A Component Research of Mare Crisium on the near side of the Moon.H. Liu[1] X. F. Zhou[1] X. W. Zhang [1]
[1]No.163 Xianlin St., Qixia District, Nanjing, Jiangsu 210023, P.R.China

Introduction: Crisium(approximately from 40 °- 75 °E longitude and 0 °-40 °N latitude) is a Nectarian-age multi-ring basin on the eastern near side of the Moon[1] bewteen Mare Fecunditatis on its south and Mare Serenitatis on its northwest.

Researches based on Fe and Ti on the lunar surface are of great importance to scientific studying and re-source studying. Fe is one of the highest abundances element in the lunar silicate mineral. By studying the abundance and distribution of Fe and Ti will help us to get a better understand of the nature and origin of the moon, and the early evolution of lunar rocks. The first global map of lunar iron was produced by[2], and they used the relationship presented by[3] to infer the crus-tal and bulk aluminum content of the Moon.

In this paper, we presented some of our results from spectroscopy of lunar minerals and Iron and Tita-nium weight percent(wt.%),and the relationship be-tween them.

Data and Methods: M^3 was a guest instrument onboard Chandrayaan-1, ISRO's maiden mission to the Moon[4]. It is an imaging spectrometer, and there-fore provides visual context to directly link spectra[5]. This enabled a more comprehensive exploration of the Crisium region than previous multispectral or spec-trometer data individual. M^3 has 85 bands across a range of 460 to 2980 nm, giving it high enough spec-tral resolution to distinguish mineral signatures[6]. In our work,for the existence of thermal emission compo-nent we abandoned the part of the spectra which wave-length is longer than 2400nm.

We carefully selected 13 fresh craters and 176 ma-ture soil distributed evenly on Mare Crisium using M^3 data. To characterize the reflectance properties of the samples we selected, we performed the band analysis to derive the central wavelengths of the 1- and 2-μm(we labeled as Band A and B) pyroxene-olivine absorption features.In order to compute the band cen-ter,band strength and band area values et al precise-ly,we have applied continuum removal by fitting a straight line continuum tangent on both sides of the absorption band for the Band A and B respectively and dividing the spectra by the separately comtinuum.

Results: Spectra of the fresh craters from most of the basaltic units of Mare Crisium present strong Band A and Band B absorption features with subtle varia-tions in band strength, band center and band ar-ea(Fig.1). By performing continuum removal we obtain the band center of Band A and B and plotted them in a scatter plot(Fig.2) along with the scatter plot of pure

ortho-and clino-pyroxenes given by[7] and modified by [9].Band Aand B centers of synthetic pyroxenes as obtained from[10] are also plotted in the same Band A versus Band B scatter plot as shown in Fig.2 for com-parison purpose. The band centers of small fresh cra-ters of Mare Crisium typically range from 959nm to 978nm for Band A which has been proved related to Fe^{2+} in sixfold coordination[7]. Band centers of Band B typically range from 2018nm to 2098nm. As the only mineralogical component of lunar soil that contains a significant band near 2 μm is pyroxene[7][8], we can deduce the type of pyroxene by studying the band cen-ter of Band A and Band B. From Fig.2, the band cen-ters of Mare Crisium appear between synthetic OPX and synthetic CPX and much alike to nature CPX and synthetic Pig. For Band A samples located at the north-east of the study area appears to have lower band strength than those located at southwest however Band B shows the opposite result, which indicating the dif-ference between ferrous iron content and pyroxene types of Mare Crisium in northeast and southwest.
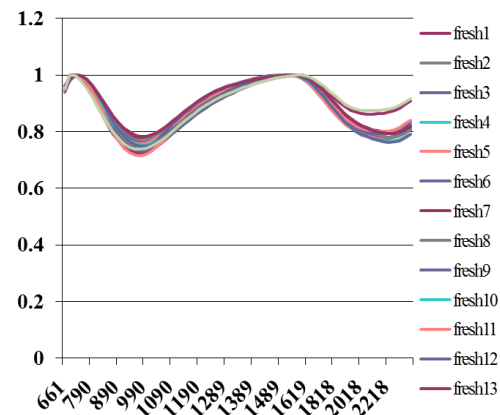

