SMALL BODY MAPPING RESULTS, 1995-96. P. J. Stooke[1], [1]Department of Geography, University of Western Ontario, London, Ontario, Canada N6A 5C2 (stooke@sscl.uwo.ca).

INTRODUCTION. The Small Body Mapping Program has the goal of consistent mapping of all small irregularly shaped objects as data become available. This poster display includes relief, photomosaic or geological maps of at least 15 small bodies, including satellites of Mars and the outer planets, the nucleus of Comet 1P/Halley and radar-imaged asteroids. Maps in common formats are important for comparative studies. Here I describe recent geological interpretations of asteroids 951 Gaspra, 4179 Toutatis, 1620 Geographos and the nucleus of Comet Halley. Gaspra has an older surface than was previously recognized, and three distinct families of craters date different phases in its history. Toutatis has grooves and ridges defining a structural grain, possibly implying a monolithic rather than binary interior and a regolith several tens of metres thick in places. Geographos has a crater population similar to Toutatis and may also have at least one linear structure. Circular depressions are the dominant landform on Halley, and its activity may be concentrated in regions which experience greater insolation.

GASPRA. Low resolution images show or imply more craters 1 to 4 km in diameter than reported in (**1**). The number of facets, assumed to be mostly impact scars, date its formation by disruption of a parent body. Each one must erase topography smaller than the scale of facets. Therefore the 1 to 4 km craters date the formation of the last facet. The unusually crater-free interior of Yeates Regio dates the last 3 or 4 km crater, which mobilized a thick regolith deposit on a steeply-sloping rotational leading surface to erase most craters within it. Smooth material may also occur north of Charax at the edge of another rotational leading surface. I concur with (**2**) that the global groove distribution implies a monolithic interior. At least one dark spot is visible near the subsolar point.

TOUTATIS. Preliminary mapping was described in (**3**). Refined mapping supports the identification of grooves, implying a regolith about as thick as the grooves are wide (30-50m). The grooves and several ridges are roughly parallel to the equatorial plane, suggesting a pervasive structural grain which in turn implies a globally coherent, monolithic, interior. The deepest part of the 'neck' may be an impact crater, and other parts of the structure may have the same origin. I conclude that it is safest to state that the binary nature of Toutatis is 'not proven', despite the pervasive opinion in the literature that this is a contact binary object. Better images in 2004 may be required to settle the issue, and every effort should be made to obtain them by radar or spacecraft. The 1996 images will help extend mapping but are not adequate to resolve the internal structure issue. However, improved knowledge of internal density variations, derived from the image inversion, might help with this by resolving a presumably low density debris-filled neck, if one exists.

GEOGRAPHOS. 1994 Radar images of 1620 Geographos (**4**) show geologically significant detail but are complicated by north-south ambiguity caused by the equatorial viewing. A very preliminary map (Figure 1) shows features on both the north and south sides superimposed. I am presently evaluating the possibility that minor shifts in position of craters between the two days of imaging, and perhaps between viewing longitudes on one day, may be exploited to resolve the north-south ambiguity. The crater density and size range are comparable to Toutatis. One possible crater chain or groove is observed. The suggestion (**4**) that the hook-shaped extremities of Geographos are related to a symmetrical pattern of ejecta loss and reaccretion is not supported by mapping since there is no evidence for mantling of rotational leading surfaces as seen on Ida and Gaspra. Craters seem to be distributed uniformly, though admittedly the low quality and hemispheric ambiguity of images published to date might mask variations.

HALLEY. Preliminary shape modelling undertaken with Alain Abergel using Giotto and Vega images was described in (**5**). The finished shape model does not differ greatly from that earlier work. A separate study is in progress to interpret the highest resolution images, in which a small region is seen at a resolution of about 50 m/pixel. The nucleus surface is pocked with roughly circular depressions of all sizes (Figure 2), which on any other body would be interpreted as impact craters. Either craters are the dominant landform on Halley at a resolution of a few hundred m, or emission processes produce landforms which mimic impact craters. One straight trough about 3 km long could be structural, or the result of an oblique impact, or might be analogous to a 'sapping' landform progressively enlarged by undermining, perhaps along a zone of weakness. Other than that there is no evidence in the 1986 images of landforms unique to comets. Better images, such as will be obtained by Deep Space 1 and Stardust, will be needed before we can begin to understand cometary landforms.

Plotting the path of the sub-solar point across Halley during one 7.4 day period shows that some areas experience considerably more solar heating than others (Figure 3). The surface can be divided into 90 by 90 degree octants. Alternating octants experience one rapid solar passage or three slower ones in a 7.4 day period. There is some suggestion that activity is more common in areas which experience more heating, but this must be regarded as highly uncertain based on the small numbers of vents, current knowledge of the global shape, the locations of active regions, and their history of activity.

