

**U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**PRESENTATION TO
THE NUCLEAR WASTE TECHNICAL REVIEW BOARD**

**SUBJECT: NATURAL ANALOGUES AND
PERFORMANCE ASSESSMENT:
A HISTORIC PERSPECTIVE**

PRESENTER: DR. DAVID B. CURTIS

**PRESENTER'S TITLE
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**RENO, NEVADA
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NATURAL ANALOGUES

- * 1) "...CHECK ON PERFORMANCE ASSESSMENT METHODOLOGY;"
- * 2) "... MORE MEANINGFUL THAN SOPHISTICATED NUMERICAL PREDICTIONS TO THE LAY PUBLIC."

- * "RETHINKING HIGH-LEVEL RADIOACTIVE WASTE DISPOSAL," COMMISSION ON GEOSCIENCES, ENVIRONMENT AND RESOURCES NATIONAL RESEARCH COUNCIL (NATIONAL ACADEMY PRESS, WASHINGTON, D.C., 1990).

THE OKLO NATURAL REACTORS AND PUBLIC PERCEPTION

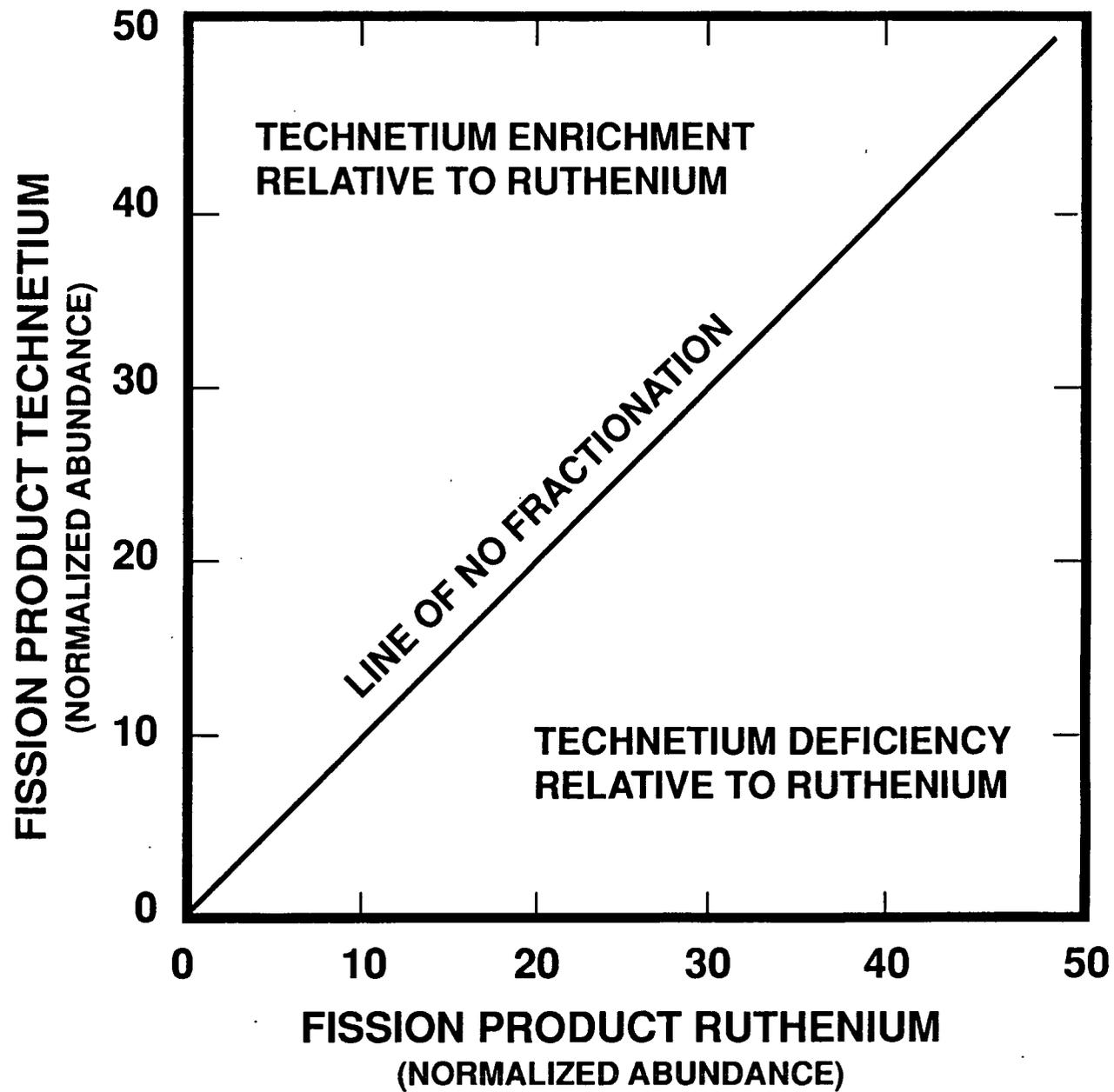
- **PUBLIC FORUMS**
- **POPULAR SCIENCE PRESS**
- **PUBLIC REACTIONS**
- **ACADEMIC CURRICULA**

