MINERAL CHEMISTRY OF TWO NEW MARE BASALTS NORTHWEST AFRICA (NWA) 14526 AND NWA 14992

Peiyi Li [1,2] and Yun Jiang [1], [1] Purple Mountain Observatory, Chinese Academy of Sciences, Nanjing 210023, China (E-mail: yjiang@pmo.ac.cn)
[2]School of Astronomy and Space Sciences, University of Science and Technology of China, Hefei 230026, China

Introduction: Lunar mare basalts are considered to have formed by the remelting of the lunar magma ocean (LMO) cumulate mantle at a depth of 100 to 400 kilometers, which can provide essential information for the origin and evolution of the lunar interior [1]. Lunar return samples collected by the Apollo, Luna and Chang'e-5 missions are from limited areas, while lunar meteorites sample from random areas on the lunar surface [2], among which some of them may be pairs. Northwest Africa (NWA) 14526 and NWA 14992 are two lunar basalt meteorites newly discovered. In this work, their mineral chemical characteristics are preliminarily reported, to explore the genetic relationship with NWA 10597.

Method: Scanning electron microscope (HITACHI S-3400N II) were used to observe the petrography characteristics of the samples. Electron probe (JOEL JXA-8230) was used to quantitatively analyze the chemical composition of minerals. Raman spectroscopy (RM-2000) was used to measure the Raman spectra of some minerals in situ.

Result and Discussion: The main mineral phases of NWA 14526 and NWA 14992 are pyroxene (model abundance is 61.5 vol.%, 51.5 vol.%, respectively), feldspar (20.8 vol.%, 30.4 vol.%), olivine (10.7 vol.%, 13.1 vol.%) and a small amount of ilmenite (2.9 vol.%, 2.8 vol.%). According to the X-ray elemental image (Fig. 1b, d), the petrography of NWA 14526 can be divided into two different areas, which we call Ilmenite-Poor (IP area) and Ilmenite-Rich (IR area), respectively. The feldspar in IP area is rich, olivine ($Fa_{42.7\text{-}53.9}$) and pyroxene ($Fs_{20.7\text{-}33.5}$) are more Mg-rich; Pyroxenes in IR area have obvious composition zones ($Fs_{22.5\text{-}63.5}$), and olivine is more Fe-rich ($Fa_{59.6\text{-}85.7}$). NWA 14992 also has the same IP and IR areas as NWA 14526. Mineral phases of the late stage of magma crystallization occurred in the IR area, such as silica, phosphate, baddeleyite, tranquillityite and monazite. Both NWA 14526 and NWA 14992 have high shock metamorphism, including impact melting veins (3.5 mm long) and melt pockets, and most of feldspar has been transformed into maskelynite as Raman spectra show.

The chemical composition of olivine ($Fo_{14.3\text{-}57.3}$), pyroxene ($En_{19.2\text{-}61.1}$) and feldspar ($An_{82.4\text{-}93.5}$) of NWA 14526 is very similar to that in NWA 14992 ($Fo_{16.1\text{-}57.3}$, $En_{20.24\text{-}59.5}$, $An_{82.3\text{-}92.5}$, respectively), The correlation of Ti/(Ti+Cr) and Fe/(Fe+Mg) of pyroxene in NWA 14526 and NWA 14992 is consistent with the evolution trend of low-titanium basalt [3] (Fig. 1f). The preliminary results show that NWA 14526 and NWA 14992 probably belong to a pair of low-titanium mare basalts, and they are closely related to NWA 10597.

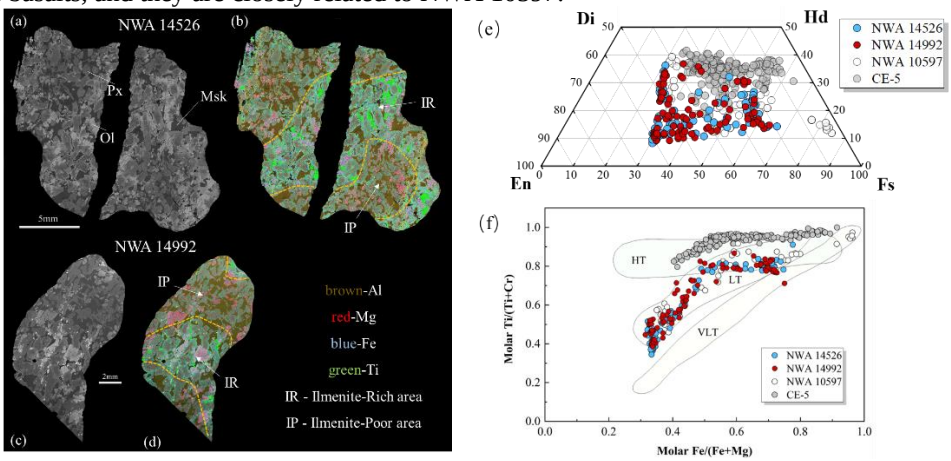

Fig. 1 BSE images and X-rays elemental image of NWA 14526 (a, b) and NWA 14992(c,d); Chemical composition diagram of pyroxene (e) and evolution trend of Ti# and Fe# composition of pyroxene (f); CE-5 data are from [4] and NWA 10597 data are from [5]. Px: pyroxene, Ol: Olivine, Msk: maskelynite.

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