GEOCHEMICAL CHARACTERIZATION OF A MULTIPLE PERMEABLE REACTIVE BARRIER, MORTANDAD CANYON, NEW MEXICO

PATRICK LONGMIRE[1], DALE COUNCE[1],
ROBERT GRAY[2], ELIZABETH STRIETELMEIER[3],
AND JOHN KASZUBA[3]

1. EARTH AND ENVIRONMENTAL SCIENCES DIVISION, LANL
2. DANIEL B. STEPHENS AND ASSOCIATES
3.CHEMISTRY DIVISION, LANL

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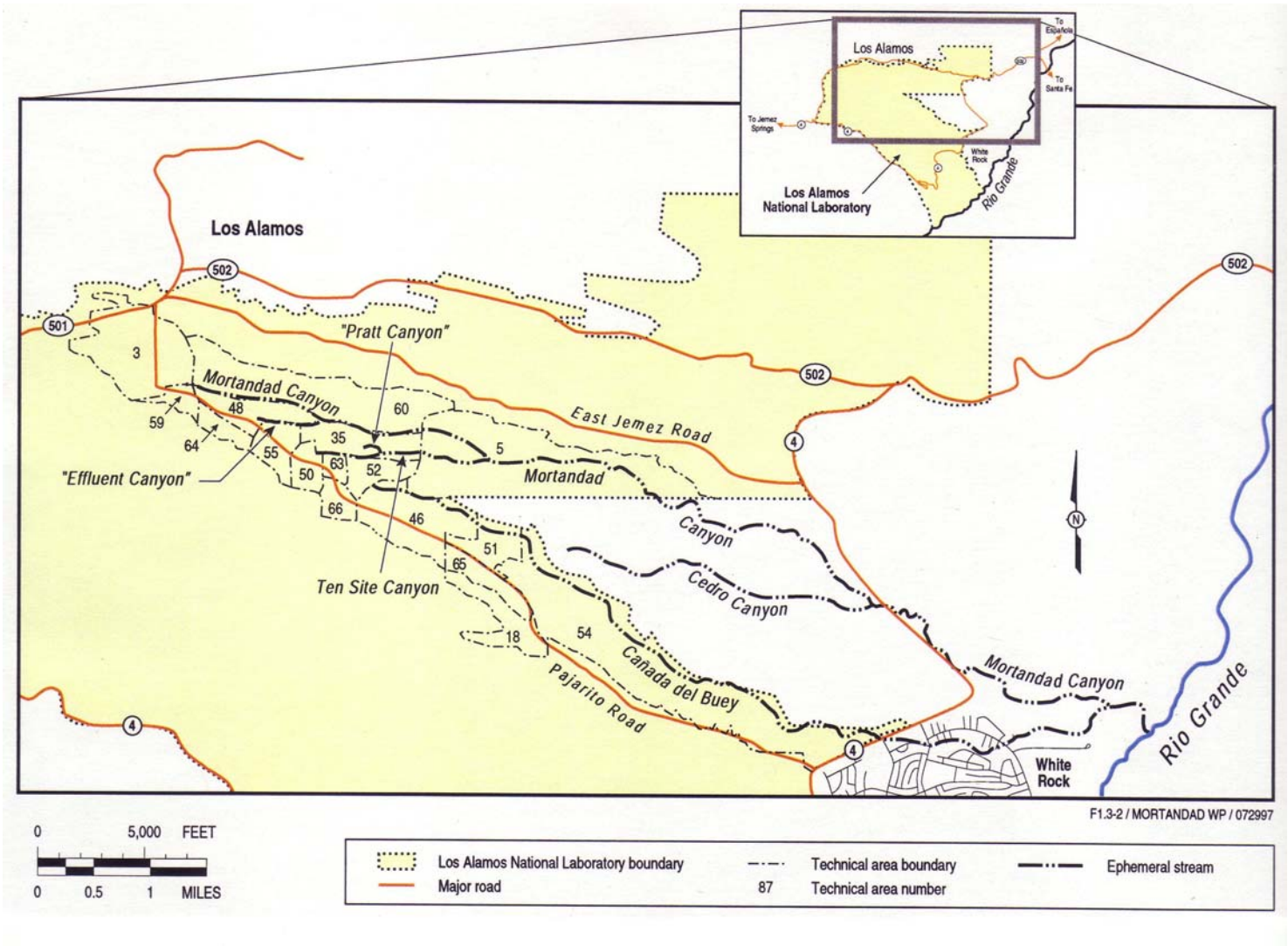
OBJECTIVE OF PRESENTATION

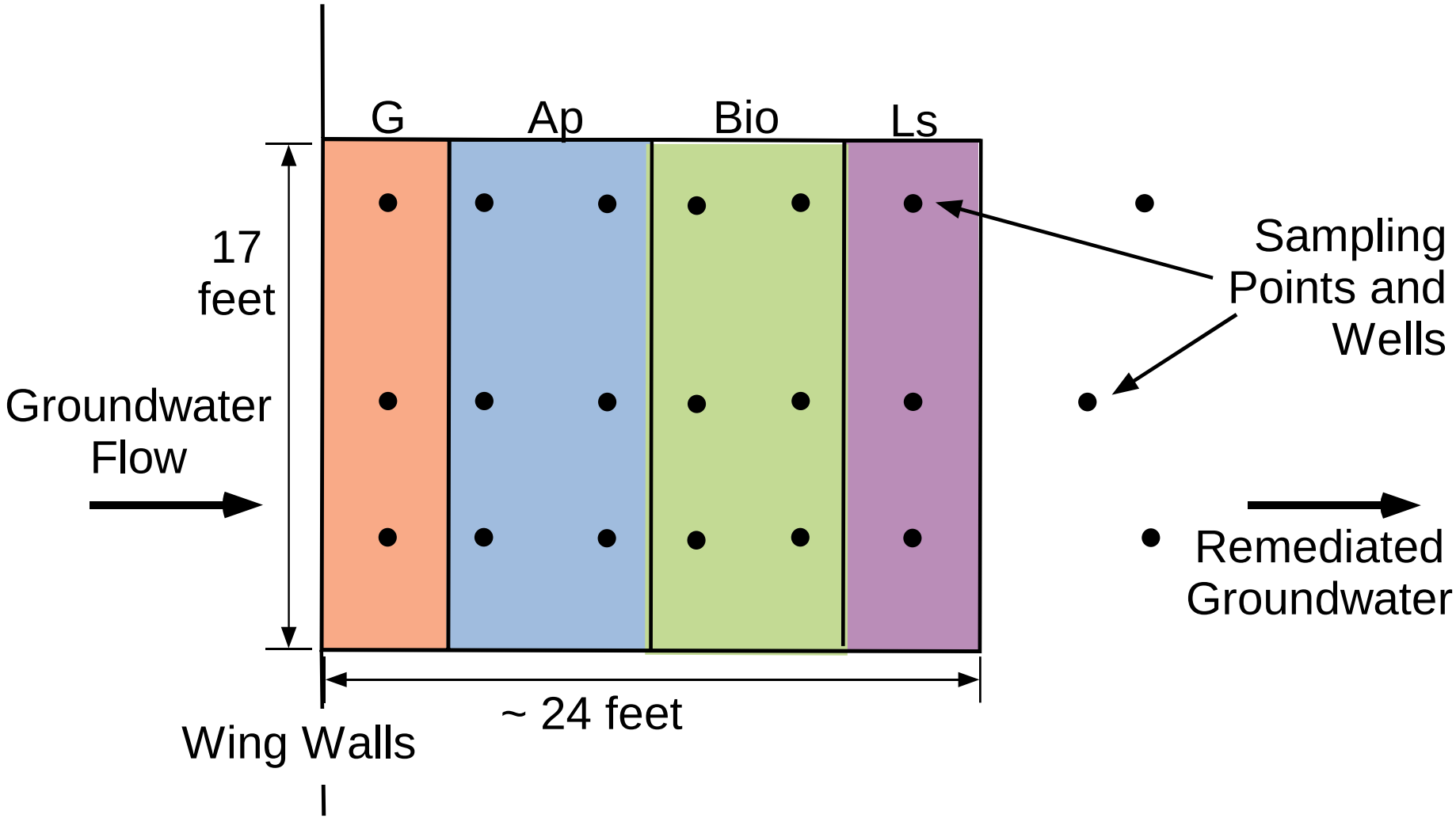
- **Evaluate hydrochemical conditions upgradient, within, and downgradient of the multiple permeable reactive barrier (PRB), Mortandad Canyon, Los Alamos, New Mexico.**

