

# Cr isotopic monitoring of bioreduction at the 100H test site - first results

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# Cr Isotope Primer

- Four isotopes:  $^{50}\text{Cr}$  (4.3%),  $^{52}\text{Cr}$  (83.8%),  $^{53}\text{Cr}$  (9.5%) and  $^{54}\text{Cr}$  (2.4%)
- Double spike ( $^{50}\text{Cr}$  and  $^{54}\text{Cr}$ ) using TIMS (or MC-ICPMS)
- Results expressed as  $\delta^{53}\text{Cr} \text{ ‰} =$

$$\left[ \frac{(^{53}\text{Cr}/^{52}\text{Cr})_{\text{smpl}} - (^{53}\text{Cr}/^{52}\text{Cr})_{979}}{(^{53}\text{Cr}/^{52}\text{Cr})_{979}} \right] \times 1000$$

- Rayleigh fractionation with abiotic  $\text{Cr}^{6+}$  reduction = 3.4 ‰
- Fractionation with  $\text{Cr}^{6+}$  adsorption (e.g. geothite) < 0.04 ‰
- Bacterial reduction: high  $e^-$  donor, less fractionation

low  $e^-$  donor, greater fractionation

(Ellis et al. 2002, 2004; Tom Johnson pers. com.)

# A Few Other Equations

Fractionation factor

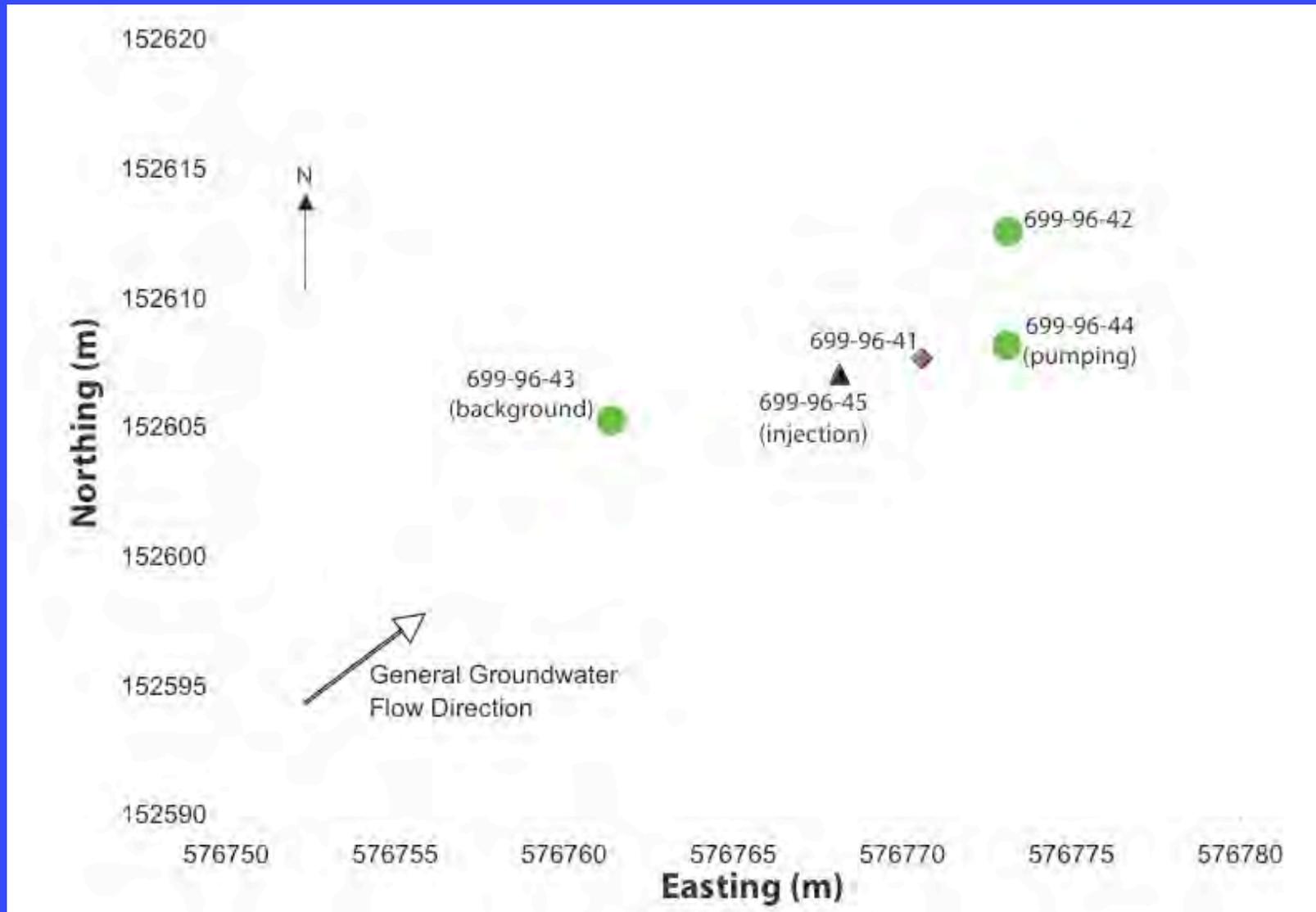
$$\alpha = R_{\text{prod}}/R_{\text{react}}$$