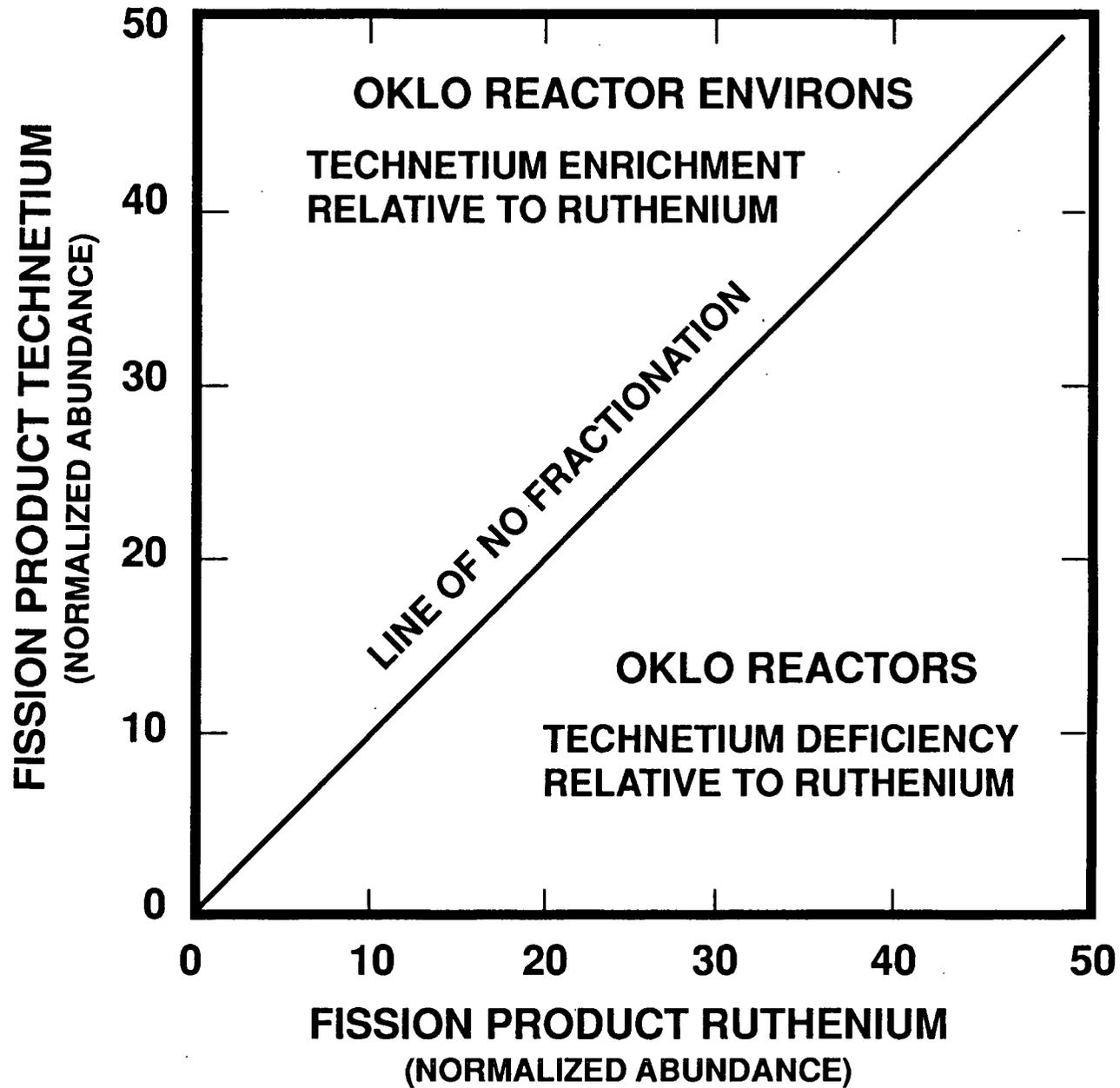
ISSUE: TECHNETIUM MIGRATION