LOCATION OF MULTIPLE PRB, MORTANDAD CANYON

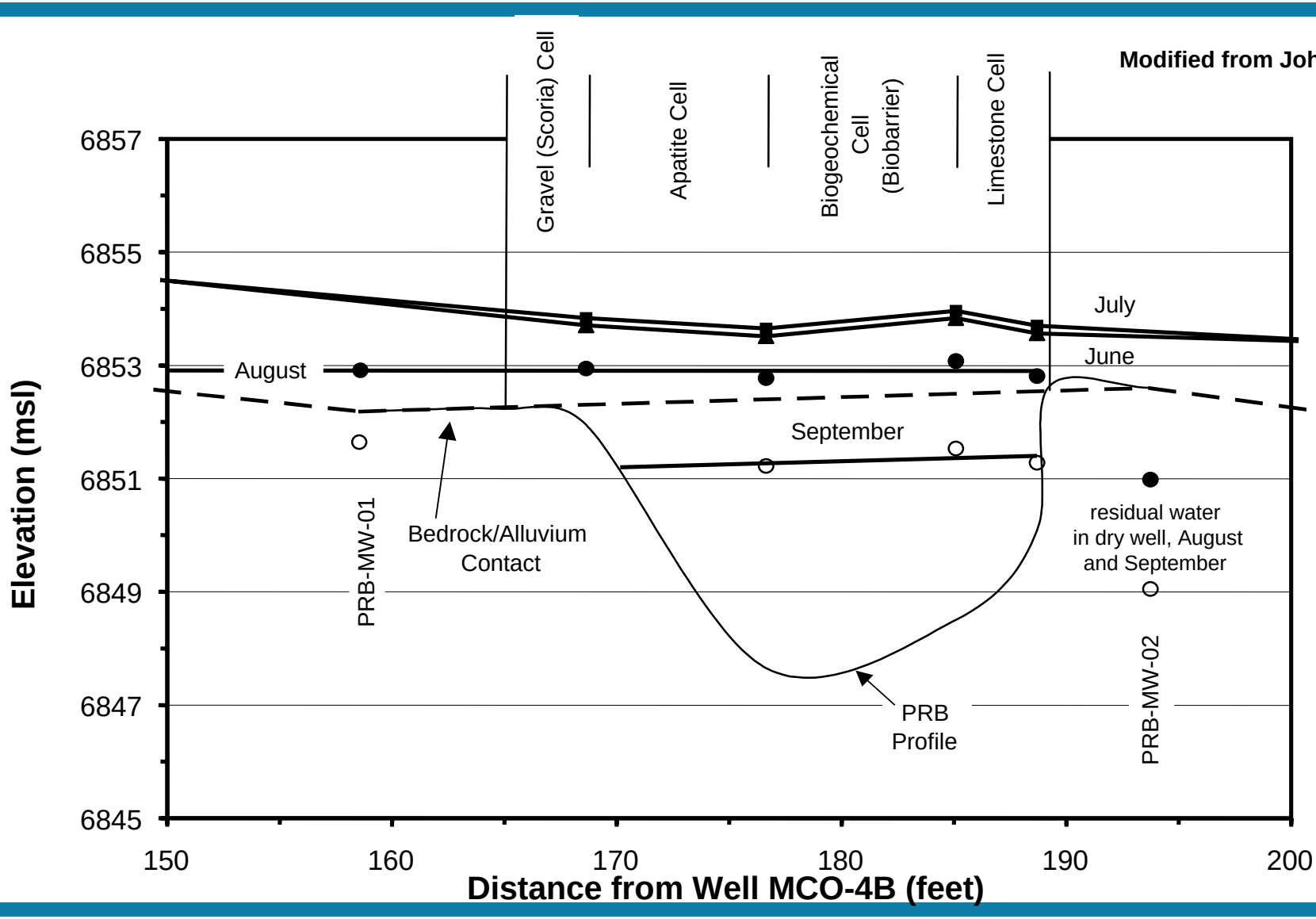


PHOTOGRAPH OF INSTALLED MULTIPLE PRB

PLAN VIEW OF MULTIPLE PRB



CROSS SECTION OF MULTIPLE PRB AND WATER LEVELS JUNE-SEPTEMBER 2003



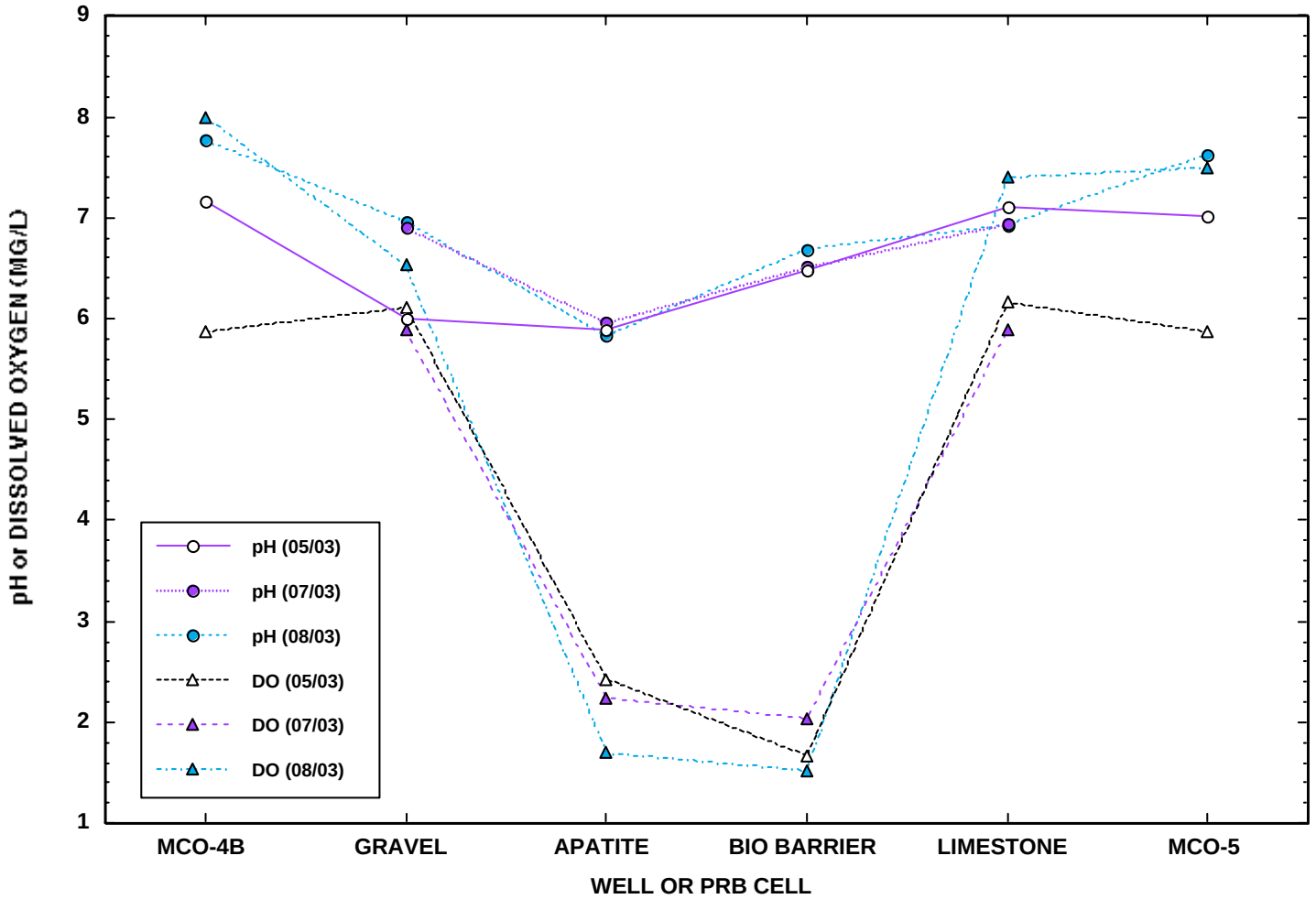
ANALYTICAL METHODS

- **Anions, including nitrate and perchlorate, were analyzed by ion chromatography.**

