Age Determination of Raditladi and Rembrandt Basins and related Geological Units. Elena Martellato[1], Matteo Massironi[1,2], Gabriele Cremonese[3], Simone Marchi[4], Sabrina Ferrari[2] and Louise M. Prockter[5]. [1]CISAS, University of Padova, Via Venezia 15, 35131, Padova, Italy (e-mail: elena.martellato@oapd.inaf.it); [2]Geoscienze Department, University of Padova, Via Giotto 1, 35127, Padova, Italy; [3]INAF-Osservatorio Astronomico di Padova, Vic. Osservatorio 5, 35122, Padova, Italy; [4]Astronomy Department, University of Padova, Vic. Osservatorio 3, 35122, Padova, Italy; [5]Johns Hopkins University Applied Physics Laboratory, Laurel, MD 20723, USA.

Introduction: MErcury Surface, Space ENvironment, Geochemistry and Ranging (MESSENGER) spacecraft was designed to visit Mercury after the long silence that follows Mariner 10 call on this planet. During these last two years, MESSENGER took three gravity assists with the planet, providing a great deal of information, first of all an extensive imaging of a portion of Mercury's surface never seen before. Two examples are Raditladi (27°N, 119°E), revealed during the first fly-by, and Rembrandt (33°N, 88°E), during the second. In this work, we analyzed these impact features with age determination purposes.

Method. Age determination was performed by adopting Marchi et al.' (2009) chronological model [2], because it makes possible (1) to take into account both the Main Belt Asteroids (MBAs) and the Near Earth Objects (NEOs) projectile population and (2) to analyze the layering of the upper target surface [3]. Marchi et al.' model is based on the inference of the Mercury Model Production Function (MPF) from the conversion of the impactor flux into the crater distribution via appropriate both scaling law and target properties estimation. Since our poor knowledge in Mercury upper shells, we adopted a lunar-like crustal structure, but the crust-mantle transition is set to the value recently computed at the time of lobate scarps formation [6]. To this regard, we set a 10 km layer of fracturated silicates, on top of a bulk anorthositic crust in turn laying above a peridotitic mantle.

Raditladi Basin. Raditladi is a double-ring impact feature (250 km in diameter), that stands for its peculiar low crater density of its interior plains. Raditladi floor is partially filled with smooth, bright plains material that embays the rim and the central peak ring, inside which troughs have been found arranged in a partially concentric pattern. On the basis of surface texture and albedo, Prockter et al. [4] (Fig. 1) identified two main units that do not show clear stratigraphic relationships: the smooth and the hummocky plains. Crater counts has been performed on the whole basin (bonafide craters in Fig. 2) as well as on these two units separately (Fig. 2: e.g., smooth plains). The bonafide craters distribution of the whole basin has been fitted with MPF giving an age of about 1.2 Gyr. In this case, the MPF is built considering an upper 2.5 km-layer of fractured material on top of hard rock. The best MPF fit proposed for the whole basin is somehow valid also for both the individual plains (exept for the large craters, which are however characterized by a poor statistics). The Volcanic vs Impact melt origin of the Raditladi smooth plain unit is still controversial: our results show an undistinguishable age of all the units inside the basin hence favor the impact hypothesis.

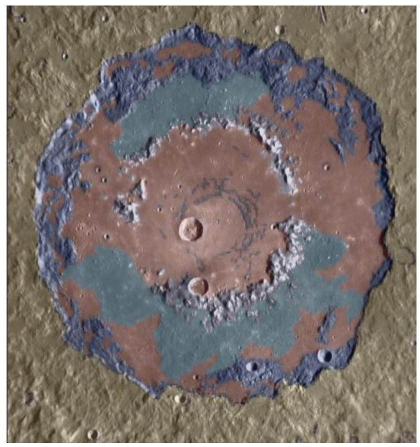

Fig 1: *Geological map of the Raditladi basin [4] over the MESSENGER MDIS-NAC image.*

