STRATIGRAPHIC POSITION OF SOME CORONAE ON VENUS. *A. A. Pronin*, University of Oulu, Dept. of Geosciences and Astronomy, Finland. Permanent address: Vernadsky Institute of Geochemistry and Analytical Chemistry, Russian Academy of Sciences, Kosygina st. 19, Moscow Russia, e-mail: abasilevsky@glas.apc.org.

INTRODUCTION The evaluation of the age status of Venusian coronae is based on detailed mapping of small areas of the surface that include coronae using Magellan imagery. The mapping allowed to construct local stratigraphic columns for areas including both coronae and regional geological units that are part of the accepted stratigraphic guidelines /1/. The result made it possible to demonstrate that the population of coronae was formed throughout the geologic history of the Venusian plains. The age position of the coronae indicates that planetary activity continued after the period of the most intensive tessera-forming deformations for at least another 20 to 30% of the observed history on an area of about 10% of the Venusian surface.

STRATIGRAPHY The most detailed of the presently available stratigraphic schemes is seems that of /1/, and this was adopted as a basis. Three major material units are identified in it. The old, Fortunian, consists of tessera material; the intermediate, Guineverian, is composed of plains material, and the youngest, Aurelian, is represented mainly by exogenic deposits of eolian and/or impact origin. Particularly interesting in the context of the present paper is the Guineverian unit, with its groups. The youngest, Atla group, is represented by plains with recognisable lobate flows. In this paper is singled out a unit of lobate plains (LbP) that fully corresponds to the plains of Atla group. The next age group singled out on the scheme /1/ is Rusalka group represented by plains with wrinkle ridges. In this work it corresponds to a unit (WRP) whose formation was consummated by the episode of the formation of wrinkle ridges (WR). Stratigraphically below Rusalka group is Lavinia group, which embraces belts of wide ridges and related plains with fractures and broad ridges (RB), and also the Sigrun group, which embraces the densely fractured plains (F); these plains have united here with tesserae (T) in a group of the oldest units. Thus three age groups (apart from Aurelian) possess the most indisputable age criteria in the stratigraphic scheme /1/. These groups are: ***young plains*** (LbP, Sm near small young volcanic edifices (Vo)), ***plains of middle age*** with wrinkle ridges (WRP), and ***old units*** (RB, F, T).

Because of the old units and middle-aged plains differ in type of deformations, they appear on the maps as clearly delineated structural zones. So, the legends of coronae maps include the core of the corona (Co), the region inside the annulus, and the surrounding annulus (Su), and sometimes of the annulus: the outer and the inner zone (SuO and SuI, respectively).

Beside of the similarity of the revealed sequences, what is important for us is the fact that in the all of the stratigraphic sections there is a geological unit with a characteristic episode of deformations - WR. It is shown /2/ that there is only the small number of lava-flooded craters and while only several impact craters have been deformed by WR, about 600 craters are superimposed on WR. This narrows the time gap between the brief consummation of the formation of the plains and the beginning of the episode of WR formation on them /1/. In this context the episode can be considered as a stratigraphic marker. It is not quite clear just how synchronous this marker is in different parts of Venus, but it possesses two important properties: universal and as yet unrefuted characteristics of brevity /1,2/.

CORRELATION Thirty-one coronae 100 to 400 km across, which are listed by /3/ and can be treated as possibly the most short-lived /4/, were investigated. The visual estimates of corona topography on the basis of altimetry served to divide them into two categories: fresh and mature coronae /5/. Having the WR as a marker the sequences of events established in the formation of coronae can be correlated in terms of age. This is the method of compiling correlation tables (Fig. 1, 2).

Each of the columns of the tables reflects an age sequence of the formation of structural elements and material units in one specific corona. It follows from the tables that: (1) The formation of some coronae unquestionably began prior to the stage of the plains and continued after their extrusion, witness the presence of remnants of old units in the structure and signs of continued deformations after the WR episode. (2) The presence of both pre- and post-plains coronae indicates that the investigated sample of small coronae formed during a period of time roughly twice as long as the mean time of the formation of a single corona provided the WR episode was indeed very brief and synchronous. If, on the other hand, we accept that all the coronae formed synchronously, then the lifetime of the sample is restricted to the lifetime of a single corona, and that upsets the synchronous character of the WR episode.