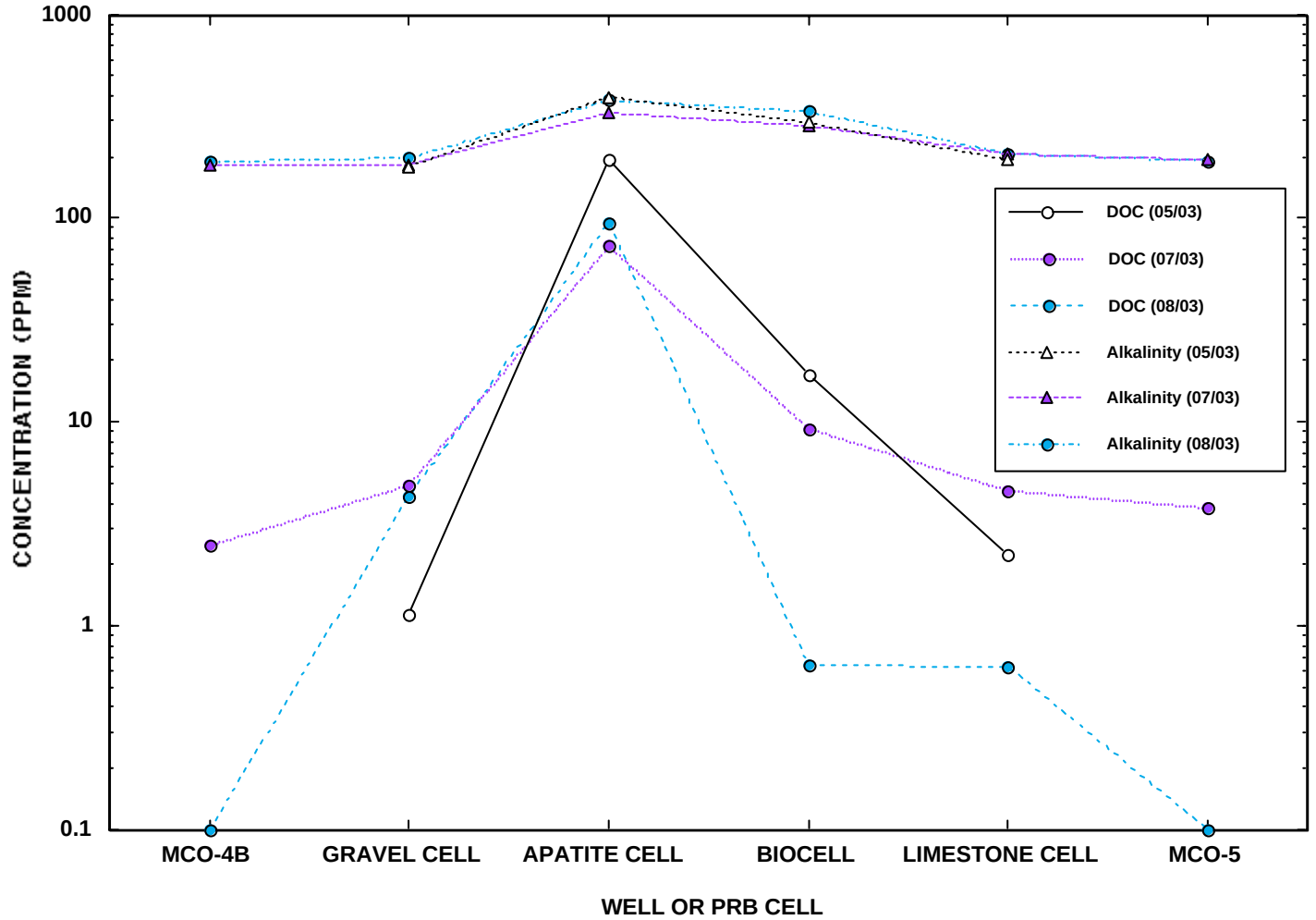
- **Radionuclides were analyzed by gas proportional counting (Sr-90), gamma spectroscopy (Cs-137 and other gamma emitting isotopes), and alpha spectrometry (uranium, plutonium, and americium isotopes).**

- **Metals were analyzed by inductively coupled plasma optical emission spectroscopy (ICPOES) and inductively coupled plasma mass spectrometry (ICPMS).**

