Abundances in Boötes I Dwarf Spheroidal Galaxy

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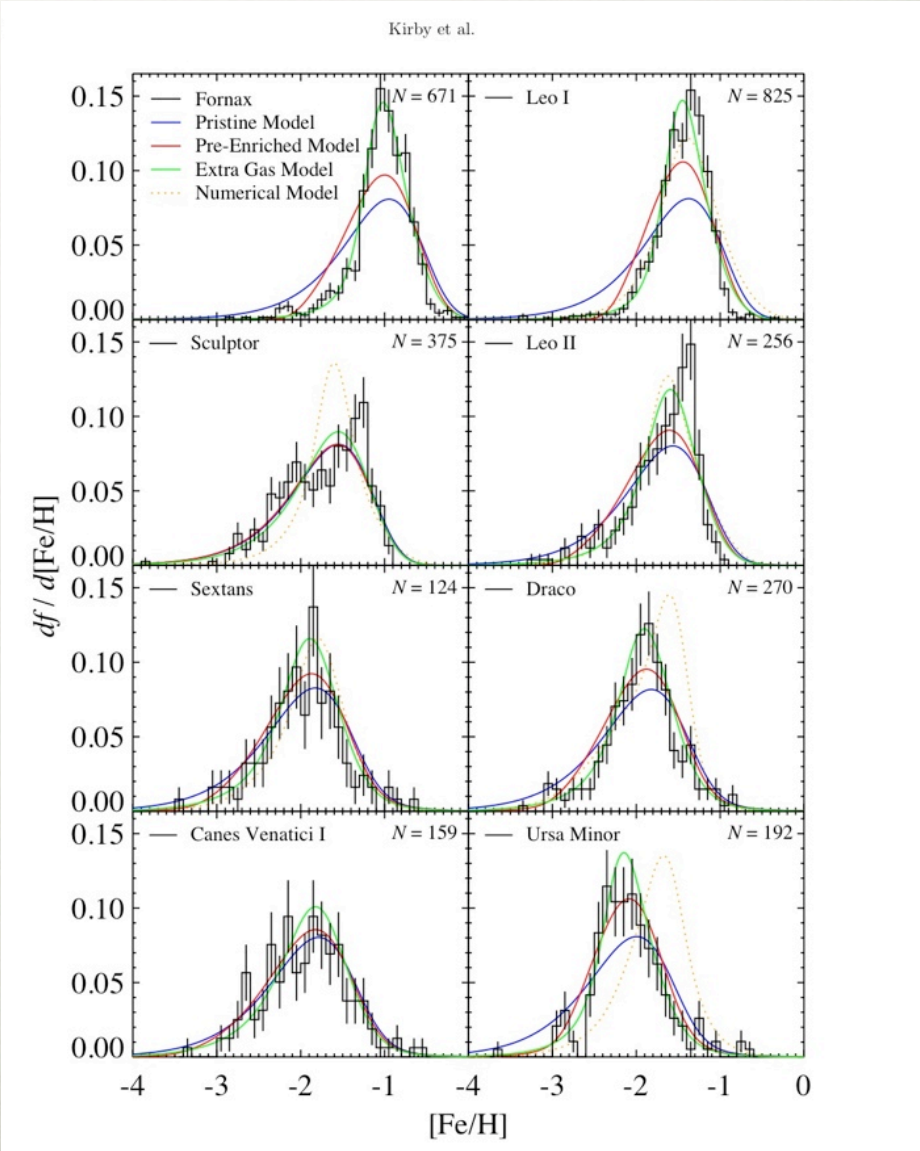
dSphs and Halo formation?

