MORPHOLOGICAL VARIATIONS AND EVOLUTION OF CHANNELS ON MARS

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Traces of flows from different origins are visible on the surface of Mars. The analyse of these channels on the whole planet points out the existence of different morphological and morphometrical groups,corresponding to only 2 main categories:the one which,by their morphologies,require the action of free liquid water (channels of probably pluvial origin) and the one which can be explained by the melting of permafrost.Therefore,the precise analysis of the morphologies and of the dates of apparition could clarify the evolution of some geological and physical parameters of Mars and be used as indicators of periods of modification.

The older channels (4,2 to 3,9 billion years) are all grouped in valley net - works (Fig.1 to 4) with important developments of tributary systems and are similar to terrestrial rivers.This particular morphology supposes the presence of liquid water during this period.These networks have generally lengths between 80 and 300 km which require a quite long and regular alimentation,given by rainfalls,if their origin is similar to terrestrial rivers.

The beginning of a second generation of flow types (from 3,9 to 0,5 billion years) is caracterised by the apparition of very different channels.They present no tributary developments and they are generally sinuous and short (20 to 60 km).Their presence does not require the existence of rainfalls or water cycle.Their morphologies (Fig.5 to 6) can find their origin in a general context similar to the present situation,with underground water,frozen (permafrost) or liquid water (aquifers),which can be destabilized by impacts or hot spots.

In the same period some very long (300 to 1100 km) and large (60 to 100 km) channels appeared near volcanoes or in regions under volcanic influences.Their genesis is here probably due to a magmatic activity and to increase of the geothermic gradient. (Fig.7 to 8) The final result is the melting of permafrost and in this case too an atmospheric water cycle is not necessary to explain their presence.

These morphological variations between channel groups point out very important changes on Mars during 4,5 billion years,with the brieve apparition of a water cycle,its disappearing and its replacement by the present system of melted permafrost.But, this sequence is probably only a global view of the problem and, the presence of more developped channel networks in the second period may indicate the occurence of short periods of possible atmospherical changes.

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CHANNEL VARIATIONS ON MARS

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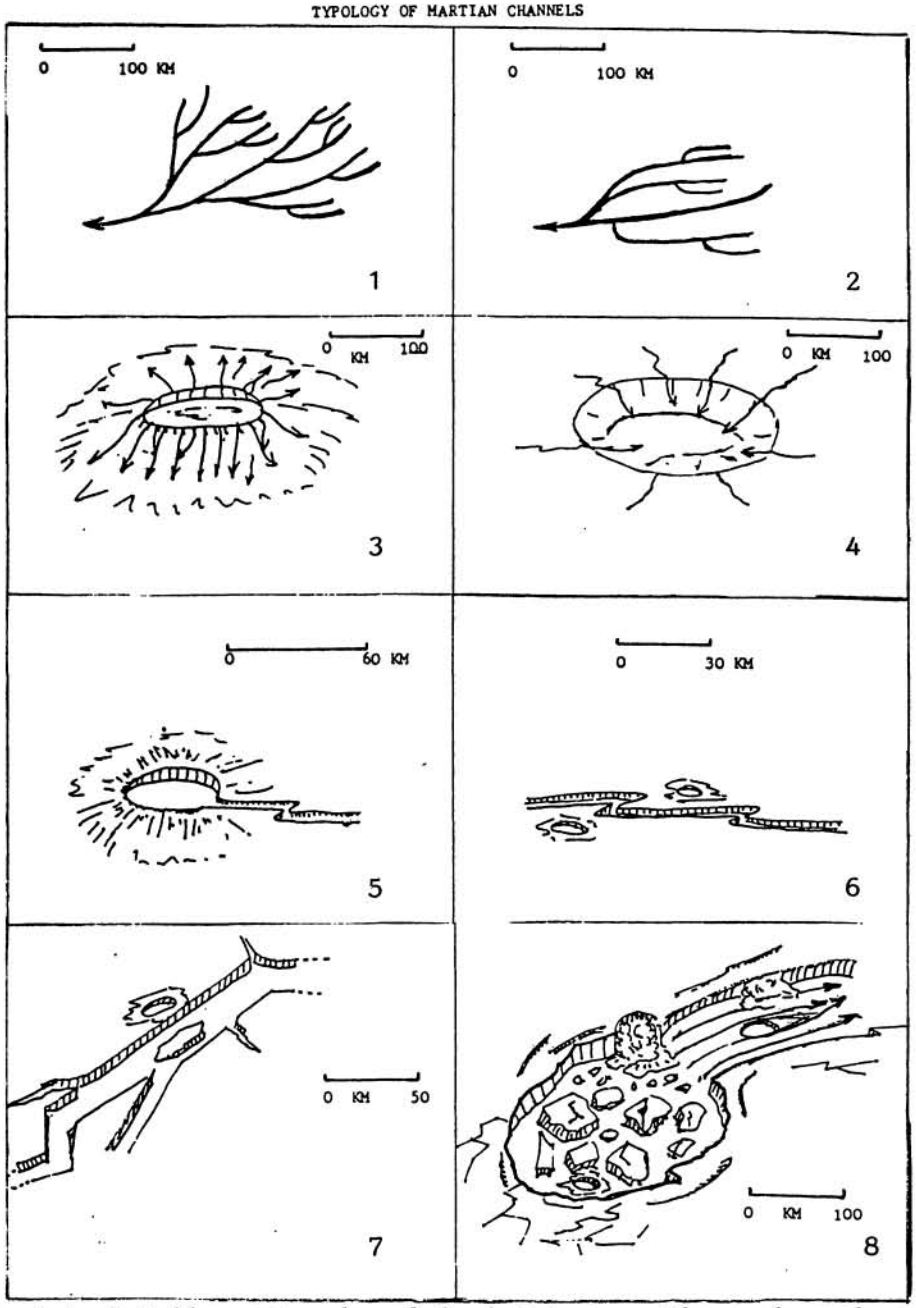
TYPOLOGY OF MARTIAN CHANNELS



LEGEND: Fig.1 to 2-Valley networks of dendritic type.These channels represent the first generation of flows and are found principally in old terrains.Their origin is probably pluvial and their morphologies imply a regular alimentation Fig.3 to 4-Channel systems on impact craters are correlated with erosion by rainfalls on crater slopes.They are generally short and deep.Fig.5 to 6- These channels represent the second generation of flows which do not require free liquid water.They start generally in impact craters but can have no apparent source point.Their origin is associated to a release of aquifers or melting of permafrost during impacts.Their short lengths can be explained by the weakness of the atmosphere and the evaporation of liquid water in a brieve period. Fig. 7to8-Large channels near volcanoes.The factor of genesis is here an interaction between ground ice and heat during volcanic or magmatic activity.