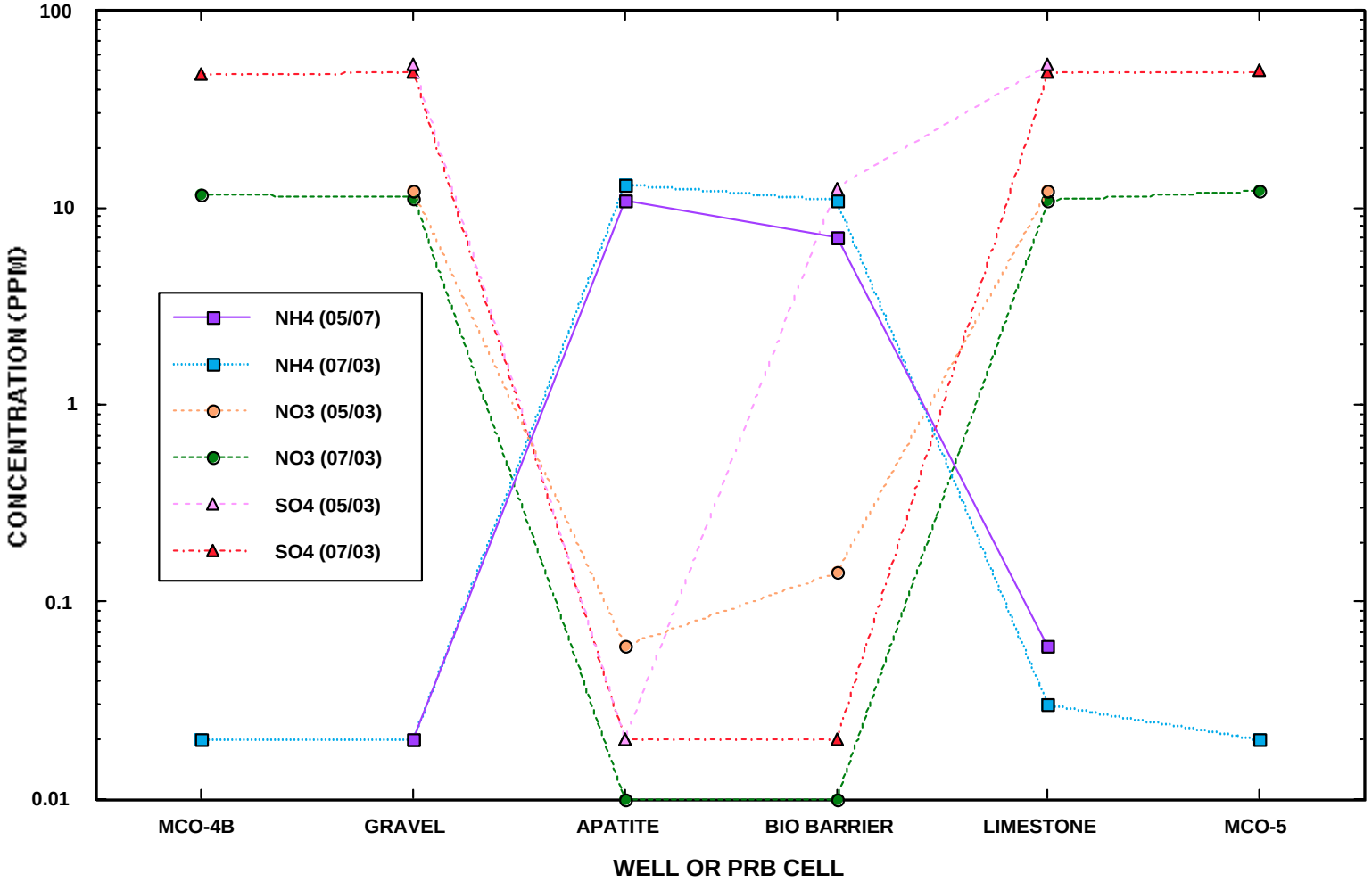
DISTRIBUTIONS OF pH AND DISSOLVED OXYGEN (MG/L) IN WELLS MCO-4B AND MCO-5 AND IN THE MULTIPLE PRB



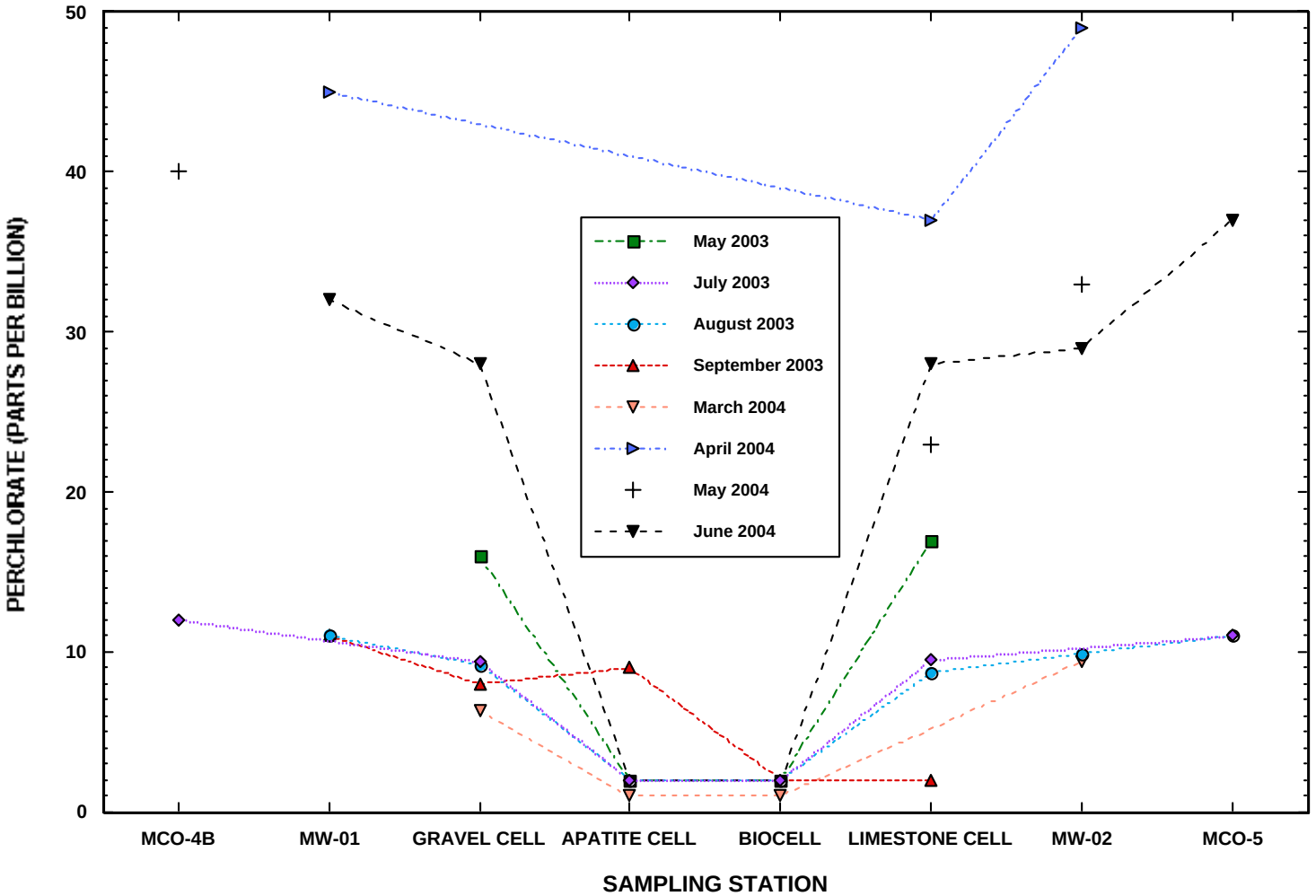
DISTRIBUTIONS OF DISSOLVED ORGANIC CARBON (DOC) AND TOTAL ALKALINITY IN WELLS MCO-4B AND MCO-5 AND IN THE MULTIPLE PRB



