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Evaluation of Magnetic Microspherules and Elemental Data from Pre-Younger Dryas to Recent Age Deposits at Squires Ridge (31ED365), Tar River, North Carolina



Abstract

A sediment column (0-110 cm) from Squires Ridge (38ED365), a stratified archaeological site on the Tar River in North Carolina, was analyzed to evaluate magnetic microspherules and other geochemical markers reported for the lary (YDB). Here we report on microspherules using a Scanning Electron Microscope (SEM) and roscopy (EDS) along with bulk sediment geochemistry, carbon and nitrogen isotopes ence dates for pre-Younger Dryas to recent age deposits. We report the presence of large istent with data reported for the GISP2 ice core and occurring within a modal peak (ingle-grain OSL, and AMS dating all indicate that the buri 82.5 cmbs at SR. Since the inferred location of the YDB at SR is between ~ 8 ers immediately above the YDB is most likely due to reworking of sediments tation is supported by the presence of 44% of the grains from the lower OSL sample that date to the uities or where changes in grain size occur. Analysis of the fine magnetic grain fraction ent with the YDB at many other sites (LeCompte et al. 2012) ations by depth suggest multiple and chronologically asynchronous formation les appear to be industrial fly ash and unrelated to more deeply buried spherules. Stable sotopes reveal no obvious change across the Pleistocene-Holocene transition or correlation with spherules, although a nid- Holocene shift may represent changes in climate and vegetation.

Methods

Microspherules. The magnetic fraction of each 2.5 centimeter (cm) interval sediment sample from Squires Ridge was extracted using a (grade-52) neodymium (NdB) magnet following the original protocol established by Firestone etic grains are extracted, they are size-sorted through USGS testing sieves in order to nagnetic grains (LeCompte et al. 2012). For this study, magnetic grain ope for the presence of microspherules. Once located, microspherules are carefully Electron Microscope (SEM) analysis stubs and imaged with a SEM and Energy Dispersive to evaluate surface textures and elemental composition. Relative spherule abundance is

Stable Isotopes. For stable isotope analyses, 10% HCl was added to bulk sediment to remove carbonates and the rinsed with distilled water until neutral. Samples were then dried at 50°C and homogenized into using a mortar and pestle. Bulk sedimentary δ^{13} C, δ^{15} N, %C, and %N analyses were conducted using a Analyzer paired with a Thermo Delta V Plus continuous flow mass spectrometer. All carbon itions are reported in standard δ –per mil notation relative to the Vienna-Pee Dee arine-carbonate or Air standard, respectively, where: δ^{13} C or δ^{15} N (per mil) = 1000 $[(R_{comple}/R_{stendard}) - 1]$, where $R = {}^{13}C/{}^{12}C$ or ${}^{15}N/{}^{14}N$, respective

of sediment samples was performed by Actlabs Inc. using both the 1C-Research and 1EX analyses. **Particle-Size Analysis.** The CamsizerTM (from Retsch) is a desktop instrument used for simultaneous measurement of particle size distribution, particle shape, and additional parameters of dry materials ranging in size unique scanning of all particles, combined with measurement algorithms, means that the measuring results are 100% compatible to those of sieve analysis. Particles fall through a feeder slot and are imaged by two calibrated camera systems that collect roughly 60 images per second. Typically 1-4 million measurements are made for each sample and statistics include mean diameter, sphericity, elongation, and others. Particle diameters are measured in μ m and then converted to the phi scale (Φ) using standard conversions (Folk 1968). Calculations such as graphic kurtosis and inclusive graphic standard skewness, were made following the methods outlined in Folk (1968).

Study Area



Aerial /LiDAR overlay showing Squires Ridge (31ED365) (Moore 2009).

0 0.05 0.1 0.2 0.3





meteoritic abundance of Pt/Pd based on Rudnick and Gao (2003). "CI" = Chondrite.