- What type of role did dSph like systems play?
  - What can current day systems tell us?
- Two classes of dSphs
  - Classic (pre-SDSS)
  - Ultra-faint



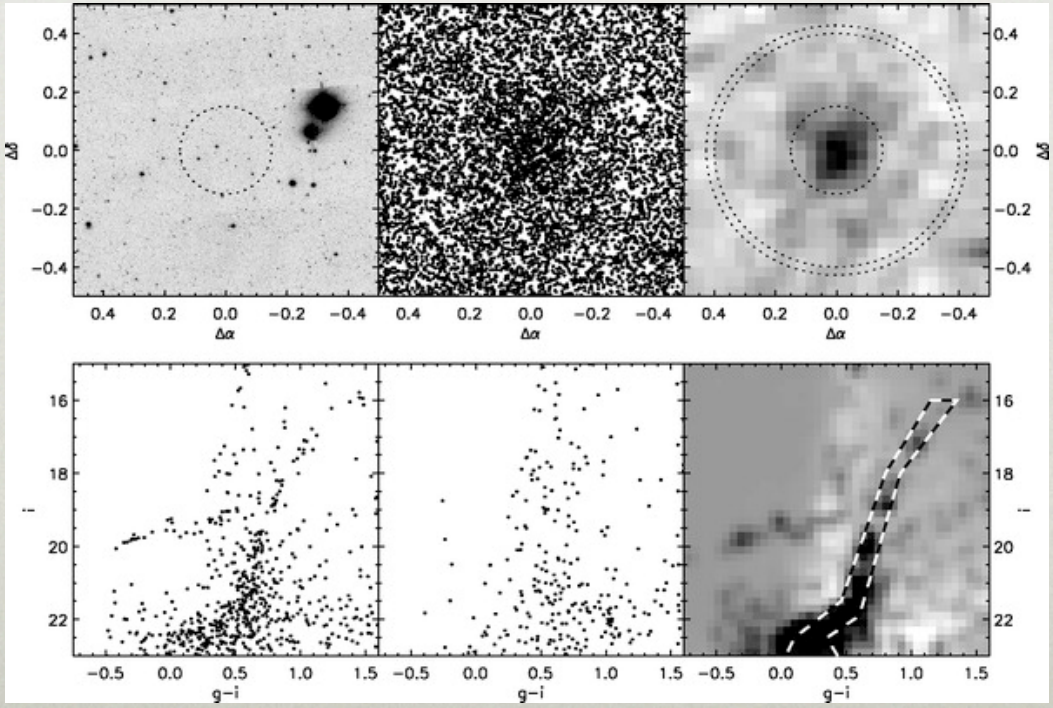
Kirby et al. 2010

Ultra-faint dSphs: a (very brief) census

- ~14 discovered
- M_V ~ −1.2 to −8.6
- mass-to-light ratios in the hundreds
- distances ~ 25 to 220 kpc

Boötes I - The basic facts

- Originally discovered by Belokurov et al. (2006)
  - 60 kpc distance
  - M_V = -5.8
  - M/L ~ 130 - 610 (Muñoz et al. 2006)