Figure 1:specral of 14 samples of fresh craters from Mare Crisium after performing continuum re-moval showing strong strong Band A and Band B ab-sorption features.
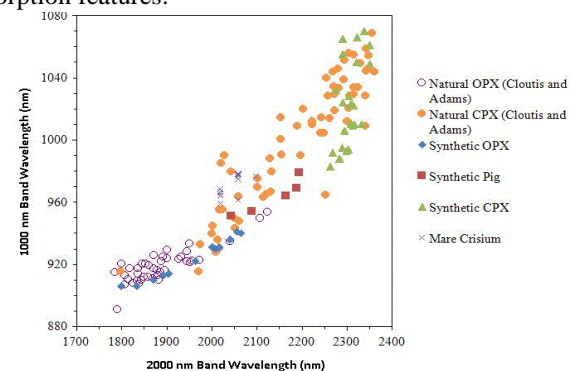
Figure 2: Comparison of Band A and B positions for fresh craters with different kind of pyroxene. Band center values of the fresh craters of Mare Crisum fall in the low to moderate natural CPX domain indicating subcalcic to calcic augitec compositional range.

The band center of Band A reflectance ratio of mature soil calculated by continuum removal plotted versus wt.%FeO is shown in Fig.3. For fresh craters, there is no systematic relationship between reflectance ratio and wt.% FeO, whereas for mature oils the Band A reflectance ratio is related negatively linearly to wt.% FeO. It should be noted that,the relationship between fresh crater flectance reatio may become apparent when enough fresh craters of similar exposure degree be compared.
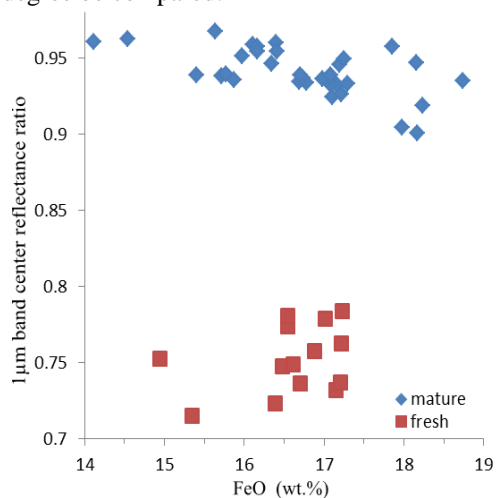

Figure 3:scatter plot of Band A band center reflectance ratio versus wt.% FeO for the highland soils and fresh catrers.

Based on global map of lunar iron produced by [2] ,we have constructed the map of classified FeO and TiO_2 wt.% . These images are mosaicked to cover the approximate exent of the Mare Crisium(Fig.4). We divied TiO2 wt.% into five parts,<1.0 very low(cyan),1.0-4.5 low(yellow),4.5-7.5 intermediate(brown),7.5-10 high(purple),>10 very high(orange) in fig.4(b). For FeO, fig.4(a) shows north-south line of high value distribution and high values clustered at fresh crater, which agrees with what we can see from Fig.3 that for fresh craters FeO wt.% seems to be higher in mean than mature soils. Fig.4(b) shows TiO2 wt.% also increases near fresh craters and we can see near the big impact crater in the west of Mare Crisium appears very high TiO2 wt.%. According the FeO and TiO_2 content inversion results,for FeO wt.%, of Mare Crisium,the maximum value is 23.07 wt.%, and the mean value is 7.36 wt.%.For TiO_2 wt.%, in the same case, the maximum value is 37.90 wt.%, and the mean value is 1.91 wt.%.
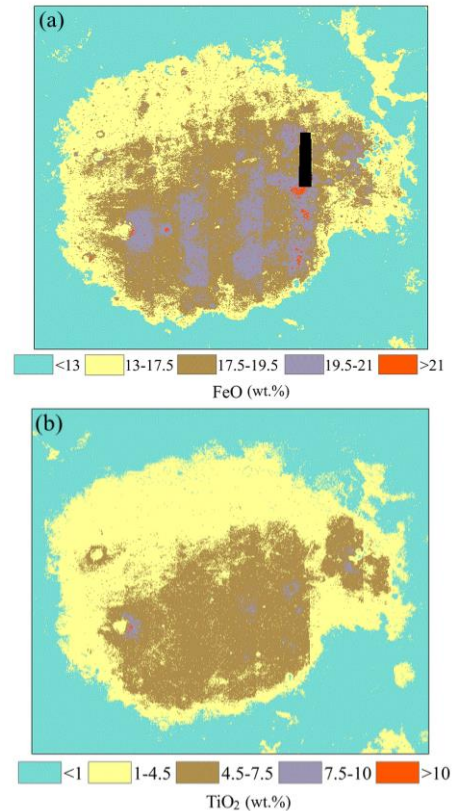

Figure 4:(a)map of FeO wt.% (b) map of TiO_2 wt.% (both the two map's law of classification is based on experiments in order to show the FeO wt.% or TiO_2 wt.% feature in a more distinguishable way)

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