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An overview of active zones in Saturnian Moons

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Abstract

In our outer Solar system, a significant proportion of the planetary bodies comprising the system of Saturn, have been subject to observation, analysis, and mapping as well as classification, based on their characteristics. Long-lasting investigations showed that one of the most fascinating characteristic of the Saturnian icy worlds is their complex, dynamic and Earth-like geology. Intervent and layered plains, icy flows, impact units, extensive ridges and grooves are the effects of endogenous and exogenous intense dynamic processes. On the surfaces of Titan and Enceladus, which geologically are the most interesting satellites, these processes are expressed in the form of cryovolcanoes, geysers and tectonic features. The activity of cryovolcanism on Titan can be described as similar to Earthly volcanism, where methane, as a product of the volcanic activity, is the main component of Titan's unique organic chemistry laboratory [1]. Methane outgassing from the interior or from the subsurface could constitute the missing reservoir to explain the presence of gaseous methane in today's atmosphere. On the southern limb of Enceladus an impressive phenomenon of icy geysers is present. Instruments on the Cassini spacecraft discovered these icy plumes during close encounters with Enceladus [2]. They could be due to condensation of the vapor escaping from a water source and stream through the cracks in the ice crust before heading into space and supposedly populate Saturn's E-ring [3]. Another moon that displays fascinating geological features is Iapetus, presenting a phenomenon called 'two-tone' coloration due to intense color differences of the leading (dark) and trailing (bright) hemispheres. The dark material is believed to be a residual product of the water ice evaporation on the surface possibly after exposure to sunlight or due to thermal anomalies after bombardment of micrometeorites that crossed Iapetus's orbit emanating from the largest reservoir of such material, Phoebe. Iapetus is heavily bombarded on both sides presenting among these a further mystery, a high equatorial ridge. The ridge is a unique geomorphological features as it rises more than 20km above the plains and synthesized by a complex system of parallel ridges, extensive portions and isolated peaks [4]. Another Saturnian icy moon that is heavily bombarded and grooved, is Rhea [5]. This moon geologically is similar to Dione and there are in both potential areas of past cryovolcanic activity. Cassini's spacecraft investigation implied that the level of active endogenic process is extremely low, although the surficial features suggest a world that in the past was geologically active similar to the present situation on Titan and Enceladus. The Saturnian moons suggest unique areas of geological research due to their active interiors or/and their complex formed surfaces. Almost every geological activity and feature present on Earth has so far been observed on these fascinating worlds, acting more dynamically, creating an extremely active and powerful system. We shall present here an overview of all the geological phenomena found in the family of kronian satellites with the intention of extracting common and outstanding features which could help identify their origin.

References

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