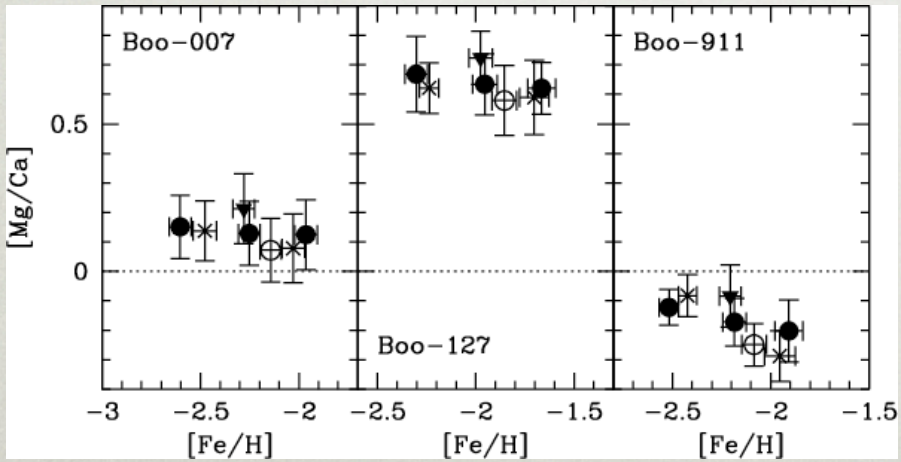
Belokurov et al. 2006

Boötes I: prior chemical information

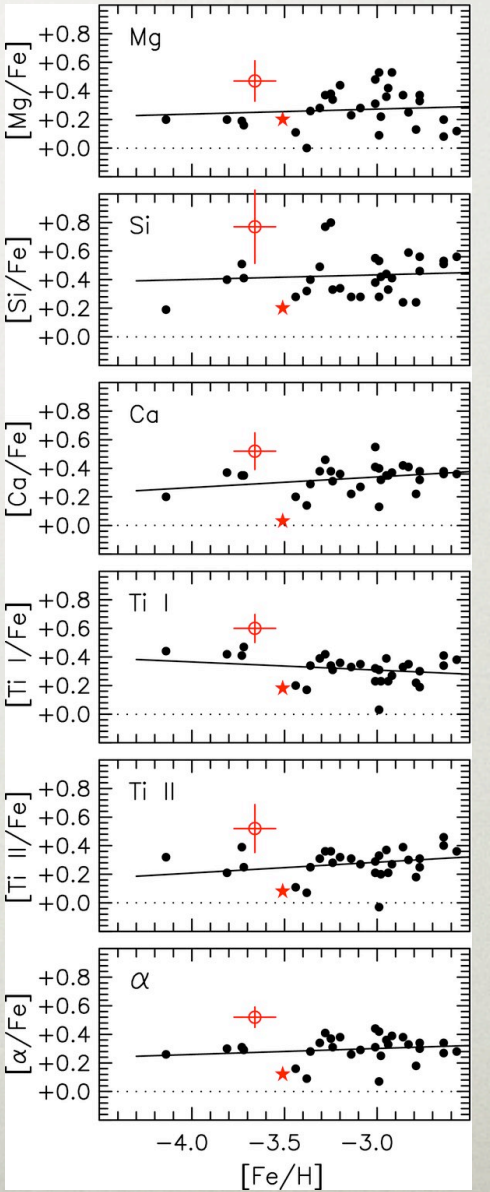
- Photometric and low-resolution studies
  - CaT (Martin et al. 2007)
  - Washington photometry (Hughes et al. 2008)
  - CaII K line indicator (Norris et al. 2008)
- However, metallicity is only a part of the of the puzzle
  - need α-elements, carbon, etc.

