COMPOSITIONAL AND STRUCTURAL STUDY OF THE ARISTARCHUS PLATEAU FROM INTEGRATED UV-VIS-NIR SPECTRAL DATA. S. D. Chevrel[1], P. C. Pinet[1], Y. Daydou[1], D. Baratoux[1], F. Costard[2], S. Le Mouélic[3,4], Y. Langevin[3], S. Erard[3], [1]UMR5562/CNRS Observatoire Midi-Pyrénées, 14 Av. E. Belin, 31400 Toulouse, France (Serge.Chevrel@cnes.fr), [2]UMR8616/CNRS Université de Paris-Sud, Orsay, France [3]Institut d'Astrophysique Spatiale, Orsay, France.

Introduction: The Aristarchus Plateau is one of the most complex region on the Moon. It is an old rectangular elevated crustal block about 170x220 km, with its west and east borders approximately concentric to the Imbrium basin, surrounded by younger mare basalts of Oceanus Procellarum. The Plateau shows extensive dark mantling deposit (DMD) of volcanic pyroclastic origin, cratering (Aristarchus crater; 40 Km wide), and mare basalt flooding (Figure 1) [e.g., 1, 2, 3]. This region is important to understand the nature of the lunar crust and its relation with the early volcanism.

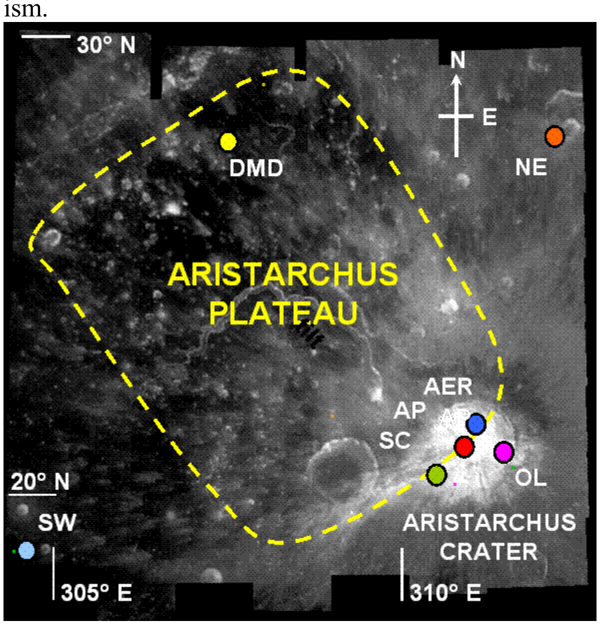

Figure 1. The Aristarchus Plateau (boundary shown by dashed line) and the area under study in this work.

Data and analysis: Following previous works [4, 5], we present here results from integrated UV-VIS-NIR (410-2000nm) Clementine spectral reflectance data [6, 7](i.e. using both the UV-VIS and NIR camera). The area under investigation is shown in figure 1. A statistical analysis (PCA: principal component analysis) has been applied to the integrated dataset in order to evidence extreme spectral behaviors in the spectral population within the Plateau. This permits to determine spectral units in relation with different types of lunar materials. Then an iterative linear mixing modeling has been applied to the dataset, using endmembers spectra determined from the PCA analysis, in order to characterize the lithology and to map geological units. This mapping gives for each unit the degree of eventual mixing of the different types of materials at the subpixel scale.

Results: The integration of the UV-VIS-NIR Clementine data and the method of analysis of the dataset permit to better characterize the composition (mafic components) of the different volcanic and crustal materials present within the Aristarchus Plateau and determine their stratigraphic relationships in order to better understand the chronology of the geologic events (tectonic, volcanic, cratering) in this region of the Moon.

Our analysis shows that seven endmembers taken in seven different geological units are requested to give a comprehensive description of the distribution and amount of surface mixing of the units present within the Plateau and its immediate vicinity. The mean spectrum corresponding to the 7 units are given in figure 2, with their mineralogical interpretation in table 1.

