



INTERNATIONAL ATOMIC ENERGY AGENCY
UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION
INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS
I.C.T.P., P.O. BOX 586, 34100 TRIESTE, ITALY, CABLE: CENTRATOM TRIESTE



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION



INTERNATIONAL CENTRE FOR SCIENCE AND HIGH TECHNOLOGY

c/o INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS 34100 TRIESTE (ITALY) VIA GRIGNANO, 9 (ADRIATICO PALACE) P.O. BOX 586 TELEPHONE 040-224572 TELEFAX 040-224575 TELEX 460440 APH I

SMR.648 - 14

SECOND AUTUMN WORKSHOP ON MATHEMATICAL ECOLOGY

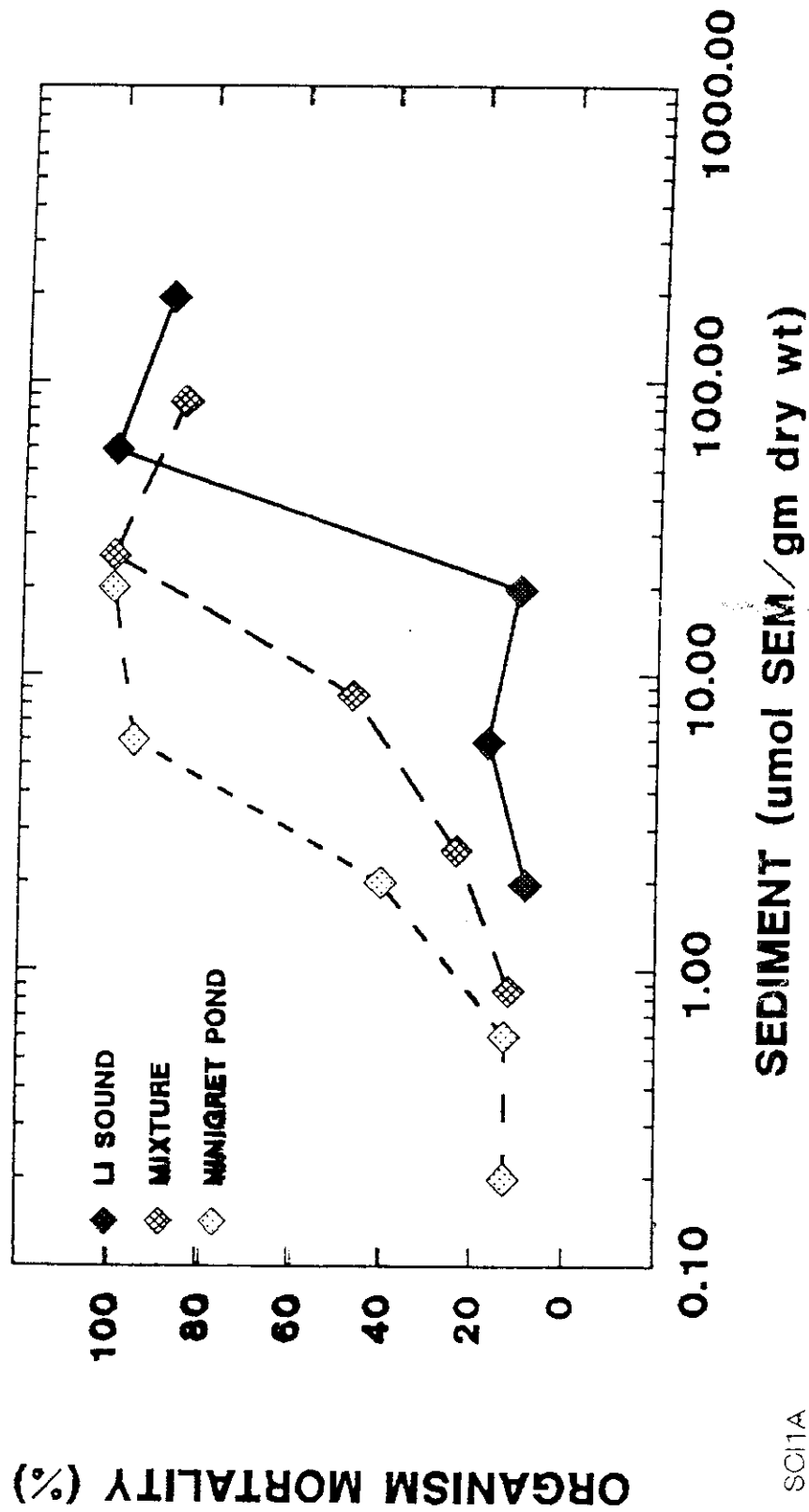
(2 - 20 November 1992)