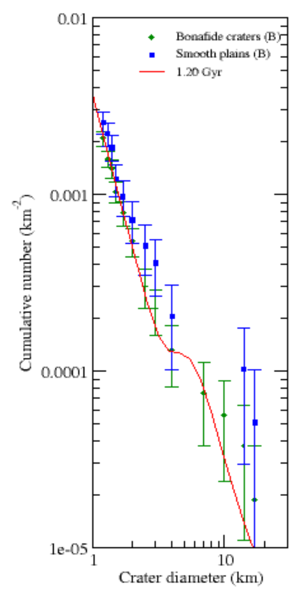

Fig. 2: *Cumulative frequency of craters on the interior smooth plains of the Raditladi basin.*

Rembrandt Basin. Rembrandt basin is a 715 km-diameter impact feature which displays a distinct, hummocky rim, broken up by the presence of several large impact craters. Its interior is covered by smooth plains, that extend up to the southern, eastern and part of the western rims [7], and has undergone extensive modification by tectonics forces and impact cratering.

Our age inference leads to a similar age for the rim and the inner plains (Fig. 3: e.g., rim). In particular, assuming an MBA population, we found the values of 3.77 and 3.65 Gyr, respectively. Watters et al. [7] suggest the origin of the inner plains to be volcanic on the basis of the embayment relationships and the color and reflectance differences between the rim and the plains units. Our findings support this hypothesis, but, unlike Caloris infilling which has been recently demonstrated to be the product of a long lived volcanism [1, 3], in the case of Rembradt basin our age estimates point for a shorter volcanism after the basin formation. However, the age of the inner plains of both the basins are not far one to each other and strongly support a thermal state of the planet which could sustain volcanism over contractional tectonics for a long time.

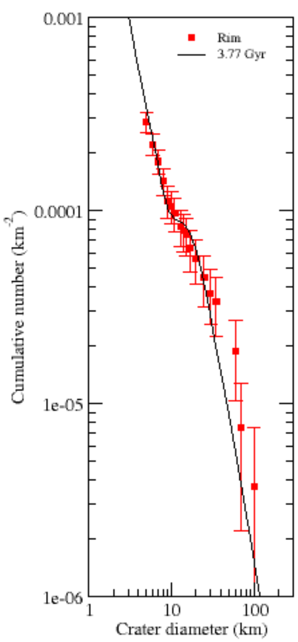

Fig. 3: *Cumulative frequency of craters on the rim of the Rembrandt basin.*

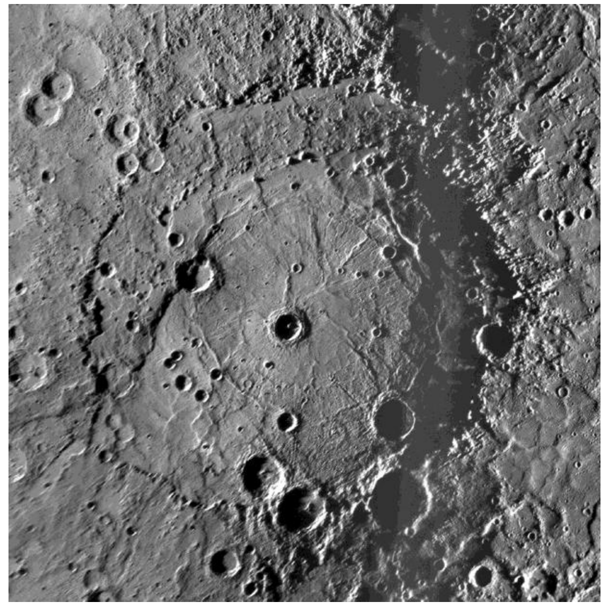

Fig. 4: *The Rembrandt basin (MESSENGER MDIS-NAC image).*

References: [1] Fasset et al., (2009) *Earth Planet. Sci. Lett., 285*, 297-398. [2] Marchi, S. et al. (2009) *Astrophys. J., 137,* 4936-4948. [3] Massironi, M. et al. (2009) *Geophys. Res. Lett., 36,* L21204. [4] Prockter et al. (2009) *LPS IV,* Abstract #1758. [5] Rothery, D.A. et al. (2009) *Planet. Sp. Sci.*. [6] Watters, T.R. et al. (2002) *Geophys. Res. Lett., 29,* 1542. [7] Watters, T.R. et al. (2009) *Science, 324,* 618-621.