SPATIAL DISTRIBUTION OF OLIVINE IN THE SINUS IRIDIUM USING M^3 DATA.

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Introduction: Olivine in particular is a useful mineral with which to evaluate the geologic evolution of igeneous planetary bodies such as the Moon [1], as it is commonly the first mineral to crystallize from typical mafic magmas [2]. Recent results suggest that olivine is exposed largely in and around the rims of large lunar impact basins [3]. However, many of the detections are associated with exposures of plagioclase reported by Ohtake et al [4]. The distribution, compositon and degree (high Mg# or low Mg#) of the olivine is an important indicative clue to the olivine's soure and history [1,5].

Here we present an olivine survey of the Sinus Iridium using M^3 data. Base on the local geologic context, we found many exporures of olivine are located in the interior crater slopes and debris ejected from the impact-formed Iridum crater. Some of the olivine-rich sites are associated with plagioclase.

Data and Methods: The dataset used was acquired by the Global model Level-2 M^3 reflectance data, which comprises of 7 M^3 strips each with 83 near-contiguous bands spanning 540-2980nm. The spatial resolution is 140 meters and the spectral resolution varies between 20-40nm depending upon spectral range. The data is photometrically and thermally corrected. For carrying out regional study, we collected one spectral reflectance curve at intervals of ten pixels in black box (Fig.1), and these areas are fresh craters and slopes where the effect fo space weathering is minimal. To ameliorate the effect of the instrument distortions we fit the spectra using moving average method smoothing spline.

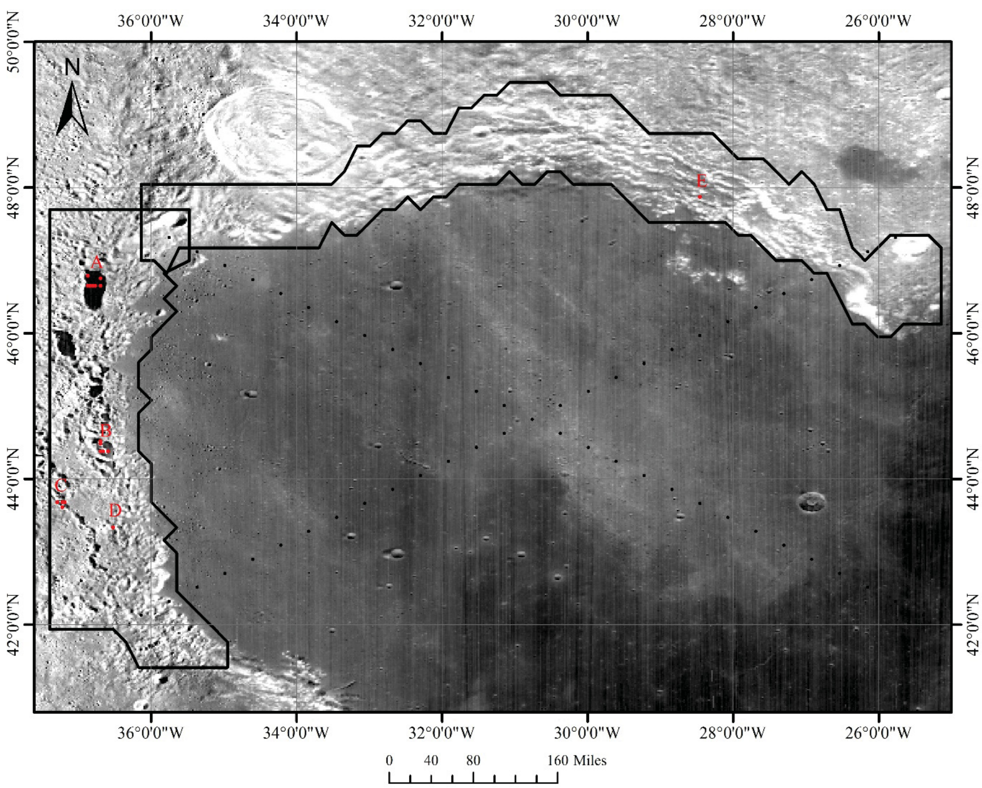

Figure 1:The distributiong of olivine-rich poits (red points) in the Sinus Iridium. The background map is the mosaic image of Sinus Iridium using M^3 data (1009nm reflectance image).

Spectral Feature Fitting (SFF) is an absorption-feature-based methodology by least-squares technique, which for matching the unknown spectra to laboratory reflectance spectra using the depth and shape feature

[6,7]. We have applied SFF to matching the spectra derived from the M^3 data to the spectra of lunar samples measured in Earth-based laboratory, and the scale value is calculated for each reference spectrum. The points are selected as olivine-rich points, which obtained the highest scale value by comparing to the reference spectrums of the olivine.