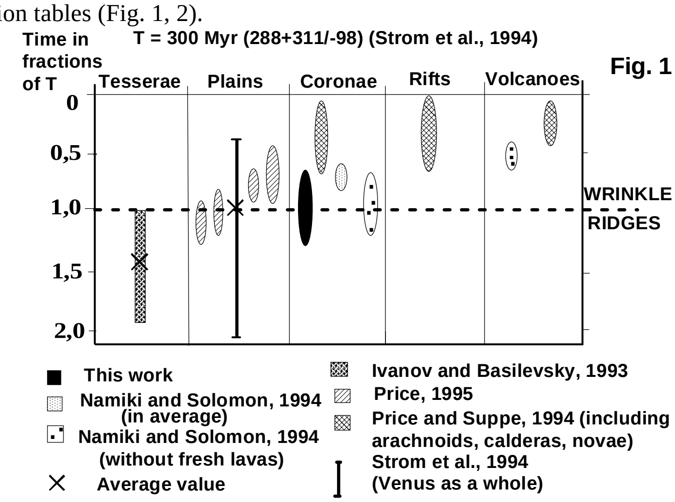

Fig. 1

Both interpretations represent extreme cases. It was found that for part of the coronae the WR episode turns out to lie within the sequence of events of their formation. Therefore, the problem of the absolute lifetime of coronae becomes closely associated with the problem of the synchronous formation of the bulk of the Venusian plains.

LIFETIME OF CORONAE Information from two sources can shed bright on the problem of the lifetime of a corona: theoretical estimates and direct observations based on crater statistics. The most trustworthy of the above estimates is that relating to the conductive cooling of the layer, for even the most effective loss of heat via advection by about half the coronae /6/ leaves behind a zone superheated with respect to the surrounding rock; the temperature of such a zone differs but slightly from the melting point, and the further life of such a zone is determined by conductive cooling (Kreslavsky, personal communication). As a result, many of the models yields a rough estimate of 100 Myr for the lifetime of a small corona /7, 8/.

The stratigraphic scheme (Fig. 1) showing the age status of the studied coronae with respect to other dated Venusian units /9, 10, 11,12/. For the coronae investigated in this study the estimates of absolute lifetimes of the population and the position of the coronae with respect to the stratigraphic marker are used. Figure 3 has been plotted for T=300 Myr /2/. However, increasing T to 500 Myr /13/ does not substantially alter the picture of the age relationships of the coronae with regional geological units.

CONCLUSIONS (1) The investigated coronae arose in the period of the formation of WRP material (and, perhaps, even earlier) and throughout the entire subsequent period to the last manifestations of volcanic activity on the plains. (2) Local stratigraphic columns differ somewhat however, if a material unit with its deformations is viewed as a structural stage, each of these columns can be described in a single legend covering three structural stages : old intensely deformed units (T, F RB), middle-aged WRP, and young LBP. In this variant, the stratigraphic scheme /1/ is corroborated in each of the investigated sites.(3) The presence of both pre- and post-plains coronae indicates that the sample of small coronae formed during a period of time roughly twice as long as the mean time of the formation of a single corona provided the WR episode was indeed very brief and synchronous. If we accept that all the coronae formed synchronously, that upsets the synchronous character of the WR episode.

MATURE CORONAE **TABLE 1**

SIZE, KM	125	150	150	150	162	170	175	175	180	180	200	200	218	225	300
Struc. stage															
UPPER			Vo			Vo	Vo		Sm			Vo			
			LbP	Vo		LbP	Sm		LbP			Sm	Sm	Vo	
	LbP	Sm	Sm	Sm		Co	LbP	LbP	Co	Vo	LbP	Co	SuI	LbP	
	Sm	LbP	SuI	Su	LbP	Su	Co	Sm	Su	Sm	Co	SuI	Co	Co	LbP
MIDDLE	WRINKLE RIDGES FORMATION														
	SuI	Su	SuO		Su		Su	SuI		Co	Su	SuO	SuO	SuI	Co
	SuO							SuO		SuI				SuO	SuI
	PLAINS WITH WRINKLE RIDGES FORMATION														
													RB		RB
		F	F				F							F	
LOWER	T F			T	T			T F			T				

FRESH CORONAE **TABLE 2**

SIZE, KM	145	150	180	190	200	200	206	220	245	290	290	300	300	300	300	37 5
Struc. stage																
UPPER	Sm	Sm										Vo		LbP		
	LbP	LbP			LbP							Sm		Co		
	Su	Co	Vo		Co		LbP		LbP			LbP	Sm	SuI	Sm	Sm
	Co	Su	Sm	Vo	Su	LbP	Sm	LbP	Sm	Sm	Vo	Co	Vo	SuO	Co	Co
MIDDLE	WRINKLE RIDGES FORMATION															
			Co	Su		SuI	Co	Co	Su	Su	Co	SuI	Co		Su	Su
			SuI	Co		SuO	Su	Su			Su	SuO	Su			
			SuO													
	PLAINS WITH WRINKLE RIDGES FORMATION															
LOWER	RB					RB						RB				
		F						F					F	F	F	
							T			T	T F					T

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