

Water and liquid brines on Mars

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Water is one of the most abundant chemical compounds in our universe. In interstellar dust clouds, water is stable in form of ice-mantles covering iced grains. In forming planetary systems the ice survives only in the outer and cool parts of preplanetary disks. The water in the inner parts of our solar system has later been transported inward into the originally warmer and dryer region of the terrestrial planets by large water carrying bodies like comets and asteroids.

Thus, early Mars, like Earth, can be expected to have originally been a water rich planet, and this view is increasingly confirmed by current investigations on Mars. Today, the surface of Mars is dry at mid- and low latitude. Water there exists in form of ice in the permanent polar caps, and in form of water vapour in the atmosphere. There are speculations that water might be present in form of permafrost in the deep subsurface and eventually in form of liquid water below that. The present thermo-physical conditions at the surface of Mars do not permit the stable existence of liquid water on the surface. Liquid water has to evaporate or to freeze and sublimate there.

The freezing point depression of salty solutions permits brines to remain liquid also far below 0° C – these are the so-called cryobrines. Thus, cryobrines are the only possible liquids on present Mars. Properties and distribution of the (at least temporary) liquid cryobrines on Mars will be described in some detail. These are new results of current research.

Liquid water is understood to be necessary to overtake the life-supporting transport of nutrients and waste, and of entropy; its presence is sometimes seen to be the necessary precondition for life to exist, at least of life of “terrestrial type”. Therefore, the question of the availability of liquid water at and in the surface of Mars is of high importance also in view of possibly related biological implications.

But, the key-role of water as transport agent is not necessarily restricted to pure water only. The water in brines, i.e. the liquid cryobrines, can overtake that too! Terrestrial life forms, like halophilic bacteria e.g., are well known to exist in brines. Thus, the at least temporary presence of liquid cryobrines on present Mars is a challenge also to astrobiology.