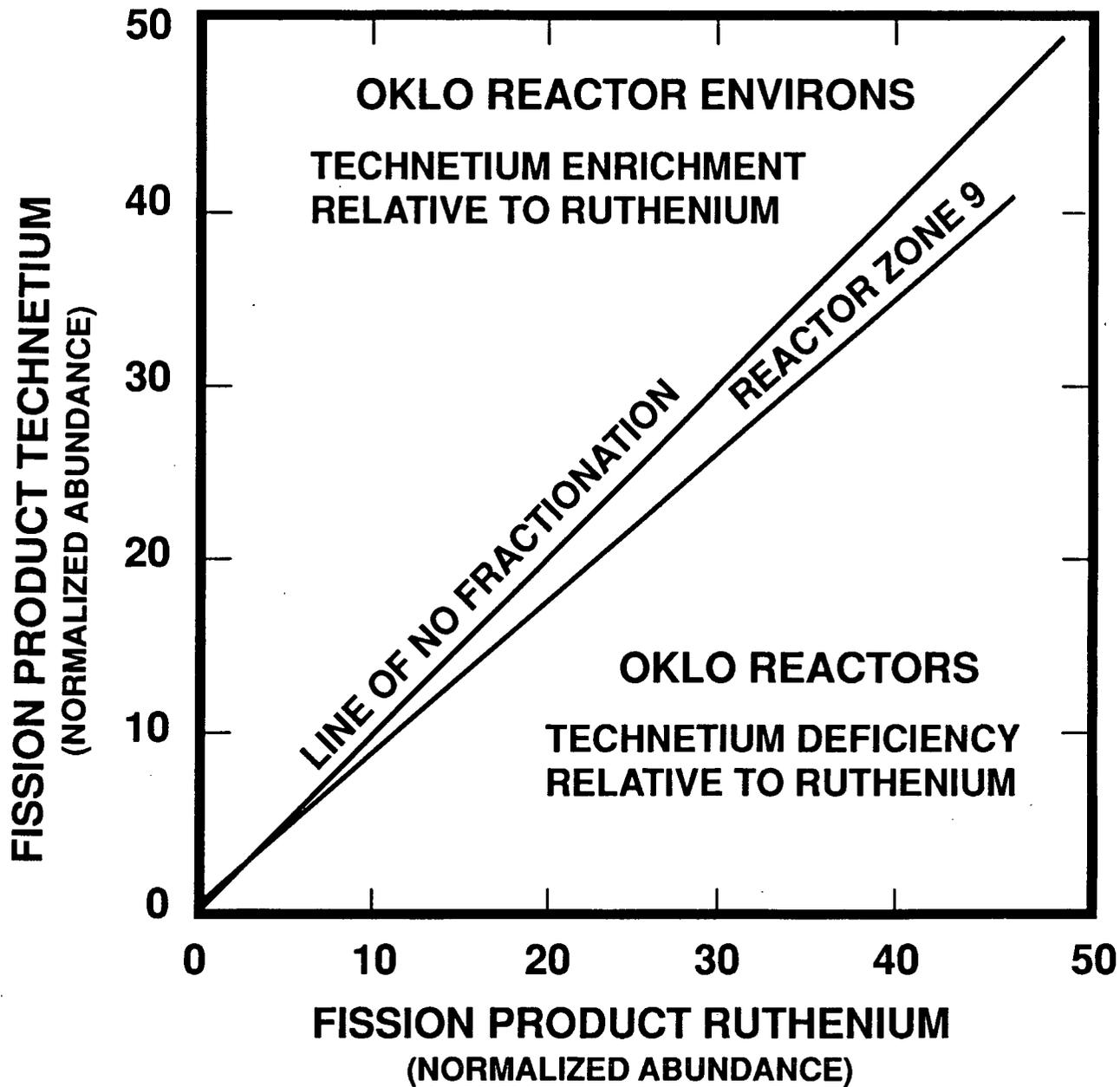
PERFORMANCE ASSESSMENT ASSUMPTION:

