PRELIMINARY STRATIGRAPHIC BASIS FOR GEOLOGIC MAPPING OF VENUS; A. T. Basilevsky[1,2] and J. W. Head[2], 1) Vernadsky Institute, Moscow 117975 Russia, 2) Dept. Geol. Scis., Brown Univ., Providence, RI 02912 USA

SUMMARY. The age relations between geologic formations have been studied at 36 1000x1000 km areas centered at the dark paraboloid craters. The geologic setting in all these sites could be characterized using only 16 types of features and terrains (units). These units form a basic stratigraphic sequence (from older to younger): 1) Tessera (Tt); 2-3) Densely fractured terrains associated with coronae (COdf) and in the form of remnants among plains (Pdf); 4) Fractured and ridged plains (Pfr); 5) Plains with wrinkle ridges (Pwr); 6-7) Smooth and lobate plains (Ps/Pl); and 8) Rift-associated fractures (Fra). The stratigraphic position of the other units is determined by their relation with the units of the basic sequence: 9) Ridge belts (RB), contemporary with Pfr; 10-11) Ridges of coronae and arachnoids annuli (COar/Aar), contemporary with wrinkle ridges of Pwr; 12) Fractures of coronae annuli (COaf) disrupt Pwr and Ps/Pl; 13)Fractures (F) disrupt Pwr or younger units; 14) Craters with associated dark paraboloids (Cdp), which are on top of all volcanic and tectonic units except the youngest episodes of rift-associated fracturing and volcanism; 15-16) Surficial streaks (Ss) and surficial patches (Sp) are approximately contemporary with Cdp. These units may be used as a tentative basis for the geologic mapping of Venus including VMAP. This mapping should test the stratigraphy and answer the question of whether this stratigraphic sequence corresponds to geologic events which were generally synchronous all around the planet or whether the sequence is simply a typical sequence of events which occurred in different places at different times.

INTRODUCTION. High-resolution global Magellan imagery provides an opportunity to analyze the stratigraphic relations among various features and terrains on Venus. In this work an analysis of stratigraphic relationships between 36 impact craters with dark paraboloids and other geologic formations at these localities has been done. The age relations were analyzed at the areas of about 1000x1000 km centered at the craters. Due to the nature of impact cratering the study areas seem to be randomly distributed on the surface of Venus.

STRATIGRAPHIC UNITS. We could characterise practically all geologic situations in all 36 sites using only 16 major types of features and terrains (units, see figure): 1)Tessera (Tt) represents intersecting ridges and grooves and forms continental-like blocks and small islands standing above and embayed by adjacent plains; 2-3) Densely fractured terrains associated with coronae (COdf) or forming outliers among the younger plains (Pdf); 4) Fractured and ridged plains (Pfr) forming remnants usually among plains with wrinke ridges; a typical characteristic of Pfr is the presence of relatively broad (5-10 km wide) ridges tens of km long; 5) Ridge belts (RB) consisting of clusters of densely spaced 5-10-km-wide ridges; 6) Plains with wrinkle ridges (Pwr); 7) Ridges of corona annulus (COar), outline sectors of annulus of many coronae, typically are in structural alignment with neighboring wrinkle ridges of plains; 8) Ridges of arachnoid annulus (Aar), practically are a part of Pwr wrinkle ridges network; 9)Smooth plains (Ps); 10) Lobate plains (Pl); 11) Fractures of corona annulus (COaf), usually sparsely spaced thus differing from COdf; 12) Fractures (F), identified as a separate unit only if they disrupt Pwr or younger units; 13) Rift-associated fractures (Fra), form swarms and clusters of subparallel and anastomosing faults as a rule in association with topographic troughs (chasmata); 14) Craters with associated dark paraboloids (Cdp), represent the youngest 10% of the Venus impact crater population [4]; 15) Surficial streaks (Ss), commonly darker than the background terrain, have been interpreted to be of eolian origin [5]; Surficial patches (Sp), radar-dark, tend to be in local topographic lows and against or behind positive topographic obstacles.