REFERENCES. (**1**) Chapman, C. *et al.* (1996), *Icarus* 120: 231-245. (**2**) Thomas, P.C.. *et al.* (1994), *Icarus* 107: 23-36. (**3**) Stooke, P.J. (1996), *LPSC XXVII,* 1283-1284. (**4**) Ostro, S. *et al.* (1996), *Icarus* 121: 46-66. (**5**) Stooke, P.J. (1995), *LPSC XXVII,* 1365-1366.

(Figures follow on the next page)

Figure 1. Very preliminary map of Geographos, Morphographic Conformal Projection, north and south sides superimposed. The circles represent craters that seem reasonably reliably identified. Many other possible craters might be identified in the images. A possible groove or crater chain is visible just above centre.

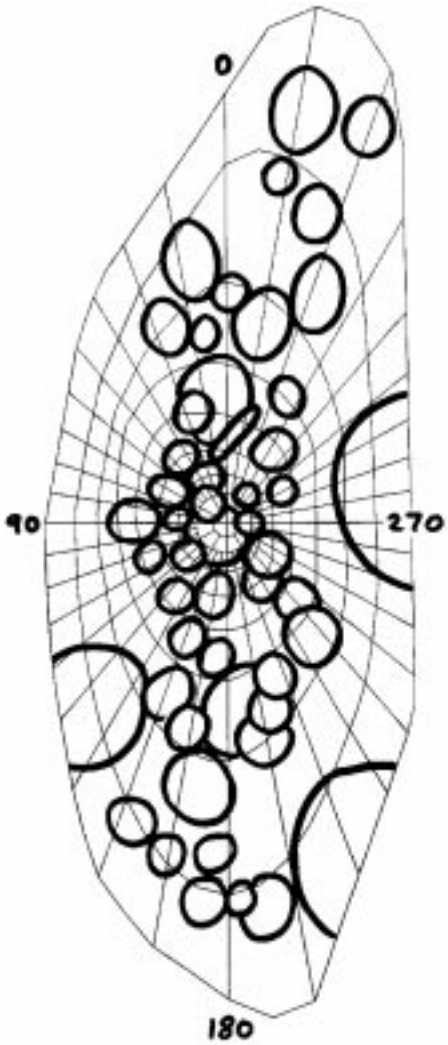

Figure 2. Map of Halley, Morphographic Conformal Projection. **Dashed loops**: various depressions. A trough is visible just below the equator at the extreme right side, and below centre in Figure 3.

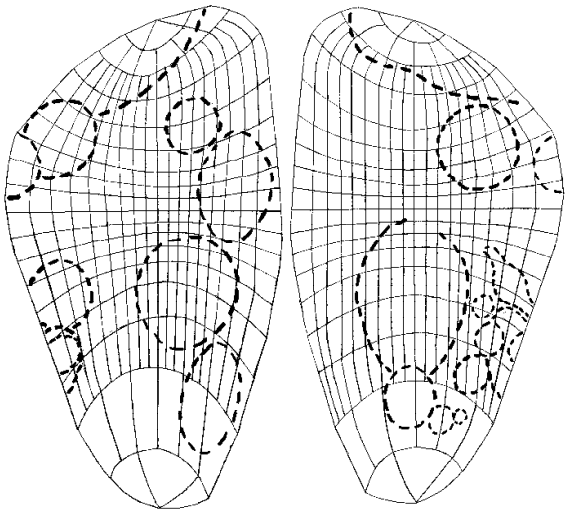
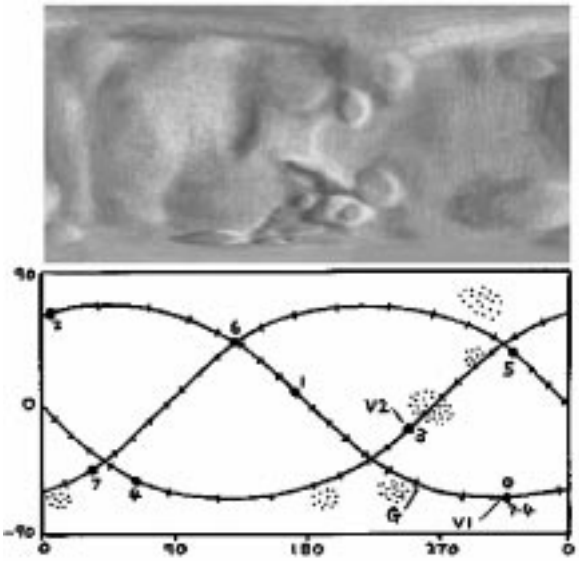
Figure 3. Halley, Cylindrical projection. Top: relief. Bottom: **Curve** is track of sub-solar point over 7.4 days, ticks at 3 hour intervals, labels at 1 day intervals.. Labels (V1, V2, G) indicate sun positions during the spacecraft encounters. **Dot pattern**: very approximate locations of active regions.