**TECHNETIUM MAY BE MOBILE IN THE PRESENCE
OF MOVING FLUIDS**

- **SOLUBLE UNDER NATURAL CONDITIONS**
- **POORLY SORBED**







ISSUE: TECHNETIUM MIGRATION

NATURAL ANALOGUE CONCLUSION:

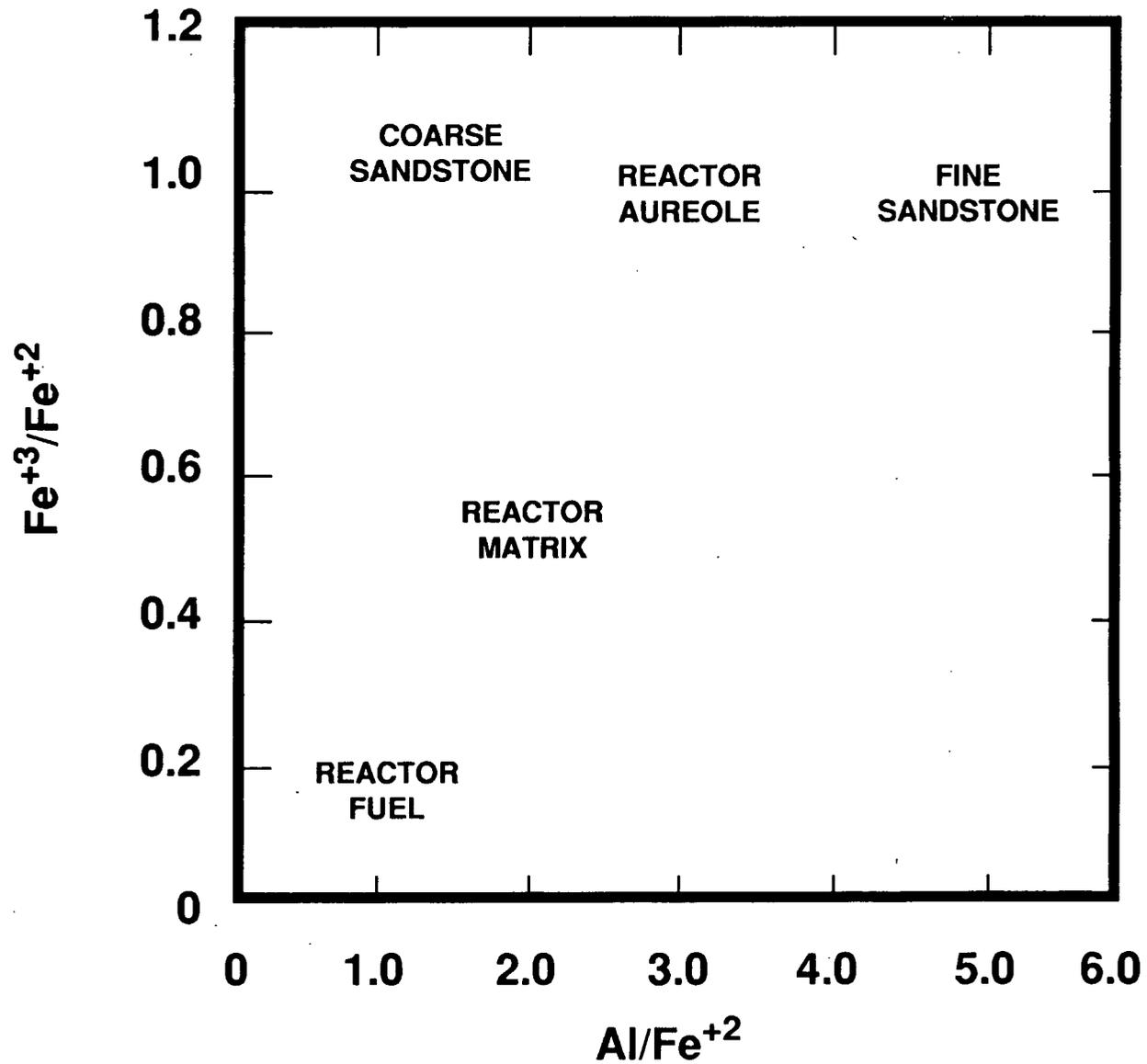
**TECHNETIUM HAS BEEN SELECTIVELY RETAINED
IN ROCK AT OKLO**

ISSUE: EFFECT OF α -RADIOLYSIS ON REPOSITORY PERFORMANCE

PERFORMANCE ASSESSMENT ASSUMPTION:

**α -RADIOLYSIS CREATES A MOVING REDOX FRONT WITH
ADVERSE EFFECTS ON THE RETENTION OF SELECTED
WASTE PRODUCTS**

OXIDATION STATE OF IRON IN OKLO DEPOSIT



ISSUE: EFFECT OF α -RADIOLYSIS ON REPOSITORY PERFORMANCE

NATURAL ANALOGUE CONCLUSION:

