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Subject: Email report-ERA17FA231
Date: Wednesday, December 12, 2018 5:27:38 PM

Tim,

A sample of an unknown solid from the vacuum regulating valve port of the accident aircraft was submitted to the Materials Laboratory. The sample was submitted to identify the material.

The material was visually examined using a 5-50x stereo zoom microscope. The material consisted of yellowish-brown spherical particulates. Plant material was entrained within the yellowish-brown material. The symmetrical morphology of the material suggested that the material was possibly a biological material. Pictures and scanning electron micrographs were sent to the Collections Manager at National Museum of Natural History Department of Entomology. The entomologist determined that the unknown material was likely insect frass (insect excretions).

A sample of the unknown material examined using a Fourier Transform Infrared (FTIR) spectrometer with a diamond attenuated total reflectance (ATR) accessory in accordance to ASTM E1252-98 (American Society for Testing Materials E1252-98: *Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis*). The spectrometer was used to collect and process infrared wavelength absorbance spectra of the unknown material(s).

The spectrum for the material contained the following combination of spectral peaks corresponding to particular functional groups found within molecular structure of the material. The presence of a strong shouldered peak $\sim 3280\text{ cm}^{-1}$ is indicative of a nitrogen-hydrogen stretching bond (N-H). The widened base of this peak also indicates the presence of an oxygen-hydrogen (O-H) bond. The presence of a strong doublet peak between $\sim 2920\text{ cm}^{-1}$ and $\sim 2850\text{ cm}^{-1}$ is indicative of a carbon-hydrogen (C-H) single stretching bond. Peaks at $\sim 1600\text{ cm}^{-1}$ and 1570 cm^{-1} are indicative of a nitrogen-hydrogen (N-H) bending bond. Peaks at $\sim 1070\text{ cm}^{-1}$ and 1020 cm^{-1} are indicative of carbon-oxygen (C-O) and carbon-nitrogen (C-N) stretching bonds. The spectrum was consistent with a carbohydrate. A spectral library search was performed on the unknown spectrum. The search found several spectra of various polysaccharides with similar spectral patterns, but no strong matches were found.

Based on the findings of the entomologist, a reference spectrum for chitin, the main constituent of insect frass, was found. The reference spectrum was visually compared to the unknown spectrum. The unknown material was a strong match for chitin.

Since the aircraft had been stored for a period of time prior to the wreckage examination, it is likely insects made a nest in the port leaving behind the frass.