$$R = {}^{53}\text{Cr}/{}^{52}\text{Cr}$$

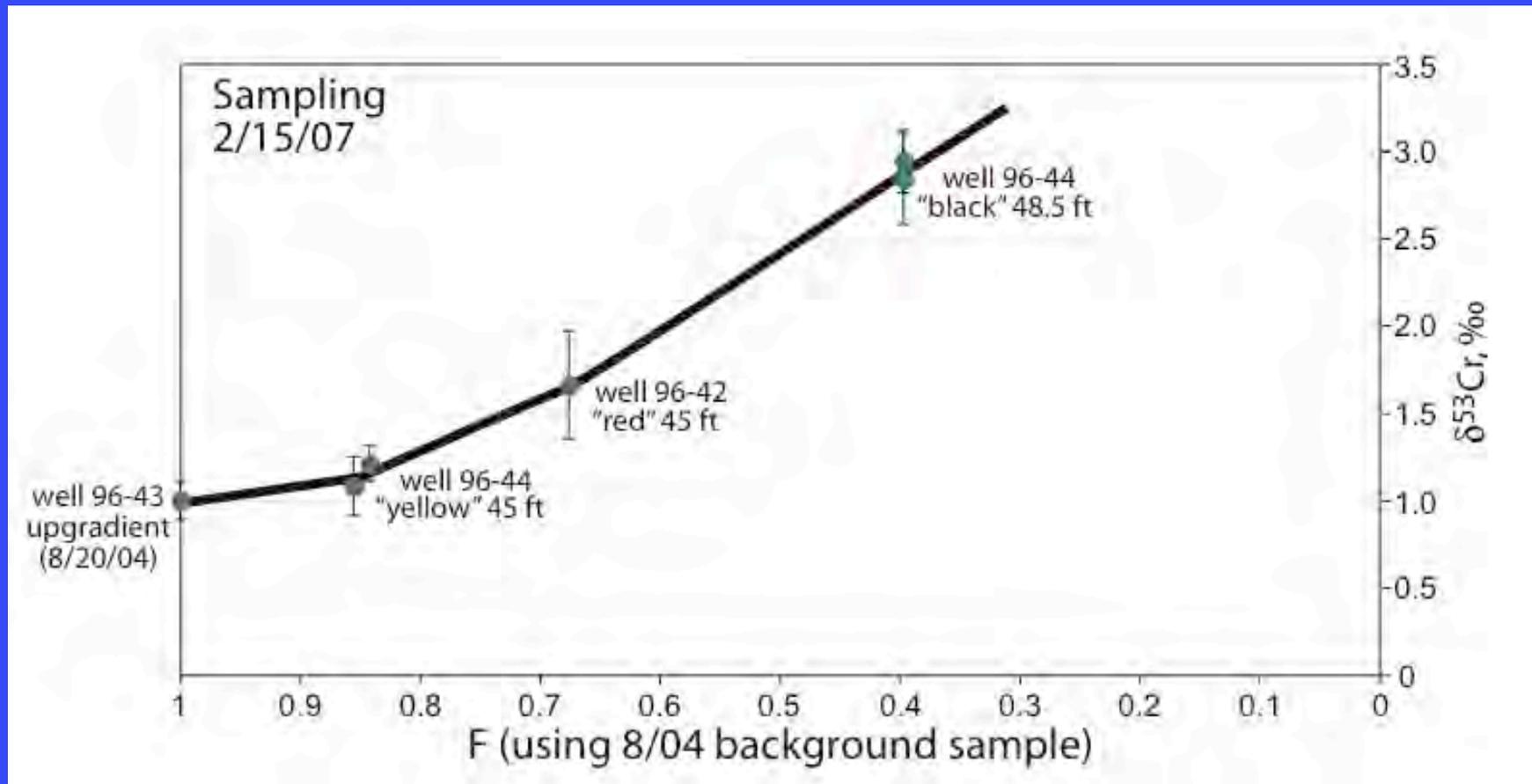
Rayleigh fractionation model

$$\delta^{53}\text{Cr} = [\delta^{53}\text{Cr}_0 + 1000)F^{(\alpha-1)}] - 1000$$

