COMPARISON OF ORGANIC MATTER IN COMETS CHURYUMOV-GERASIMENKO & WILD 2 AND IN IDPS.
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Introduction: Infrared spectra of comet Churyumov-
Gerasimenko acquired by the Visible and Infrared Thermal Imag-
ing Spectrometer (VIRTIS) on the Rosetta spacecraft show a
broad absorption between ~2.8 to 3.8 µm, where C-H, O-H, and
N-H stretching features occur [1]. VIRTIS-H, covering the range
2 to 5 µm with high spectral resolution (λ/∆λ = 3000 at 3 µm),
resolves features within this broad absorption. The strongest ab-
sorption features in published VIRTIS-H spectra occur between
3.1 and 3.3 µm [1], consistent with aromatic C-H. Since this re-
gion of the infrared spectrum has been well studied in meteorites,
interplanetary dust particles (IDPs), and samples of comet Wild 2
collected by NASA’s Stardust spacecraft, a comparis-
on with the organic matter reported on Churyumov-Gerasimenko is possible.

Comparison: While the Stardust aerogel contained signifi-
cant organic contaminant, the infrared spectra of track-free re-
gions of flight aerogel showed no detectable feature between 3.1
and 3.3 µm [2]. Contamination in the 3 µm region was dominated
by a strong aliphatic –C-H absorption feature at ~3.37 µm [2]. In
some cases aliphatic –C-H2-, associated with tracks produced by
the captured particles, was detected at 3.42 µm, but aromatic C-H
was below the detection limit [2], and the spectrum was feature-
less from 3.1 to 3.3 µm. These Wild 2 spectra are quite different
from the VIRTIS-H spectrum of the surface of Churyumov-
Gerasimenko, where any –C-H2- feature is significantly weaker
than the 3.1 to 3.3 µm feature. Aromatic C was detected by Ra-
man and C-XANES in some Wild 2 particles [2], indicating the
presence of C-rings, but their H was too low to be detected in the
infrared. The 3 µm region of spectra of the Wild 2 organic matter
is very similar to the spectra of chondritic porous (CP) IDPs [3],
suggested to have a cometary origin [4], which have aliphatic C-
H features between 3.3 and 3.6 µm (with a –C-H2- to C-H3 area
ratio of ~2.5), but no detectable features between 3.1 and 3.3 µm.

Discussion: The organic matter detected on the surface of Chu-
ryumov-Gerasimenko is distinctly different from that in Wild 2
particles and CP IDPs. One possible reason is that Churyumov-
Gerasimenko and Wild 2 are very different comets. However,
orbital modeling indicates both are Kuiper Belt comets of similar
size, ~4 km for Churyumov-Gerasimenko and ~5 km for Wild 2,
and that each was recently perturbed into its current orbit. Chu-
ryumov–Gerasimenko’s perihelion was about 2.7 AU until Febru-
ary 1959, when a Jupiter encounter moved its perihelion inward
to about 1.3 AU. Wild 2 orbited outside of Jupiter until Septem-
ber 1974, when a Jupiter encounter changed its orbital period
from 43 years to about 6 years, and its perihelion to 1.59 AU.

Alternatively, because the majority of the Wild 2 particles like-
ly originated in the interior, since active dust detectors recorded
rapid changes in flux consistent with the passage of Stardust
through dust jets [5], while VIRTIS measured the spectrum of the
exposed surface of Churyumov-Gerasimenko, the surface ma-
terial of a comet may not be representative of its bulk material.