DISTRIBUTIONS OF DISSOLVED AMMONIUM, NITRATE, AND SULFATE AT THE MULTIPLE PRB



PERCHLORATE CONCENTRATIONS (PPB) AT THE MULTIPLE PRB
(Instrument detection limit for perchlorate is 2 ppb using ion chromatography)

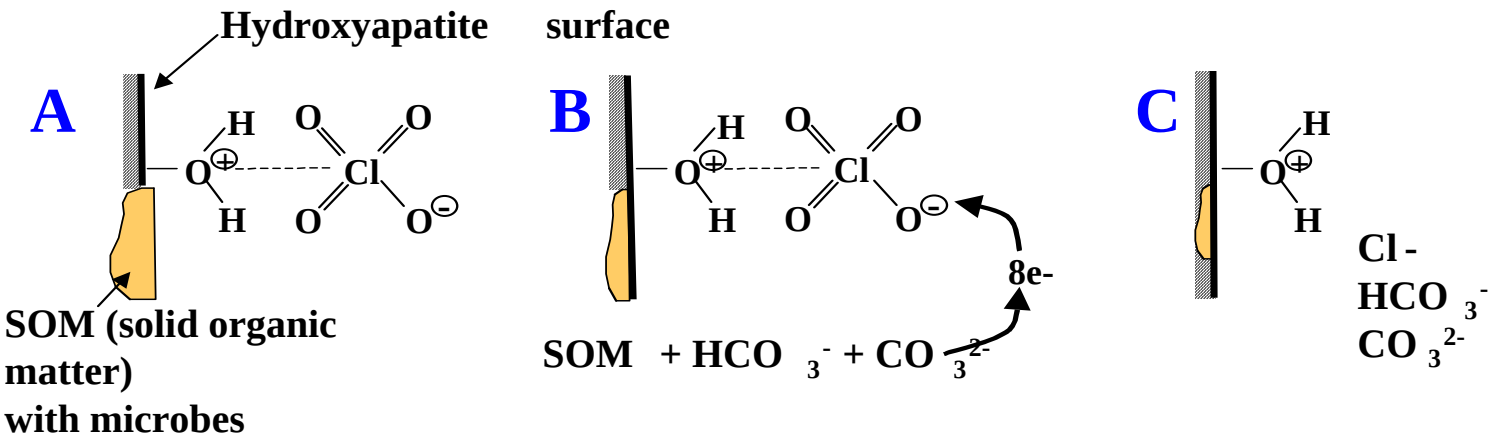


PERCHLORATE REDUCTION ON PHOSPHATE ROCK CONTAINING SOLID ORGANIC MATTER AS PART OF THE MULTIPLE PRB

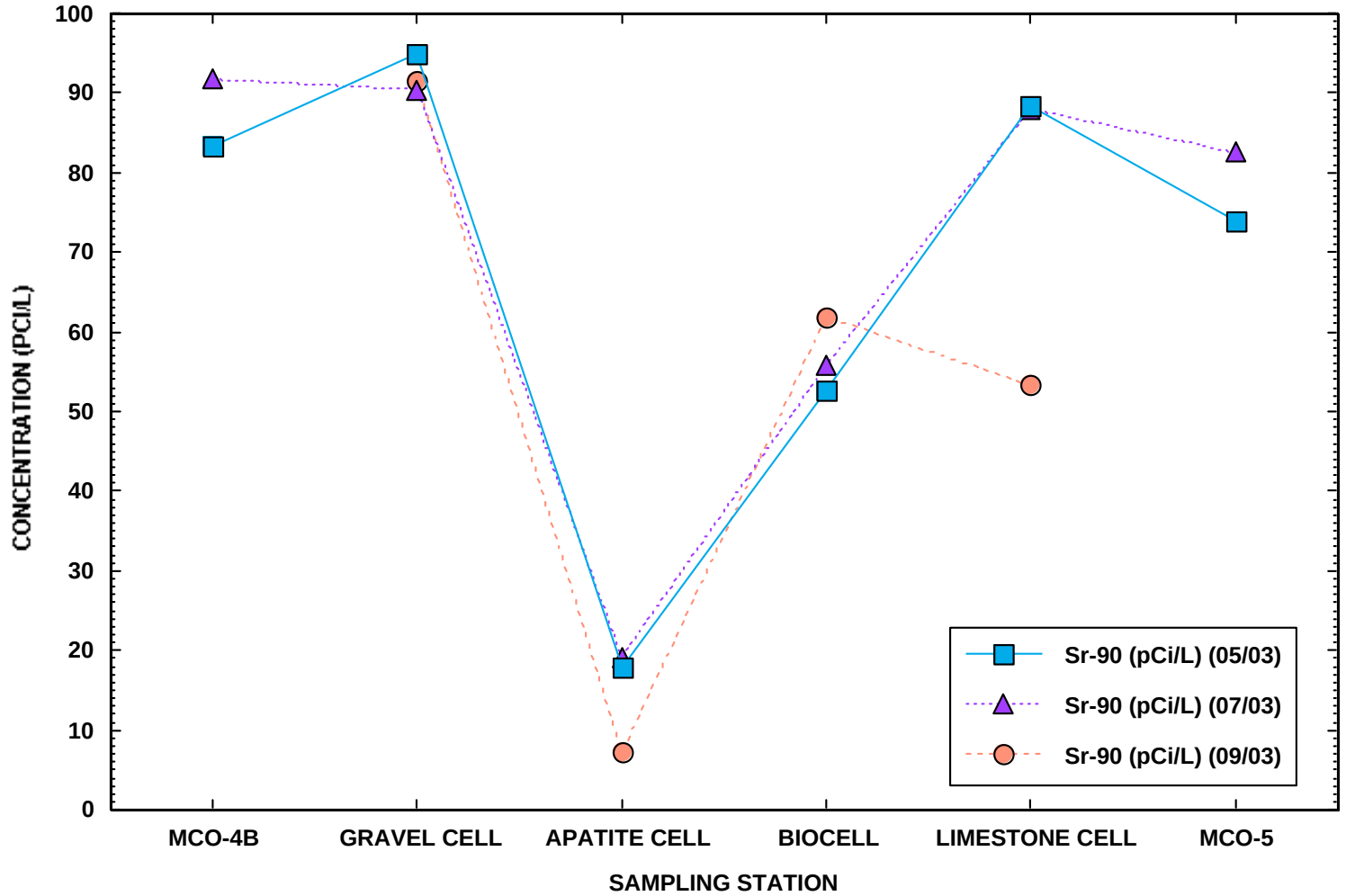
A: Initial step, perchlorate mostly adsorbs onto positive surface sites below pH 8.5 (pH_{zpc} for hydroxylapatite is 8.5).

B: Perchlorate is terminal electron acceptor and microbes use SOM as food source with energy gain from oxidation of organic carbon to bicarbonate and carbonate with the reduction of perchlorate to chloride.