# 100H test well map

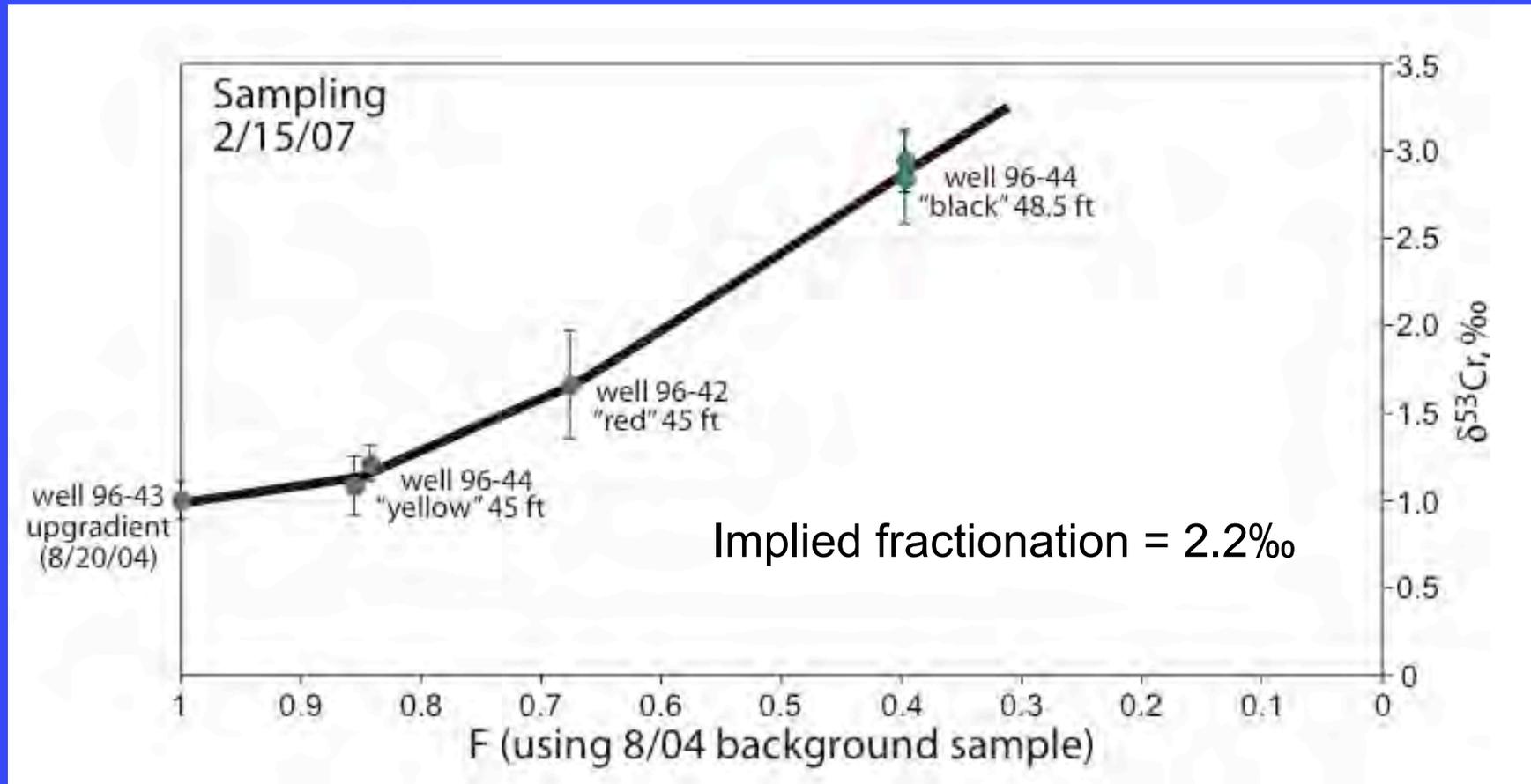


# Plot using upgradient well 96-43 sample from 8/20/04



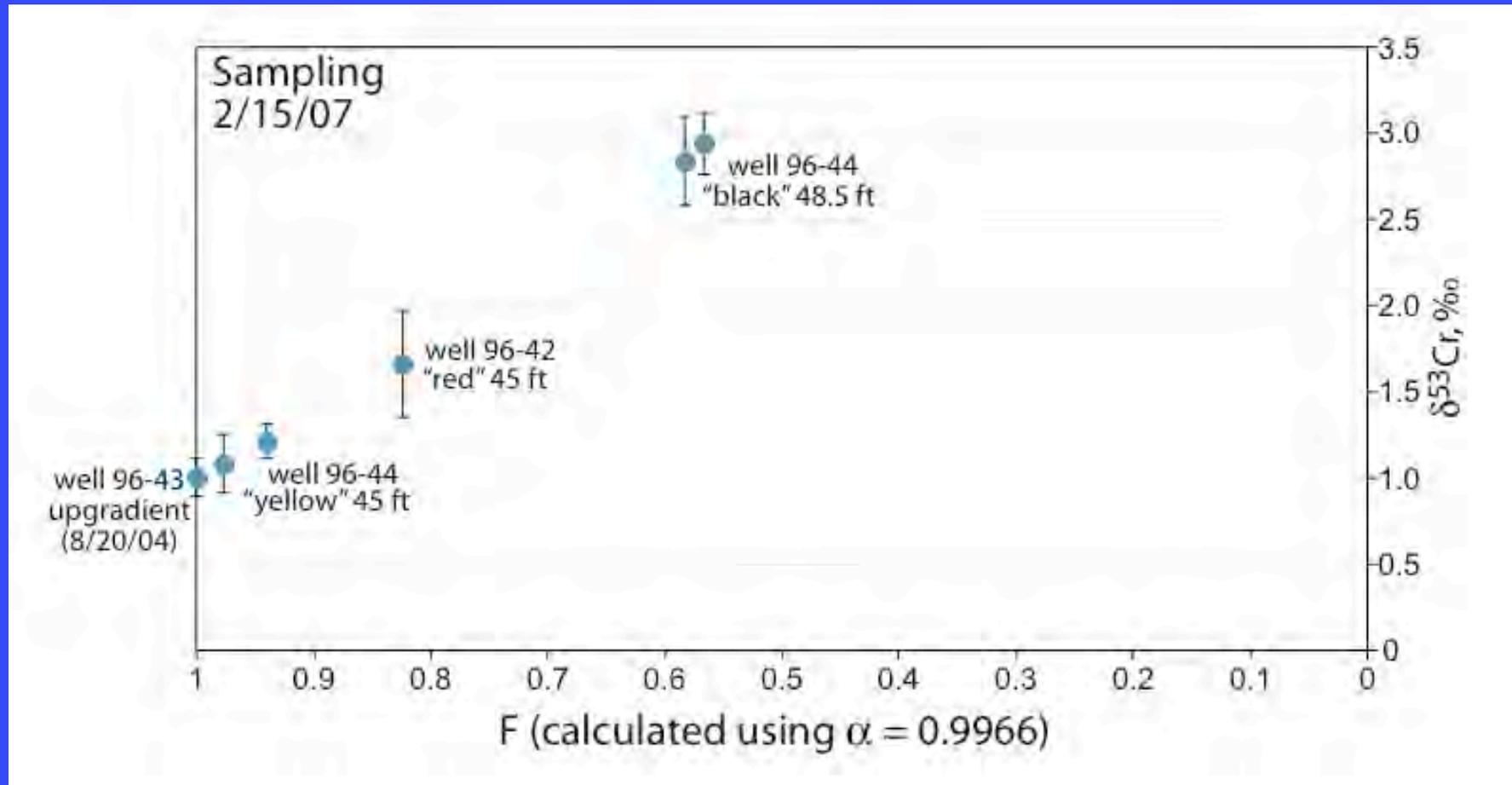
F = fraction of  $\text{Cr}^{6+}$  left in solution

# Plot using upgradient well 96-43 sample from 8/20/04



F = fraction of  $\text{Cr}^{6+}$  left in solution

## Model using a fractionation of 3.4‰



F = fraction of  $\text{Cr}^{6+}$  left in solution

Model using a fractionation of 3.4‰  
Just for fun