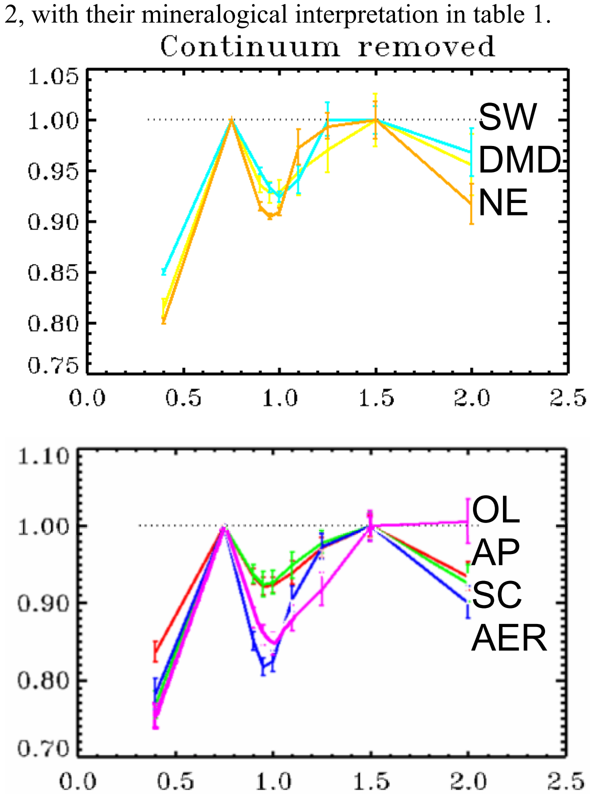

Figure 2: spectral types defined from the PCA analysis and used in the spectral mixing modeling. See Figure 1 for location and Table 1 for interpretation.

The first iteration of the spectral mixing modeling combines the four endmembers DMD-NE-AER-OL. The second and third iterations respectively combine AER-SW-SC and AP-AER-OL.

Unit	Mineralogical interpretation
NE	Crl: Pyroxene-rich materials possibly contaminated by mare materials.
AP	Crl: Anorthositic with CPX and Olivine as mafic component
AER	Crl: Anorthositic with OPX (major component) + CPX.
SC	Crl: Anorthositic with pyroxene. Similar to AP but with less feldspar.
OL	Crl: Olivine-rich materials.
DMD	Vlc: Glass-rich volcanic pyroclastic materials
SW	Vlc: Mare basalt

Table 1: Mineralogy of the spectral units identified from the PCA analysis. Crl: crustal: Vlc: volcanic; CPX: clinopyroxene (high-Ca pyroxene); OPX: orthopyroxene (low-Ca pyroxene).

Volcanic materials
Pure DMD pyroclastic materials are located around Herodotus χ and in the northern part of the Plateau. Abundances above 80% of DMD materials appear in a large portion of the Plateau, mostly in its western part. Abundances of 50-80% of DMD occur northeast of the Plateau, mixed with crustal pyroxene-rich materials (NE) and in the southern part of the Plateau mixed with anorthositic and pyroxene-rich materials (AER). It seems that DMD materials were emplaced directly on the crustal basement as we see no spectral evidence of large basaltic deposits (SW-like materials) on the Plateau.

Crustal materials
On the Plateau, north of Schröteri, and outside the Plateau, to the east (in the Krieger-Toscanelli region), craters excavate NE materials. In the southern part of the Plateau, Aristarchus and Aristarchus A craters excavate large portions of AER materials. This indicates that the basement of the Plateau (upper layer) is represented by anorthositic and pyroxene-rich (low-Ca and high-Ca) materials (NE and AER).

The interior of Aristarchus crater is represented by anorthositic materials having low and high-Ca pyroxene and olivine as mafic components. Most of the crater interior is represented by AP and AER mixed at 50-50%; pure AP being restricted to the central peak and floor and pure AER being mostly found on the northeastern interior rim. As seen above, AER is well represented on the Plateau, in the Aristarchus ejecta, mixed with DMD. Olivine-rich materials (OL) occurs outside the crater on its southeastern rim. OL mixed at 20-40% with AP and AER locally appear in the southeastern part (floor and rim) of the crater.

Our analysis shows that the regional stratigraphy, inferred from crustal materials present on the Plateau and materials excavated by the Aristarchus Plateau, is represented by deep anorthositic-rich materials overlain by pyroxene and olivine bearing crustal materials. These crustal materials are showing a more important Ca-rich pyroxene (gabbroic) and olivine-rich (troctolitic) component than found in the "usual" low-Ca pyroxene (noritic) materials forming the Imbrium basin ejecta.

The mixing modeling reveals a complex ejecta pattern for the Aristarchus crater, with large variations in the mixing of the different crustal and volcanic (mare basalts and pyroclastics) materials forming the target. In particular, the ejecta displays more mare basaltic materials (SW) than expected. The abundances, degree of mixing and the distribution of the differents materials of the units forming ejecta pattern may result from the particular geometry of the target (impact at the edge of a tilted slab).

A sequence of emplacement of the different geological units we have evidenced on the Plateau is proposed from the early emplacement of the Imbrium basin ejecta, the pyroclastic units and to the last stage of the mare basalt flooding, giving some insight on the nature of the pre-Imbrium crust and stages of volcanism in this region of the Moon.

References: [**1**] Lucey et al., (1986), JGR, 91, D344-D354. [**2**] McEwen et al., (1994), Scince, 266, 1858-1862. [**3**] Weitz et al., (1998), JGR, 103, 22725-22759. [**4**] Pinet et al., (1996), LPSC 27, 1037-1038. [**5**] Pinet et al., (1999), LPSC 30, abstract #1555. [**6**] Le Mouelic et al., (2000), JGR, 105, 9445-9455. [**7**] Chevrel et al., (2003), Geophys. Res. Abstract, EGS-Nice, 5, 14839.