Result and discussion: In Fig.1 we plot 24 olivine-rich points on the masaic image fo Sinus Iridium. Most of thesd points are grouped into several sites. Therfore,we divided the 24 points to 5 sites (A,B,C,D and E sites in Fig.1). The representative spectra for the individual olivine-rich sites are shown in Fig.2. Most of the spectra in Fig.2 show clear olivine absorption bands within the wavelength range of λ=1050±50nm after removing a linear tangential continuum, on the other hand, the absorption valley positon of spectra for adjacent to areas olivine exppsures are tended to shift toward the right to longer wavelengths, which lead to unclear to allow correct interpretation of their mineral compositons. This is may be due to the presence of minor amounts of plagioclase and plagioclase is difficult to detect in the near-infrared when mixed with absorbing mafic minerals like pyroxene and olivine.

Taking into account the Sinus Iridium geologic context [8], we conducted the survey of the geological unit corresponds to each olivine-rich sites. Sites A, B and D are located on the slope material, which including Relatively fresh rock fragments derived by slumping and spalling. Site C is located on the debris ejected form the impact-formed Iridum crater, which are either roughly concentric or radial to crater. Site E is located on the complex mixture of slumped Iridum ejecta.

Concerning the oliving-rich material originate, the recnet study propose two possible seenarios. The olivich exposures originated in the upper lunar mantle or priginates form the mafic-rich lower crust [3], and some researchers identified in association with unusual exposures of olivine, orthopyoxene and spinel (OOS) [9,10], which supported for Mg-rich pluton intruding into the lunar lower crust. Therefore, future work on this topic will make general predictions of olivine compositing (Mg/Fe content) with higher spatial resolution than the Global model of M^3 image (140m).

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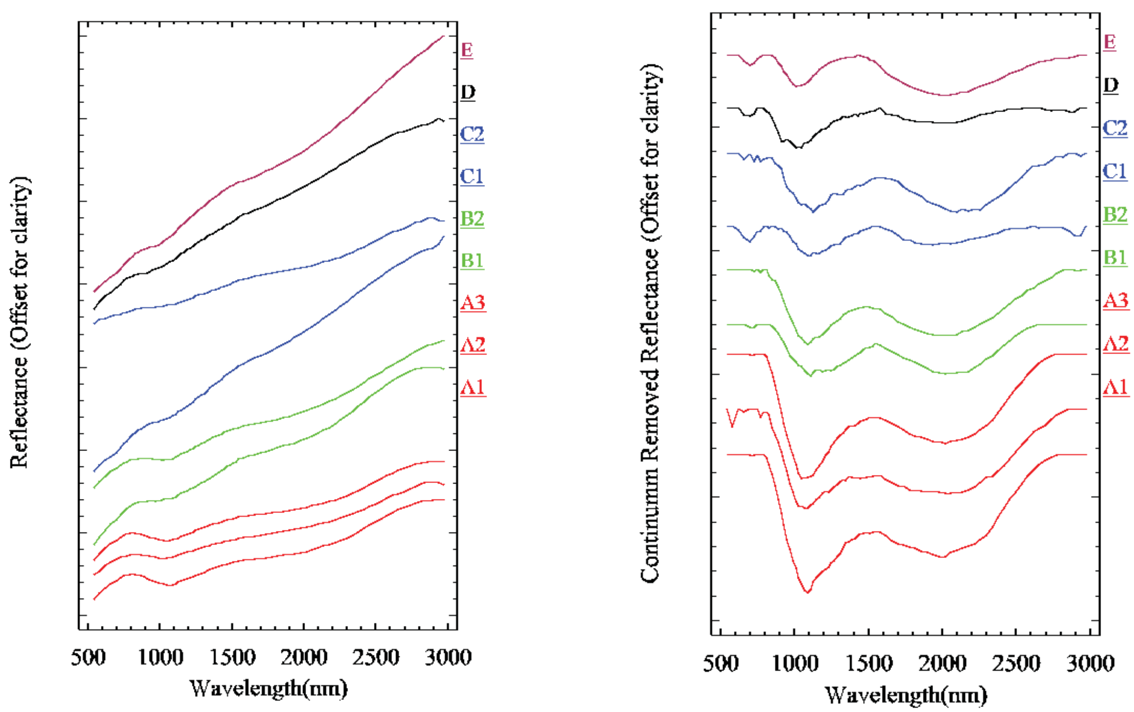

Figure 2: The representative reflectance spectra (left) and continuum removed reflectance spectra (right) for the olivine-rich sites. All sepctra have been certically offset for clarity.