GRAVITY DATA ANALYISIS

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Three different efforts have been worked. The first is the reduction of raw Doppler data from the Apollo 15 subsatallite to produce acceleration profiles as a function of latitude, longitude and altitude (~15,000 new observations). The second is an investigation related to fitting long arcs of Pioneer Venus Orbiter tracking data. The third effort was the study of gravity/topography ratios which were found to have a linear trend with longitude.

Raw Doppler data from the Apollo 15 subsatellite have been archived for the past 15 years. These data have now been reduced and put in a form compactible with user-friendly software (Geophysical Data Facility (GDF) which is being sponsored by the Lunar and Planetary Institute). Approximately 150 orbits (~15,000 acceleration observations) covering a $\pm 30^{\circ}$ band of latitude with varing space altitude are plotted and described in a report entitled "User's Guide to the JPL Doppler Gravity Data Base" JPL publication 86-16. These data have been distributed to NSSDC and LPI.

Fitting long arcs of Pioneer Venus Orbiter data (>3 orbits) became a problem a few years ago when a global 10th degree and order gravity field (Mottinger et al, 1985) was being estimated. Only realistic results for the field could be obtained when short arcs of data were used (~1 to 2 orbits). Since then many tests and empirical models have been evaluated to explain the poor fits to the observations. Presently we are obtaining some encouraging results where excellent data fits have been obtained over eight orbits. It is somewhat premature to state that the previous problem is understood. It appears that significant perturbations are being produced by the high frequency (local) gravity anomalies. The introduction of many near surface mass disks in a global sense is very effective. This work will continue.

The ratios of observed gravity to theoretical gravity based on topography (ρ = 2.7 gm/cc) were calculated for 35 well defined Venusian gravity anomalies as displayed by Sjogren, et al. 1980. The anomalies were significantly greater than 5 milligals and were located between -15° latitude and 42.5° latitude. Theoretical gravity profiles were generated using USGS topography (Pettengill, et al., 1980) gridded on $2^{\circ} \times 2^{\circ}$ spacing. The extent of the topography was 60° east and 60° west of the feature being evaluated. It also extended from 60°N to 30°S and was isostatically compensated uniformly at 100 km. Some typical profiles for four features are shown in figure 1. The dotted line is gravity while the solid line is theoretical gravity based on topography having a density of 2.7 gm/cc and being compensated at 100 km. Figure 2 shows the plot of the ratios of gravity to topography. There appears to be an increasing trend in the ratios from 60°E longitude. At least two of these ratios had previously been confirmed by other investigations (Bills, Esposito, Reasenberg) for Aphrodite Terra and Beta Regio. Shallower compensation for Aphrodite Terra and deeper compensation for Beta Regio are the generally accepted statements in the literature. These new results seem to indicate that there is a definite trend eastward and possibly some internal dynamic process may be the cause of it. Certainly the 300 km isostatic depth of compensation for Beta Regio (Esposito, et al.) seems unrealistic and therefore dynamic forces sup-

porting it would be a more acceptable model. If this is so, this result may indicate a time sequence in the age of topography. This report is presently in peer review at Icarus where Sjogren, Trager and Saunders are authors.

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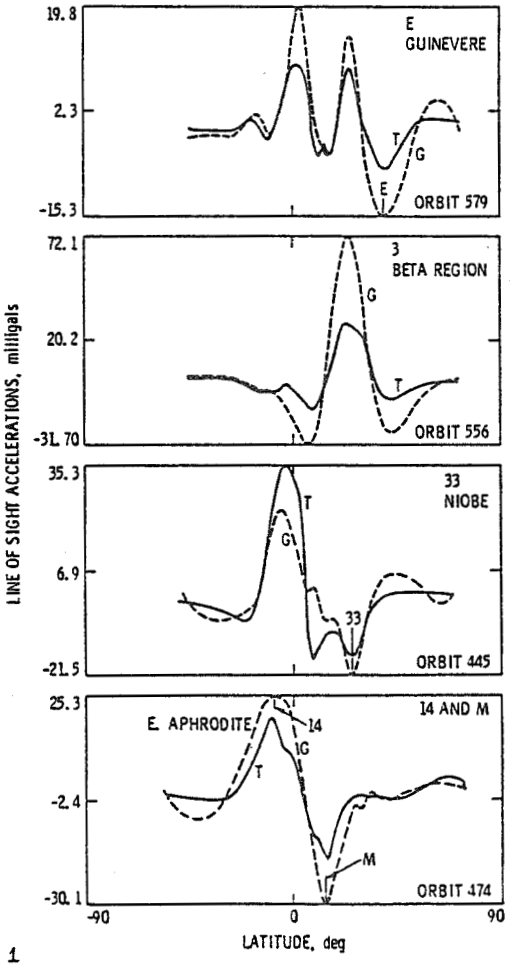
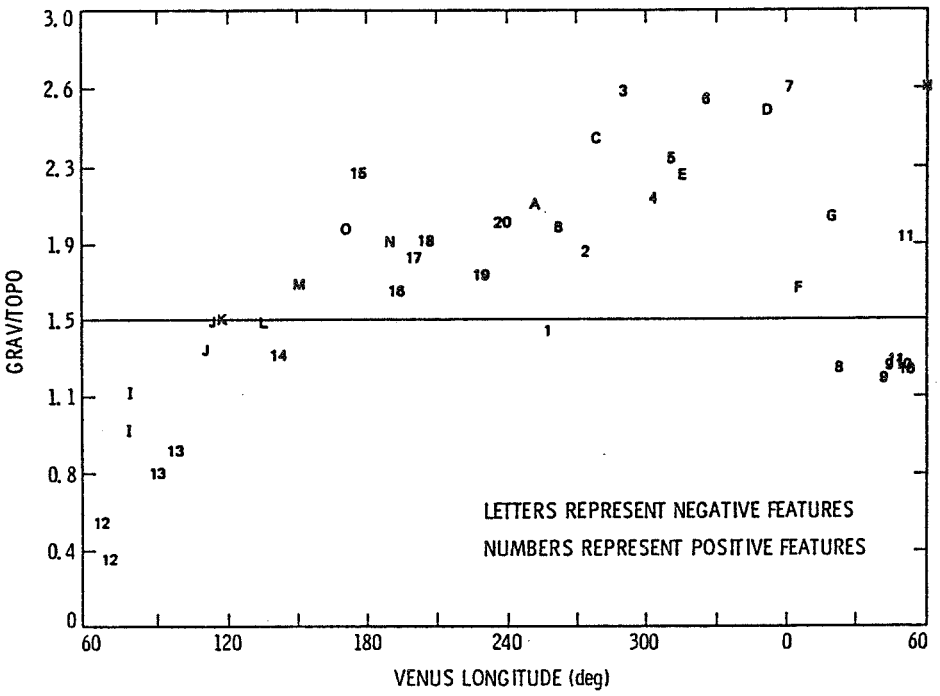


Figure 1


3.0
2.6
2.3
1.9
1.5
1.1
0.8
0.4
0
GRAV/TOPO
60
120
180
240
300
0
60
VENUS LONGITUDE (deg)
LETTERS REPRESENT NEGATIVE FEATURES
NUMBERS REPRESENT POSITIVE FEATURES

2

Figure 2