and is commonly associated with solifluction, alluvation and colluvium. E.g. Mb-C patterned ground on morainal blanket.
C^C	Channelled (inactive)	Surfaces crossed by a series of channels that were formed by glacial meltwater. Indicates the presence of numerous small meltwater channels (often ravine-like). E.g. Mb - C^C an area of morainal blanket characterized by numerous channels and/or ravines.
F	Failing (active only)	Modification of surfaces by the formation of tension fractures on by large unconsolidated or bedrock masses moving downslope e.g. Cv - F colluvial veneered slope on which the underlying bedrock is failing.
M	Frost shattered (active)	This is synonymous with congelifraction and gelifraction. Bedrock modified by the processes of frost action, frost splitting, or frost riving usually producing numerous angular rock fragments or rubble. Most active in the alpine and subalpine zone. Main process producing talus and scree.
N	Nivated (active)	Surface modified by frost action, erosion and mass-wasting beneath and around a snow bank, so as to produce transverse, longitudinal and circular hollows. Occurs in the alpine and subalpine zone. Commonly associated with the processes of cryoturbation and solifluction, and with permafrost. E.g. Cb - N nivation terraces and hollows in a colluvial blanket.
S	Solifluded (active)	Surface modified by the process of slow gravitational downslope movement of saturated, non-frozen debris behaving apparently as a viscous mass over a surface of frozen ground. Commonly associated with processes of cryoturbation and nivation, intermittent ground ice conditions, occurring in alpine and sub-alpine areas. **Shown lobes, stripes, sheets and terraces in colluvium.** E.g. Cb - S, **lobes and terraces of solifluction material**
V	Gullied (active)	**Modification of surfaces by fluvial erosion, resulting in the development of parallel and sub-parallel, steep-sided and narrow ravines in both bedrock and unconsolidated materials.**

Qualifying Descriptors

Several descriptors have been introduced to qualify either the genetic materials or the modifying process terms. These are denoted by an upper case superscript after the symbol they modify. Some are applicable to both genetic materials and modifying process terms, and are used to supply additional information about their mode of formation and/or depositional environment. They also qualify the assumed status of the modifying process. Where the status is different to the designated one, the new status is shown as part of the terrain unit (see also "Explanation of Map Symbols").

Map symbol	Descriptor	Manner of qualification
G	Glacial	Qualifies non-glacial genetic materials where there is direct evidence that glacier ice exerted a strong influence upon the mode of origin of the materials. The use of this qualifying descriptor implies that the materials were formed by the deposition of a material e.g. F^G Fluvioglacial (see also Genetic Materials).
I	Inactive	Indicates that there is no evidence that the modifying process is currently active, and also that the processes of formation of the genetic materials have ceased. Commonly used to describe relict periglacial features in subalpine zone.

On-Site Symbol

Drumlins

Scale approximately 1:100,000

Miles 2 1 0 2 4 6 8 10

Kilometers 2 1 0 2 4 6 8 10 12 14

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