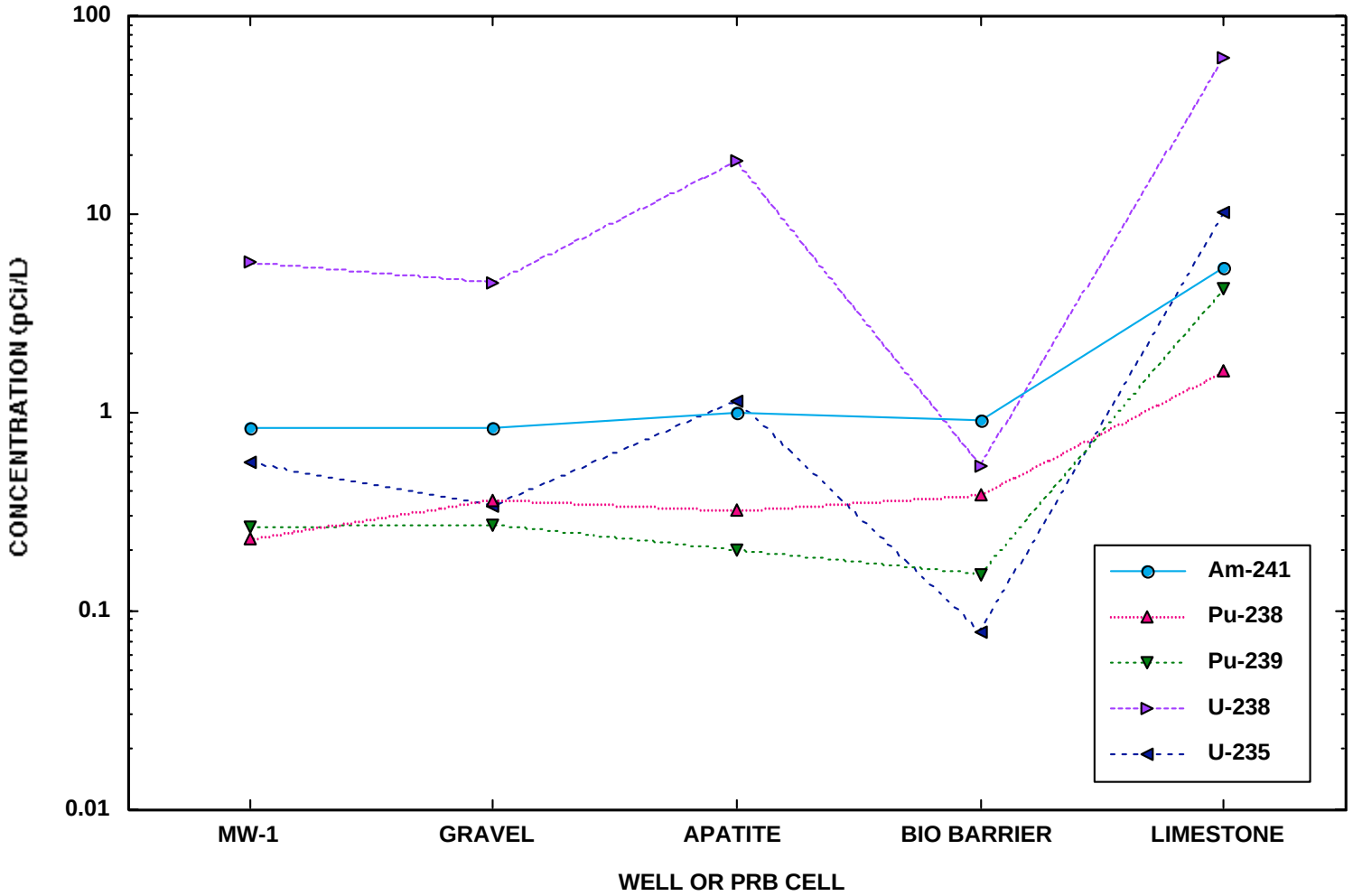
C: Complete reduction of perchlorate to chloride with oxidation of SOM to bicarbonate and carbonate. Overall reaction: $ClO_4^- + 2CH_2O \rightarrow 2HCO_3^- + 2H^+ + Cl^-$.



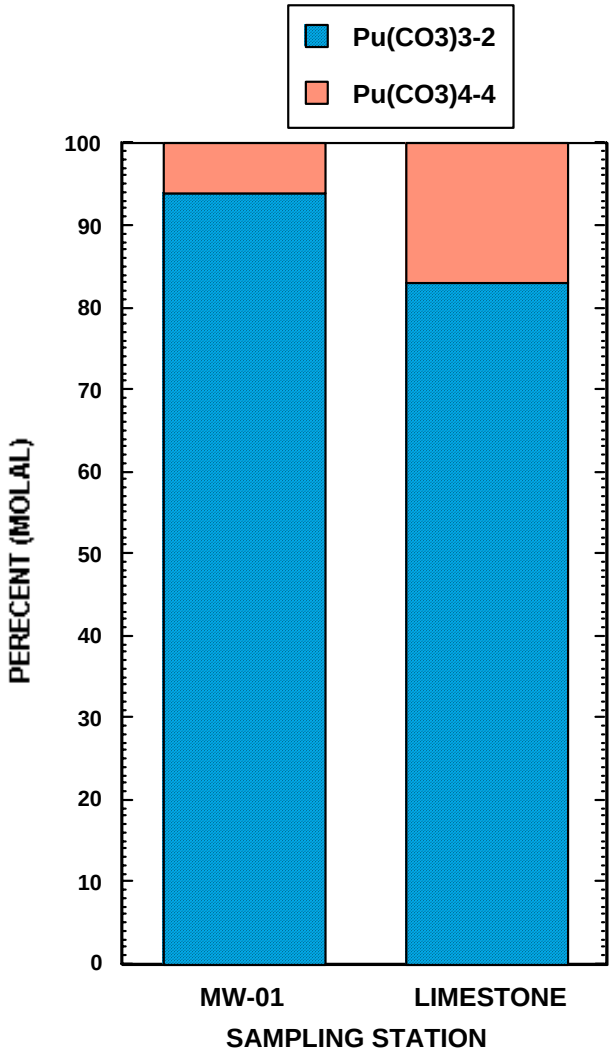
STRONTIUM-90 CONCENTRATIONS (pCi/L) AT THE MULTIPLE PRB