Boötes I: prior chemical information

- High-resolution studies have shown interesting variations in the α-elements



Feltzing et al. 2009

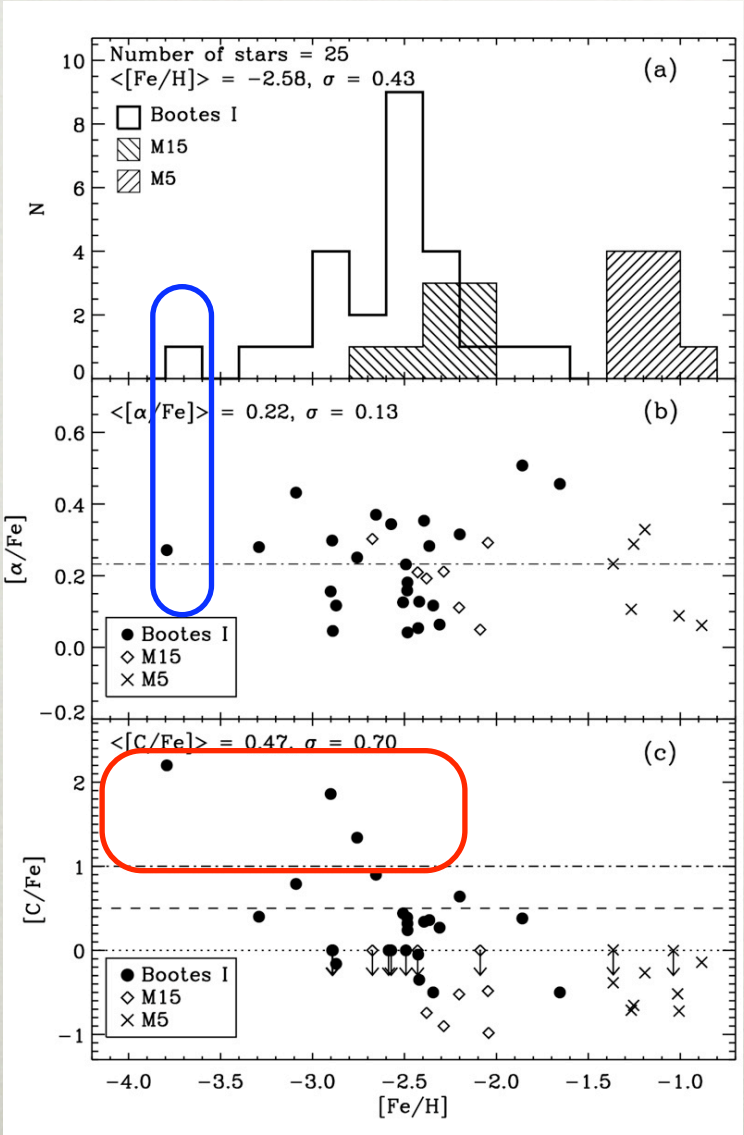


Norris et al. 2010

Our observations and analysis

- 25 stars with confirmed radial velocity membership from Martin et al. (2007)
- LRIS, R~1800
- Analyzed with a modified version of the Sloan Stellar Parameter Pipeline (SSPP)
  - Stellar parameters
  - [Fe/H], [α/Fe], and [C/Fe] (by Sivarani Thirupathi)

Boötes I: New results

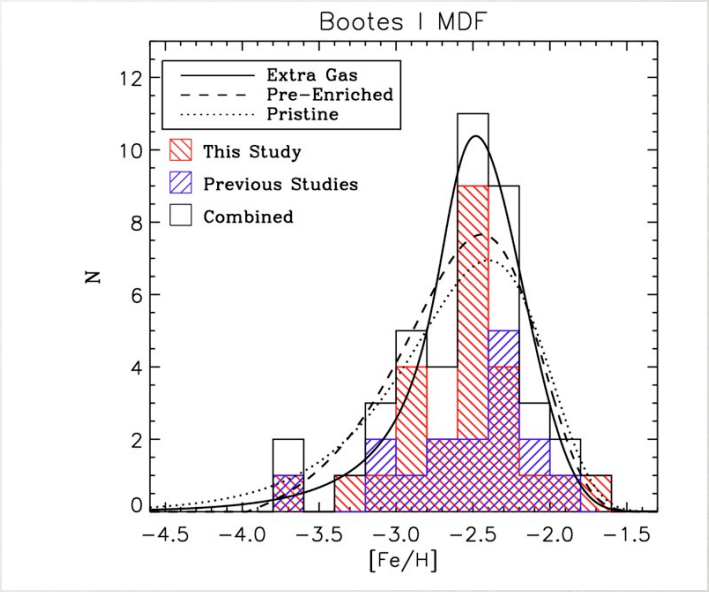


- A very metal-poor system
- One new star with [Fe/H] ≈ −3.8!
- Normal [α/Fe]
- CEMP fraction 12%

