Discovery of a meteorite that corresponds to the D asteroids and future of attempts of finding asteroid materials among meteorites

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Although majority of meteorites are believed to come from asteroids, visible-NIR reflectance spectra of meteorites and asteroids do not always have one-to-one correspondence. For example, for the last 30 years no meteorite had been found to correspond to the P and D type asteroids which distribute around the outer part of the main asteroid belt. It was believed to be because they do not come to the earth at all or they are destroyed at the atmospheric entry. However, a new kind of carbonaceous chondrite, Tagish Lake, has been found to have a reflectance spectrum very similar to those of the D asteroids in both the spectral shape and brightness.

Although majority of meteorites are believed to come from asteroids, visible-NIR reflectance spectra of meteorites and asteroids do not always have one-to-one correspondence. The correspondence between asteroid (4) Vesta and HED meteorite was the first and best case, and other cases are not so certain, have problems such as the famous the S asteroids-ordinary chondrites controversy, or simply there is no meteorite counterparts for some asteroids.

However, through recent process of study on space weathering effect and discoveries of new meteorites, correspondence of asteroid surface mineralogies and meteorites came to be understood better. This time the D asteroids are spotted, which together with the P asteroids distribute around the outer part of the main asteroid belt. Their counterpart meteorites had not been found even after the last 30 year studies. Basically, the P and D asteroids are believed to have more carbon and/or organics than any known carbonaceous chondrites, and it was believed that they never came to the earth at all or are destroyed at the atmospheric entry.

However, a new kind of carbonaceous chondrite, Tagish Lake, has been found to have a reflectance spectrum very similar to those of the D asteroids in both the spectral shape and brightness. Amont the D asteroids, (368)Haidea is spectrally the most similar to Tagish Lake.

Haidea lies at about 0.2 AU inner orbit from the 2:1 mean motion resonance with Jupiter, similar to the situation that Vesta lies in an orbit inside the 3:1 mean motion resonance with Jupiter about 0.2 AU away. Therefore, the possibility can't be denied that Tagish Lake came from this Haidea.

Tagish Lake is given a new suggested group name of CT2 consisting of abundant opaque minerals and completely hydrated minerals. This example is similar to the incident that among the meteorites Japanese Antarctic exploration tems brought back were the meteorites which were found to correspond to the C, G, B, and F asteroids about 10 years ago.

What we can learn from these examples is that by new kinds of meteorites being found in the future or measuring reflectance spectra of more preexisting meteorites, more asteroid materials can be found among meteorites.