**α -RADIOLYSIS MAY HAVE PRODUCED REDUCING
CONDITIONS IN OKLO NATURAL FISSION REACTORS**

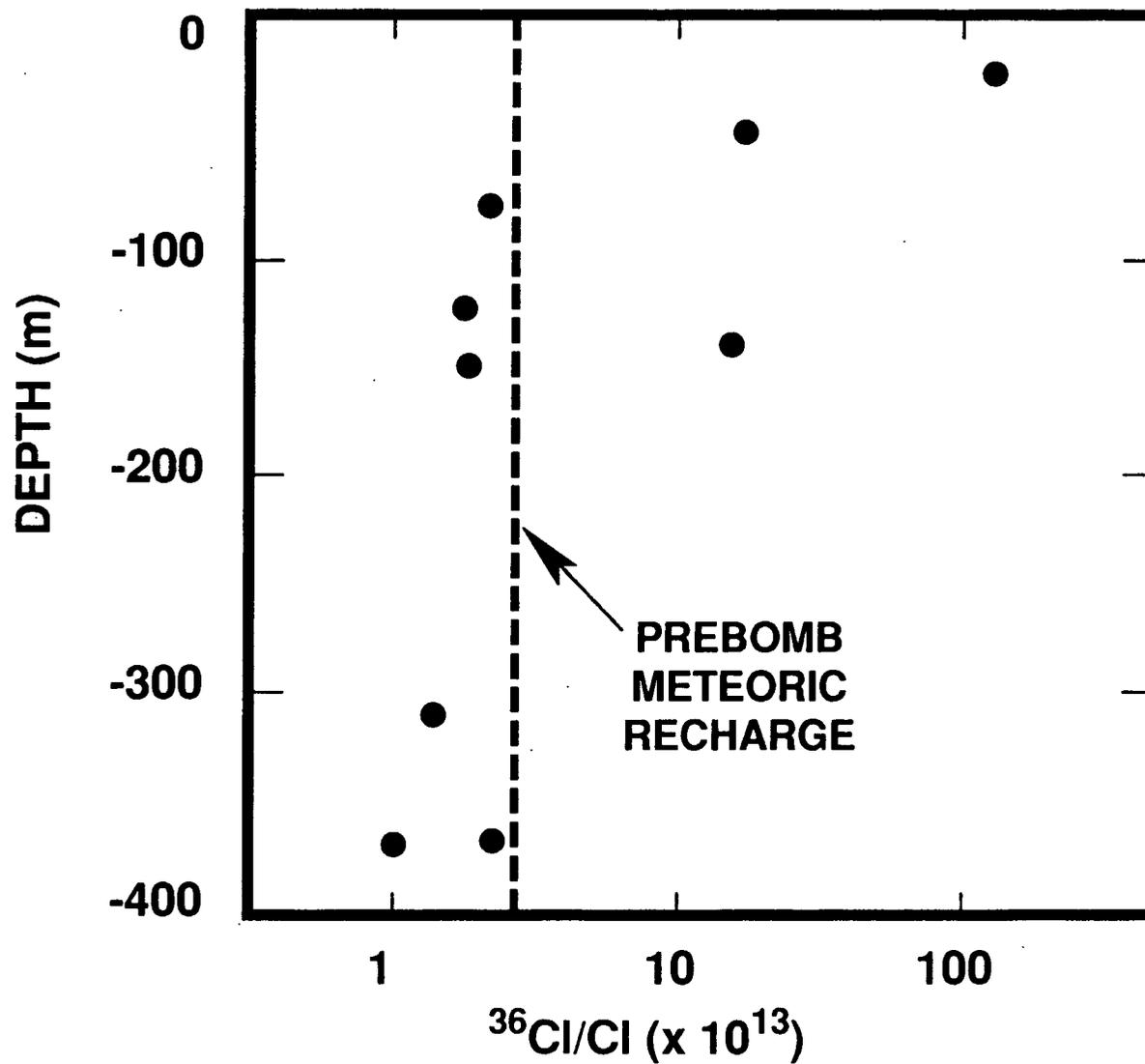
ISSUE: WATER MOVEMENT IN UNSATURATED ROCK

PERFORMANCE ASSESSMENT ASSUMPTION:

**FRACTURES DO NOT CONDUCT WATER TO SIGNIFICANT
DEPTHS IN UNSATURATED ROCKS**

- **WATER IS RAPIDLY IMBIBED INTO ROCK MATRIX AT
FRACTURE SURFACES**

^{36}Cl FROM USW UZ-1, YUCCA MOUNTAIN



ISSUE: WATER MOVEMENT IN UNSATURATED ROCK

NATURAL ANALOGUE CONCLUSION:

**WATER HAS BEEN TRANSMITTED TO SIGNIFICANT DEPTHS
IN UNSATURATED ROCKS**

- **TRANSIENT, NON-EQUILIBRIUM FLOW OF WATER
OCCURS ALONG FRACTURES**

NATURAL ANALOGUES AND PERFORMANCE ASSESSMENT

- * **1) "NATURAL CASE IS ... AN ANALOGUE OF REPOSITORY SITUATION."**

 - * **2) "NATURAL ANALOGUE MUST ADDRESS CRITICAL ELEMENTS OF REPOSITORY PERFORMANCE."**
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- * **"RETHINKING HIGH-LEVEL RADIOACTIVE WASTE DISPOSAL," COMMISSION ON GEOSCIENCES, ENVIRONMENT AND RESOURCES NATIONAL RESEARCH COUNCIL (NATIONAL ACADEMY PRESS, WASHINGTON, D.C., 1990).**

**THERE MUST BE
EFFECTIVE COMMUNICATION
BETWEEN
PERFORMANCE ASSESSMENT
AND NATURAL ANALOGUE
STUDIES**