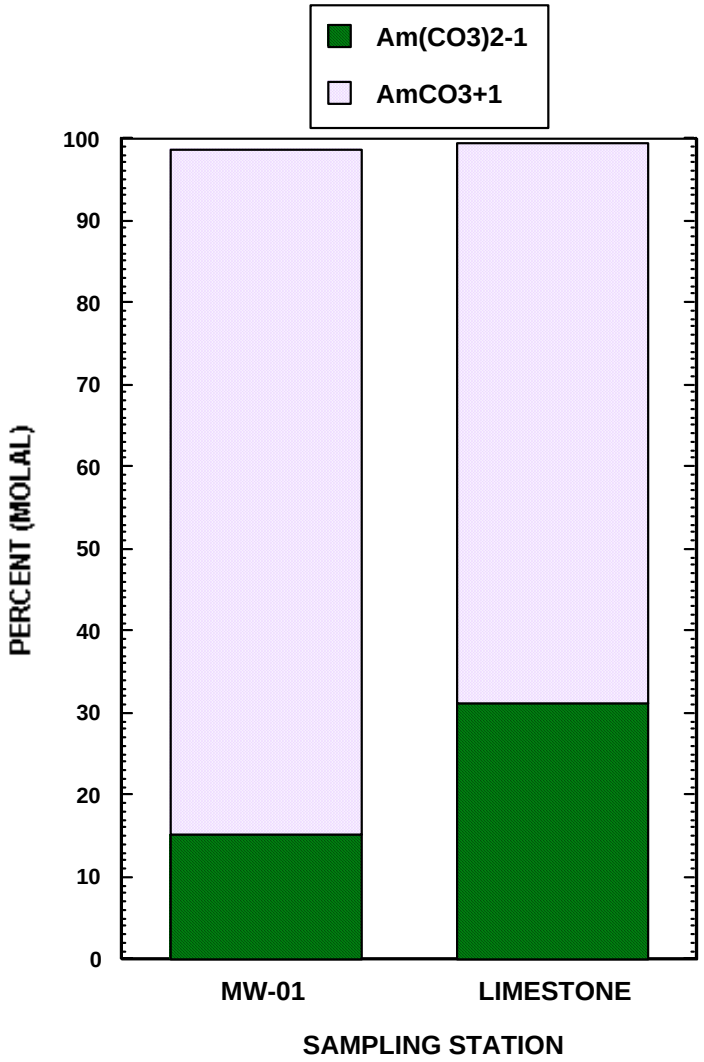


CONCENTRATIONS OF AMERICIUM-241, PLUTONIUM-238, PLUTONIUM-239, URANIUM-235, AND URANIUM 238 (pCi/L) AT THE MULTIPLE PRB (09/03)

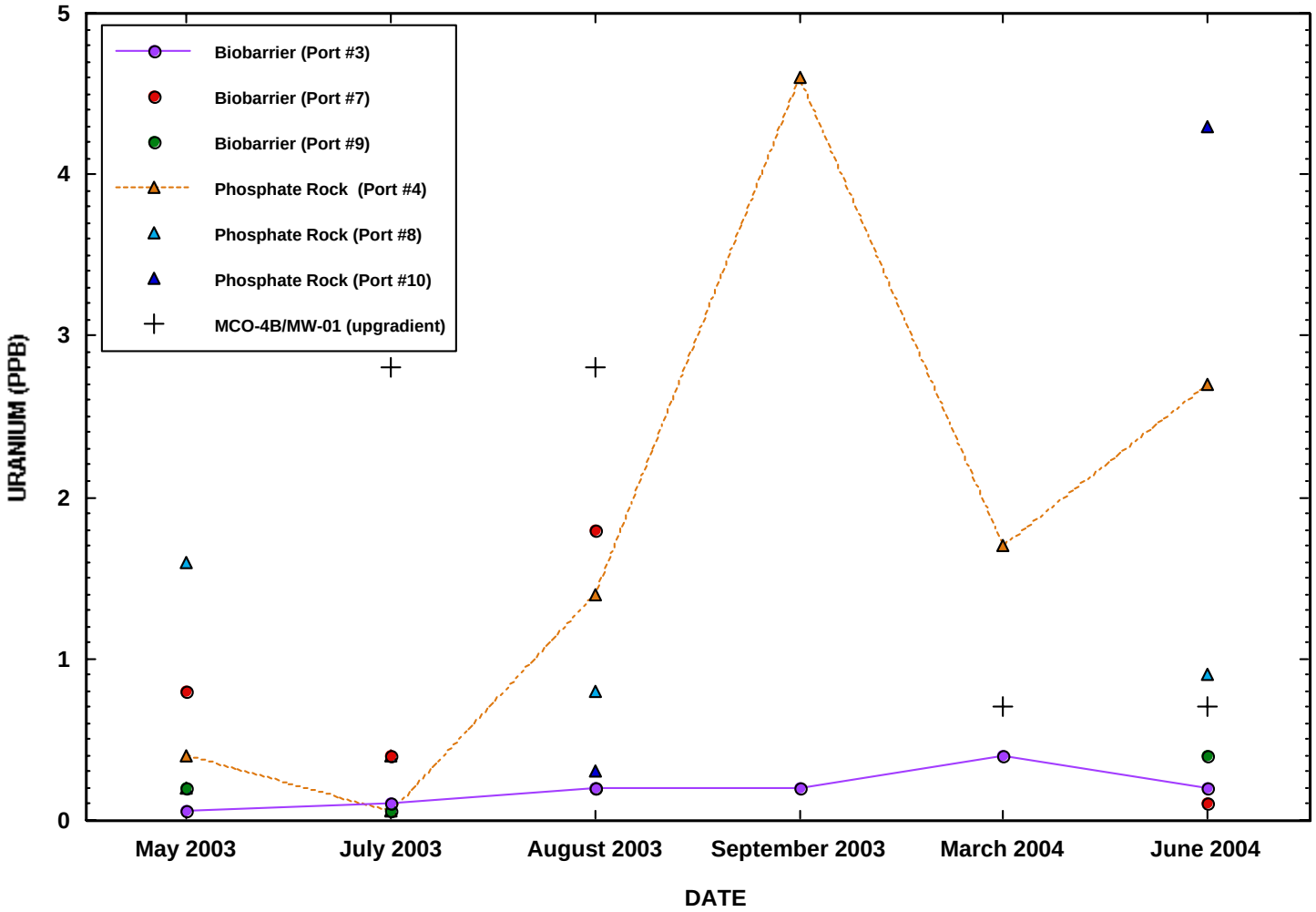


CALCULATED DISTRIBUTIONS OF PLUTONIUM(IV) AND AMERICIUM(III) SPECIES USING MINTEQA2 AT THE MULTIPLE PRB (09/03)

