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TITLE: The geologic history of the Galilean satellite Callisto.

PRESENTATION TYPE: Assigned by Commitee (Invited)

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SESSION: The Galilean Satellites: 400 Years of Discovery (P19)

AUTHORS (FIRST NAME, LAST NAME): Roland J Wagner[1], Gerhard Neukum[2], Ursula Wolf[2], Ronald Greeley[3]

INSTITUTIONS (ALL): 1. Inst. of Planetary Research, German Aerospace Center (DLR), Berlin, Germany.
2. Inst. of Geosciences, Free University of Berlin, Berlin, Germany.
3. School of Earth and Space Exploration, Arizona State University, Tempe, AZ, USA.

Title of Team:

ABSTRACT BODY: Introduction: Callisto, the second-largest Galilean satellite of Jupiter, is a Mercury-sized icy moon with a diameter of 4816 km and an average density of 1.83 gcm-3. Despite its size the images returned by the Voyager cameras in two flybys in 1979 showed a densely cratered surface with little geologic diversity, in contrast to its neighbor Ganymede [1][2][3][4]. Between 1995 and 2003 the SSI camera aboard the Galileo spacecraft has extended but not completed the existing Voyager image data base of Callisto [2][3]. Geologic processes: Galileo SSI has shown that the two dominant geological processes are impact craters and surface degradation [2][3][4]. Abundant but less important are landforms created by tectonism, such as fractures and lineaments [1][2][3][4]. Surface ages are obtained by impact chronology models either with a lunar-like cratering rate, mostly by asteroids [5], or with a constant cratering rate, mostly by comets [6]. Geologic history: Various aspects of Callisto's geologic history, based on Voyager and SSI data, were discussed in detail by [1][2][3][4]. Cratering chronology models [5][6] agree that Callisto's densely cratered plains are mostly old, on the order of 4 Ga and older. The morphology of craters and basins is much like that on Ganymede, implying similar subsurface structure at the time of their formation. Palimpsests as on Ganymede occur, but most of them are heavily degraded and not easily recognizable. Callisto could have experienced an early period of heavy bombardment, as inferred from the lunar-like chronology model [5], and large impact structures (e.g., Valhalla, Lofn) could have formed towards its end, 3.8 – 4.0 Ga ago. All topographically high-standing landforms (e.g., crater rims) were affected by sublimation degradation, triggered by a substantial amount of CO2 in the icy crust [7]. Degradation started along pre-existing zones of weakness, caused by early tectonic stress. On-going sublimation and separation of highly volatile from less volatile materials created a globally abundant dark layer. It remains an unsolved question if degradation and the accumulation of dark material was going on at a fast rate during a time of heavy bombardment but went on at a considerably slow rate since 3.4 – 3.6 ago [4][5], or has continued at a constant rate until more recent times [4][6]. References: [1] Schenk, P. M. (1995), J. Geophys. Res. 100 (E9), 19,023 – 19,040. [2] Greeley, R. et al. (2000), Planet. Space Sci. 48, 829 – 853. [3] Moore, J. M. et al. (2004), in: Jupiter (F. Bagenal et al., eds.), Cambridge Planet. Sci., Vol. 1, p. 397 – 426. [4] Wagner R. (2007), PhD. Dissertation (in german), Free University of Berlin, Germany, http://www.diss.fu-berlin.de/2007/806. [5] Neukum G. et al. (1998), Lunar Planet. Sci. Conf. XXIX, abstr. #1992 [CD-Rom]. [6] Zahnle K. et al. (2003), Icarus 163, 263 – 289. [7] Moore J. M. et al. (1999), Icarus 140, 294 – 312.

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