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We demonstrate the biosignature detection capabilities of several classes of instruments, including a compact laser desorption/ionization time-of-flight mass spectrometer, an acousto-optic tunable filter IR point spectrometer, a laser-induced breakdown spectrometer, and a scanning electron microscope. We collected biotic and abiotic calcite, gypsum, and manganese oxide samples from Fort Stanton Cave to identify the presence of biomarkers with each instrument class. We find evidence of biologic activity in these samples including the presence of organic molecules, macroscopic and microscopic morphological features consistent with fossilized mircobes, and the presence of trace elements consistent with the biotic precipitation of minerals. The identification of extant or extinct microbial life is best supported by a suite of biosignatures, rather than a single observation. We demonstrate the unique biosignature detection results of each instrument class and discuss the importance of developing an instrument suite for future landed astrobiology missions on other planetary surfaces.