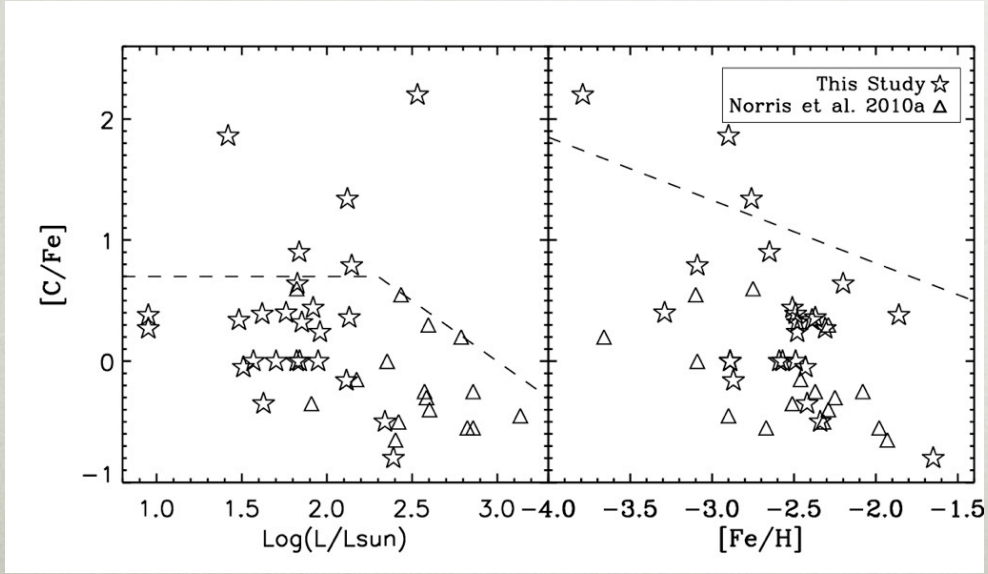
Lai et al. 2011

Boötes I: Combining with Previous studies

- A very metal-poor system, but with a very wide spread in metallicity.
- Roughly in line with trends found in other dwarf galaxies.

