GEOCHEMICAL AND PETROLOGICAL CHARACTERIZATION OF FOUR NEW SHERGOTTITES

K.J. Orr[1], L.V. Forman[1] and G.K. Benedix[1]
[1]Space Science and Technology Centre (SSTC), School of Earth and Planetary Sciences, Curtin University, Perth, Australia.
Email: kenneth.orr@postgrad.curtin.edu.au

Introduction: Martian meteorites represent the only suite of geological samples from Mars that we have on Earth. They are extremely rare, comprising < 0.5% of the total number of confirmed meteorites. Thus, new additions to this suite of meteorites represent an important and significant opportunity to expand our understanding of the geology of Mars. Northwest Africa (NWA) 10441, 10818, 11043, 12335 were all found within the last 5 years, and classified as Martian shergottites (MetBull issues 104-107). Shergottites are the most abundant and diverse type of Martian meteorite. Classified into six textural sub-groups, they represent a wide variety of magmatic, geochemical and impact related processes. This makes them a powerful tool for unraveling the geological history of Mars. NWA 10818 and 11043 were provisionally classified as poikilitic, while NWA 10441 and 12335 were classified as diabasic. Here we report new geochemical and petrological data to confirm the shergottites initial classification and then to further characterize their mineralogical and petrological relationships.

Methods: Thin-sections of each meteorite were made from ~0.6 g chips of the samples that we acquired from UNM. These were analyzed using a Tescan Integrated Mineral Analyzer (TIMA) which produces high-resolution mineral maps and calculates modal mineralogy of each sample. NWA 11043 was also analyzed using Energy Dispersive X-Ray Spectroscopy (EDS) with a MIRA3 scanning electron microscope (SEM) to determine preliminary mineral compositions. Further EDS and other e-probe (EPMA and EBSD) analysis will be carried out on all samples.

Results and Discussion: The diabasic shergottites, NWA 10441 and 12335, are primarily composed of pyroxene; ~52% and ~68%, respectively. Pyroxene generally has low-Ca pigeonite cores, with high-Ca augite rims. Both samples contain ~27% and ~36% maskelynite (shocked plagioclase), respectively. They also contain accessory phases of apatite, ilmenite, pyrrhotite, magnetite and a Si-rich mineral. The average grain sizes range from 1-2mm with NWA 12335 exhibiting a slightly coarser texture. The poikilitic shergottites, NWA 10818 and 11043, are primarily composed of pyroxene (~52% and ~37%) and olivine (~41% and ~51%). Maskelynite is also present at ~2% and ~6%, respectively. Accessory phases include apatite, pyrrhotite, Cr-spinel, magnetite and a Si-rich mineral. Both sections display areas of poikilitic and non-poikilitic texture. The pyroxene oikocrysts (low-Ca pigeonite with high-Ca augite rims) enclose olivine chadacrysts. Preliminary analysis of pyroxenes in NWA 11043 have compositions of pigeonite, En_{38-47} Wo_{5-19} Fs_{43-50} and augite, En_{30-35} Wo_{29-45} Fs_{25-36}. NWA 10818, 11043 and 12335 have Ca-rich minerals, possibly carbonate, occurring as veins throughout the sample, most likely due to terrestrial weathering [1].

We confirm the initial classification of NWA 10818 and 11043 as poikilitic shergottites and NWA 10441 and 12335 as diabasic shergottites. The diabasic shergottites display very similar textures to other diabasic shergottites, such as Los Angeles and NWA 8657 [2,3]. The primary difference is the lack of olivine (Fig 1). The poikilitic shergottites display similar textures to other poikilitic shergottites, such as RBT 04262 and NWA 4797 [4,5]. Further petrological and geochemical characterization will be presented at the meeting.

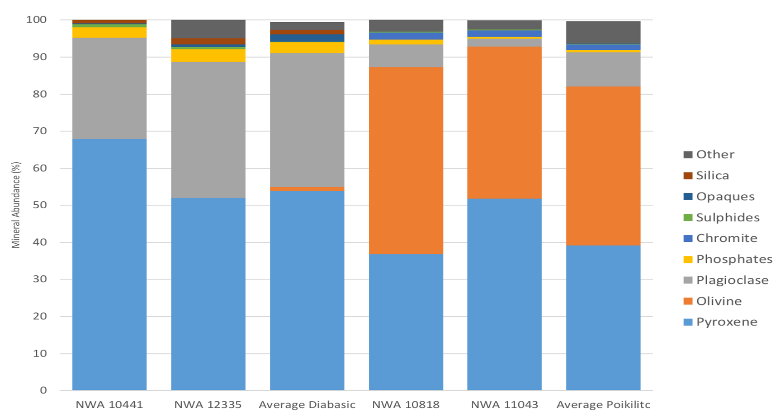

Figure 1. Mineral modal abundances of the four new shergottites compared to diabasic and poikilitic shergottite averages [3,4,5,6,7,8,9,10,11,12,13].

References: [1] Crozaz G. and Wadhwa M. (2001) *Geochimica et Cosmochimica Acta* 65: 971-978. [2] Rubin A.E. et al. 2000. *Geology* 28: 1011-1014. [3] Howarth G.H. et al. 2018. *Meteoritics & Planetary Science* 53: 249-267. [4] Usui T. et al. 2010. *Geochimica et Cosmochimica Acta* 74: 7283-7306. [5] Walton E.L. et al. 2012. *Meteoritics & Planetary Science* 47: 1449-1474. [6] Roszjar J. et al. 2012. *LPS XLIII,* Abstract #1780. [7] Hui H. et al. 2011. *Meteoritics & Planetary Science* 46: 1313-1328. [8] Mikouchi T. (2001) *Antarctic Meteorite Research* 14: 1-20. [9] Stöffler D. et al. 1986. *Geochimica et Cosmochimica Acta* 50: 889-903. [10] Mikouchi T. et al. 1996. *LPS XXVII,* Abstract #879. [11] Walton E.L. et al. 2009. *LPS XL* Abstract #1464. [12] Treiman A.H. et al. 1994. *Meteoritics* 29: 581-592. [13] Lin Y. et al. 2005. *Meteoritics & Planetary Science* 40 (Suppl.):5154.