STRATIGRAPHIC RELATIONS AMONG THE UNITS. We used standard techniques for the determination of relative stratigraphic position [6] for each of the 36 areas establishing a stratigraphic column at each site, and then examined the relationship (correlation) between the columns to search for common themes in the sequence of events. The results of our analysis have shown that the stratigraphic sequences in all studied sites are quite similar and may be combined into a model of Venus regional and global stratigraphy (Table).

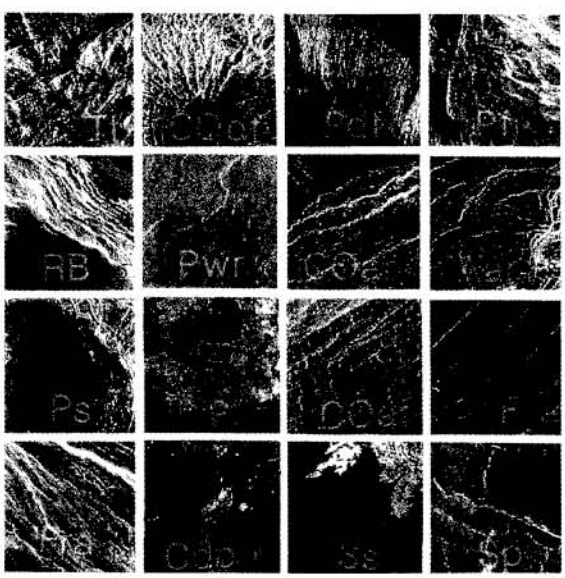
DISCUSSION. The similarity of stratigraphic columns in all 36 studied sites means that either this unit's sequence corresponds to geologic events which were generally synchronous all around the planet, or the sequence simply reflects a typical sequence of events which occurred in different places at different times, thus representing a regional tectono-magmatic cycle. The systematic mapping of Venus (VMAP program) gives a chance to resolve this alternative. Prioritizing approaches for this seems to be: 1) global-wide mapping of stratigraphically sliced structural trends (ridges, faults, tessera-forming elements) to judge whether they display a globally organized system or they are dominated by regional components; 2) analysis of relations of major stratigraphic units with such geologically instant phenomena as formation of major channels (e.g. 6,800 km long Hildr channel) [1] or crater-associated dark paraboloids [2,4]; 3)

analysis of the internal structure of the impact crater population [3] and subpopulations (percentage of craters embayed by volcanoes, deformed by tectonics). Our approach of random sampling may have left unsampled some major geologic formations, and indeed the mountain ranges of Akna, Freyja and Maxwell Montes have not been sampled, so the stratigraphic position of these unique geologic formations, important for the study of Venus, is still unclear. These and others gaps in the global stratigraphy model should be filled by systematic mapping (VMAP).

CONCLUSION. This study has shown that major mapped stratigraphic units can be indentified on Venus. Mapping of such units in 36 randomly distributed regions shows evidence for a distinctive regional and global stratigraphic sequence. This sequence, in turn, provided evidence for a stratigraphic model that highlights several major themes in the history of Venus: "catastrophic" tessera formation in the period prior about 500 m.y. ages, subsequent episodes of plains-forming volcanism alternated with episodes of extensional fracturing and compressional ridging, and geologically recent rifting and some associated volcanism. The systematic mapping gives a chance to test and improve our stratigraphic model and to resolve the alternative of the global vs. regional character of observed time sequence of geologic events.

References: [1] Baker V.R. *et al., JGR, 97*,13,421-13,444, 1992. [2] Basilevsky A.T. *GRL, 20*, 883-886, 1993. [3] Ivanov M.A. and Basilevsky A.T., *GRL, 20*, 2579-2592, 1993. [4] Campbell D.B. *et al., JGR, 97*,16249-16,277, 1992. [5] Greeley R. *et al., JGR, 97*, 13,319-13,345, 1992. [6] Wilhelms D.E., in *Planetary Mapping*, R. Greeley and R.M. Batson eds., 208-260, Cambridge University Press, NY 1990.

VENUS STRATIGRAPHY UNITS



VENUS REGIONAL AND GLOBAL STRATIGRAPHY