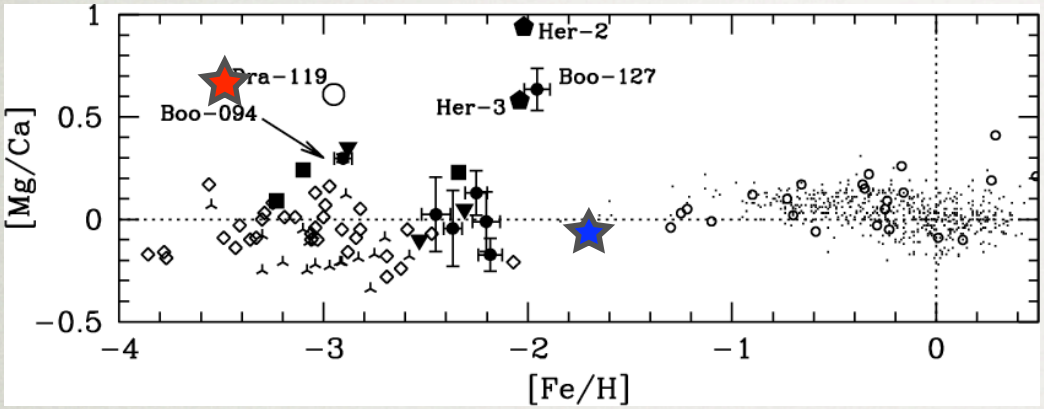


Lai et al. 2011

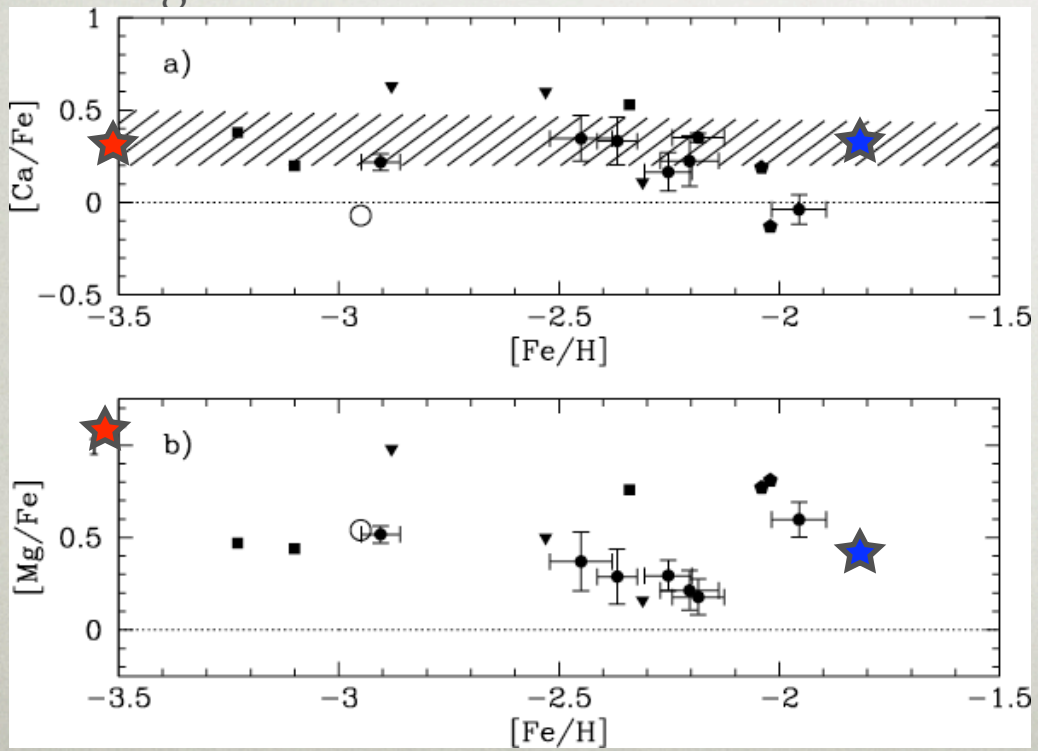


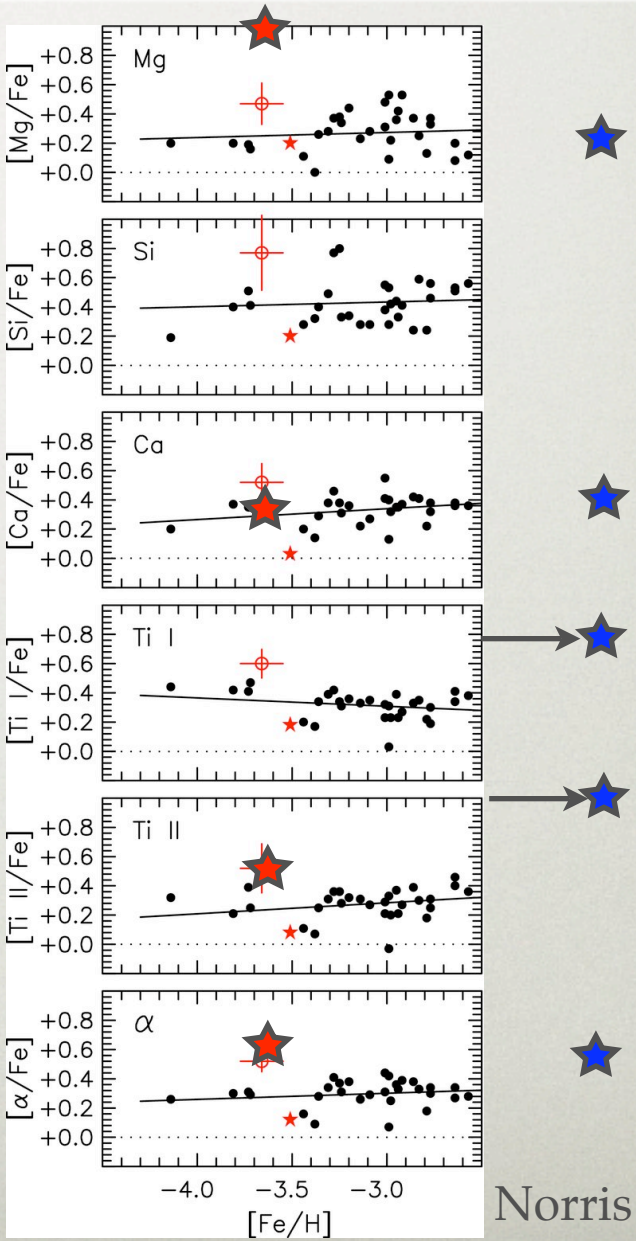
- Even when combining previous determinations of [C/Fe], still consistent with halo CEMP fraction estimates.

dSphs: Preliminary high-resolution results



Feltzing et al. 2009





Norris et al. 2010

Summary

- On *average*, Boötes I seems to have normal abundance ratios relative to the halo population.
    - CEMP fraction
    - Averaged α-element
- However, the devil is in the detailed chemical analysis.
    - Strong evidence for stochastic chemical enrichment