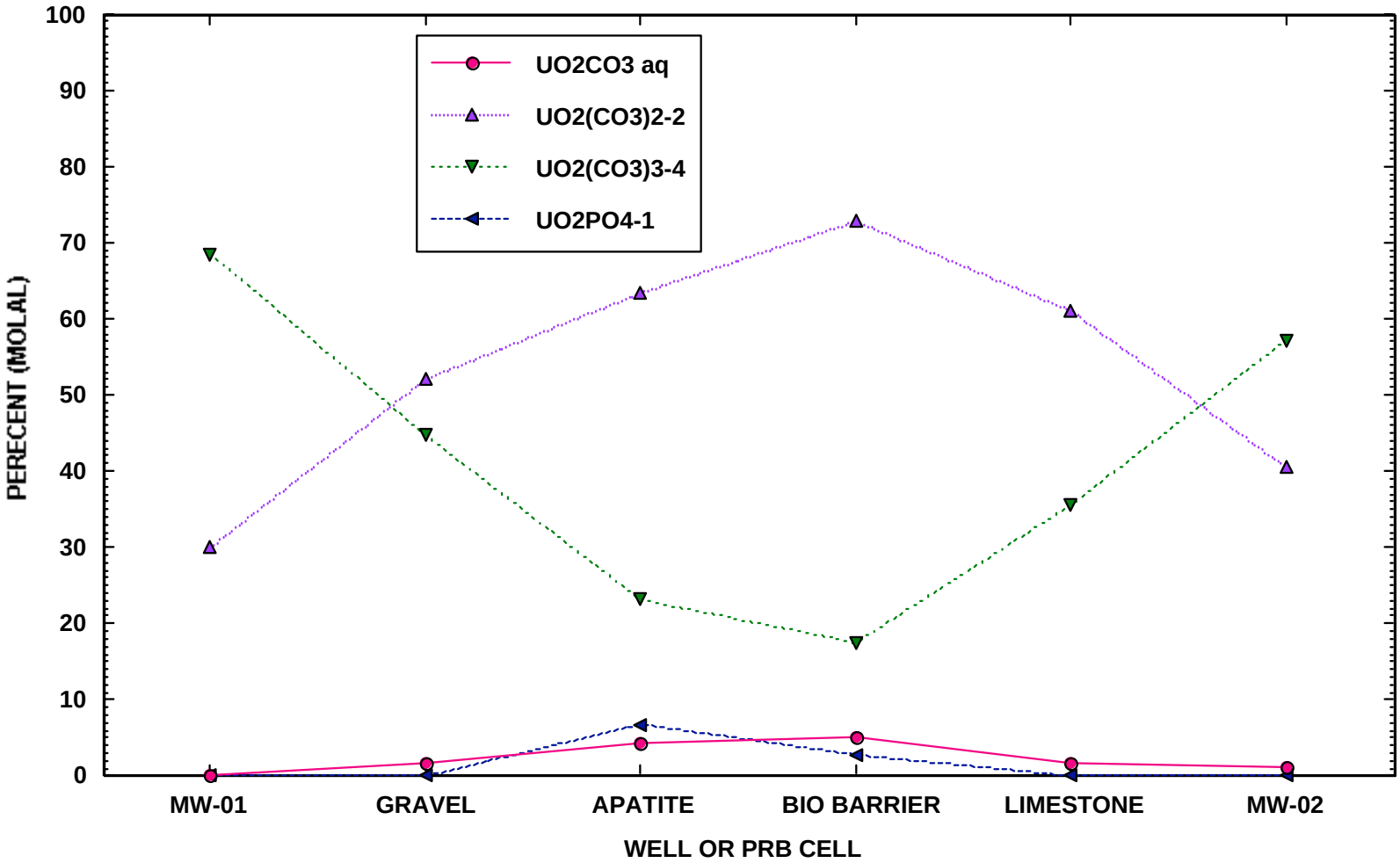




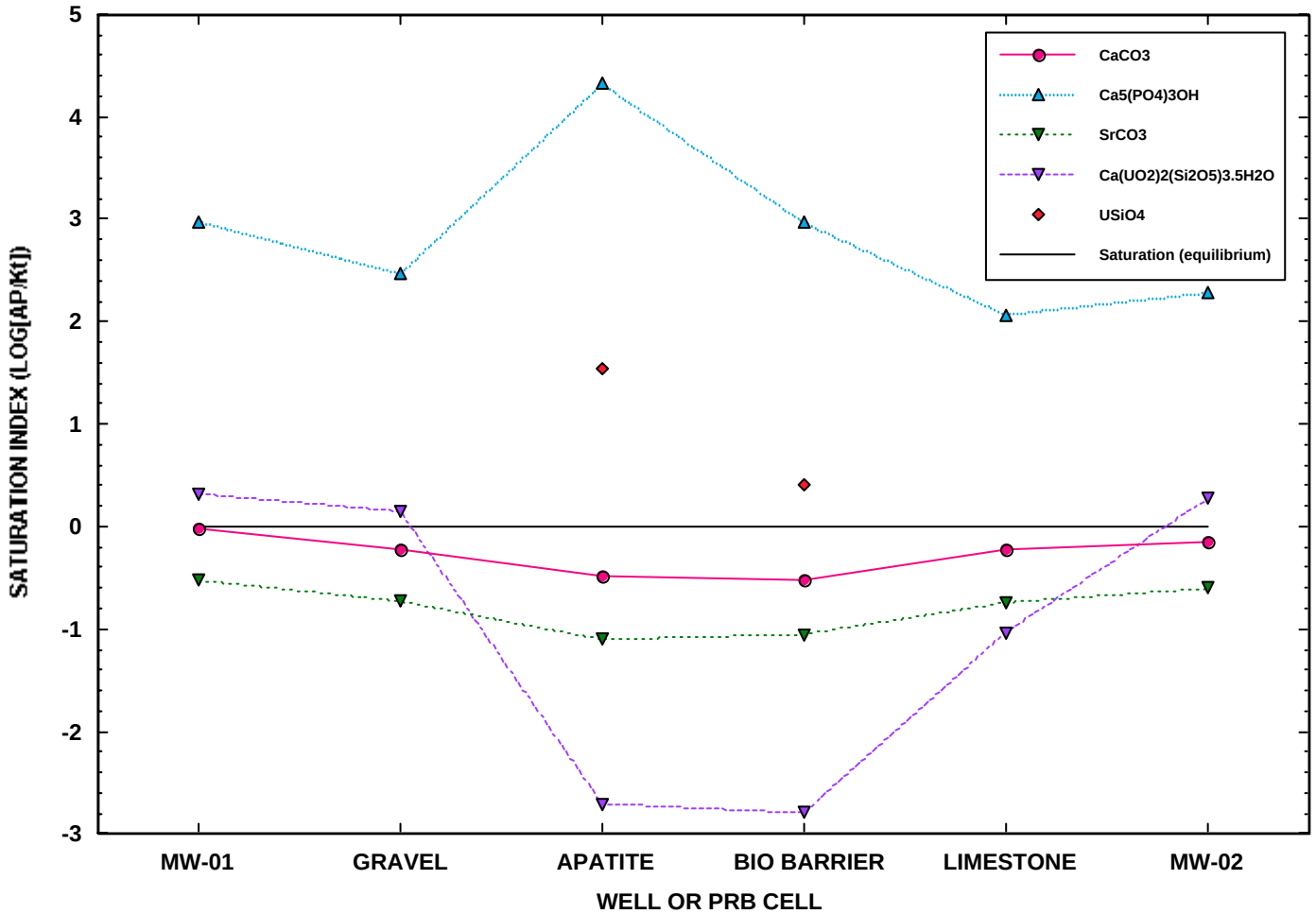
DISTRIBUTIONS OF DISSOLVED URANIUM AT THE MULTIPLE PRB



CALCULATED DISTRIBUTIONS OF DISSOLVED URANIUM(VI) SPECIES USING MINTEQA2 AT THE MULTIPLE PRB (06/08/04)



SATURATION INDICES FOR SEVERAL PHASES CALCULATED USING MINTEQA2 AT THE MULTIPLE PRB (06/08/04)



SUMMARY

- Groundwater flow through the permeable reactive barrier is occurring at variable rates.
- Perchlorate and nitrate are being transformed within the apatite and biobarrier cells within the permeable reactive barrier.
- Strontium-90 is adsorbing onto apatite surfaces within the permeable reactive barrier.