

CONSTRUCTING AN UPDATED CATALOG OF NEARBY HABITABLE STELLAR SYSTEMS WITH ELEMENTAL RATIOS. N. Tr'Ehnl¹, F. X. Timmes¹, M. Turnbull², P. A. Young¹, and S. Schmidt¹, ¹Arizona State University School of Earth and Space Exploration (P.O. Box 871404, Tempe, AZ 85287-1404; nahks@asu.edu, ftimmes@asu.edu, patrick.young.1@asu.edu, Sandra.Schmidt@asu.edu), ²Global Science Institute (P.O. Box 252, Antigo, WI 54409; turnbull.maggie@gmail.com).

Project Description: Turnbull and Tarter's original "HabCat" [1,3], intended as a target list for the Search for Extraterrestrial Life (SETI), contained 17,129 stars selected from the *Hipparcos* Catalogue on the basis of several selection criteria (*e.g.*, age, [Fe/H], known or suspected planetary systems, *etc.*) as potentially habitable by the standards of terrestrial life. We seek to augment HabCat with additional elemental and isotopic abundance determinations with an emphasis on "bio-essential" elements in alignment with the goals of Arizona State University's (ASU) "Follow the Elements" team, part of the NASA Astrobiology Institute.

While bulk [Fe/H] metallicity estimates of the parent star appear to correlate with the detection of exoplanets [2], additional abundance information of the parent star should begin to indicate the types of planets in those systems. Our study initially involves mining available star catalogs and the literature for new spectroscopic abundance determinations of [Fe/H], [C/Fe], [N/Fe], [O/Fe], [Mg/Fe], [Si/Fe], [S/Fe], and [Ti/Fe]. Phosphorus is a bioessential element, and elevated levels of chlorine are biological poisons, but both elements are difficult to measure in stars. In addition, short-lived radionuclides such as ²⁶Al and ⁶⁰Fe are generally believed to be important for a planetary system's volatile content. In these cases, we will develop reliable proxies [4] for assessing the abundances levels.

Preliminary Results: The 3-D positions of the HabCat stars with [Fe/H] determinations are shown in Figure 1. Such abundance maps allow elemental abundance gradients in the solar neighborhood to be determined along with the potential discovery of "pockets" where a greater likelihood of Earthlike planets exists.

References: [1] Turnbull M. C. and Tarter J. C., (2003) *ApJSS*, 145, 181. [2] Fischer, D. A. and Valenti, J. A., (2005) *ApJ*, 622, 1102. [3] Turnbull M. C. and Tarter J. C., (2003) *ApJSS*, 149, 423. [4] Young *et al.*, (2009) *ApJ*, 699, 938.

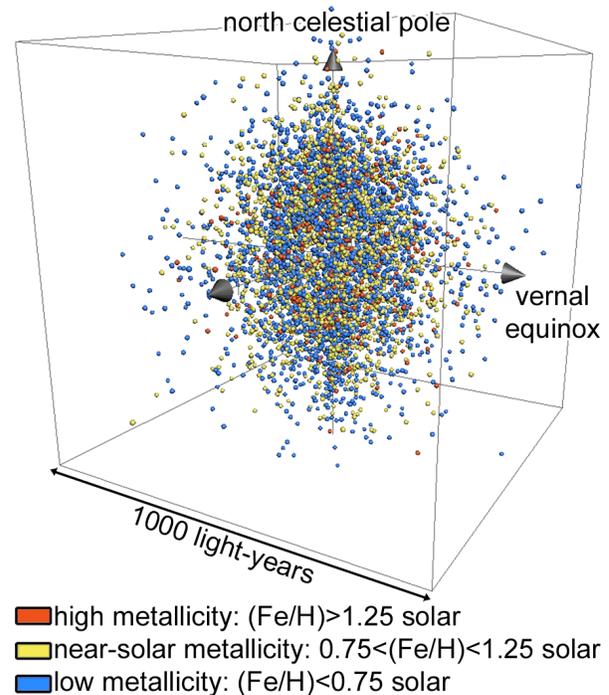


Figure 1: 3-D plot of selected "HabCat" stars [1] with Fe/H measurements within 500 light years; Earth is at the center in this plot. Point colors represent estimated metallicity relative to solar (*note*: non-logarithmic).