"Toxicity of Metals in Sediments"

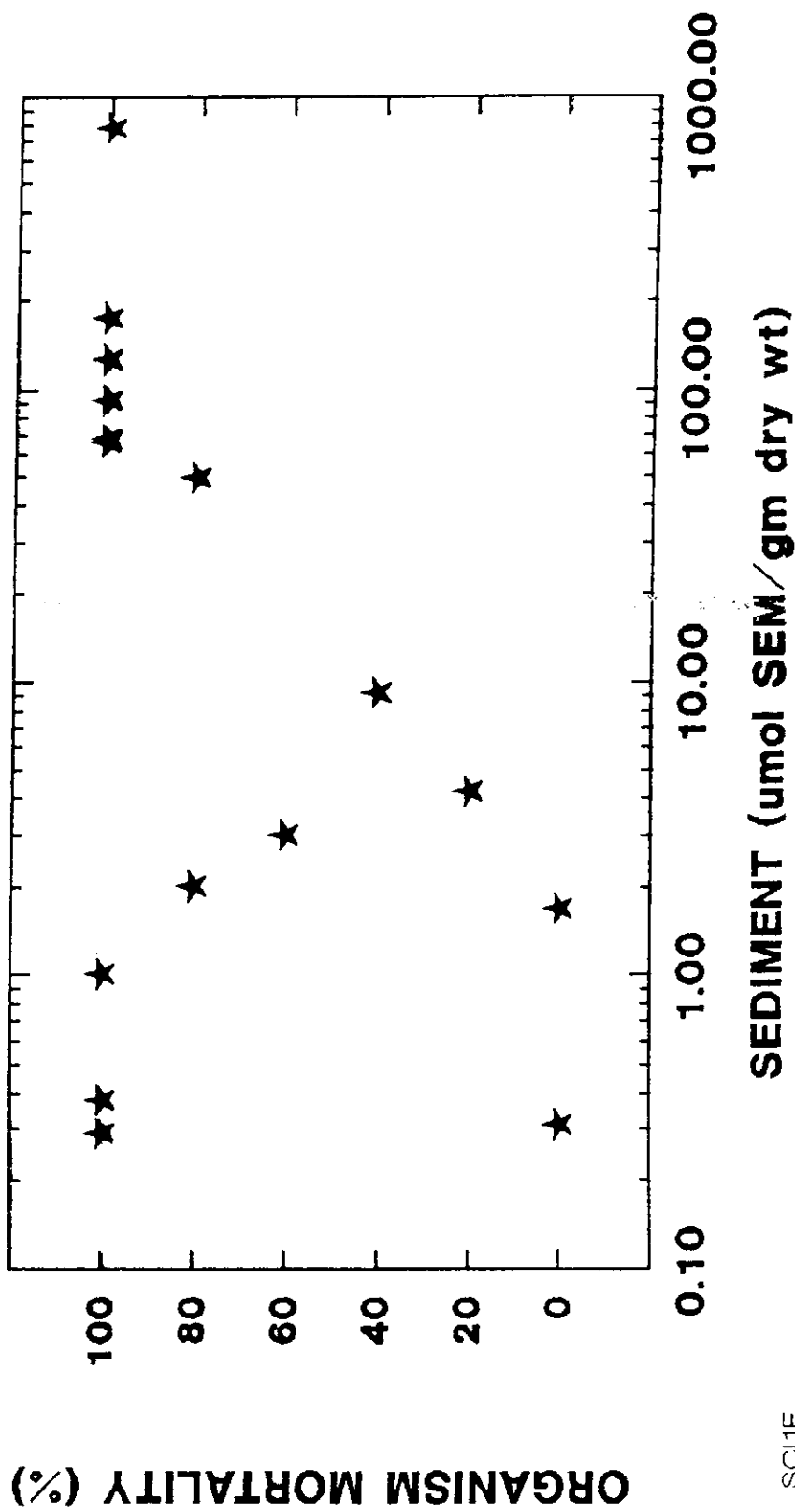
**D.M. Di Toro
Manhattan College
Environmental Engineering Dept.
Riverdale, Bronx
New York, NY 10471
U.S.A.**

These are preliminary lecture notes, intended only for distribution to participants.

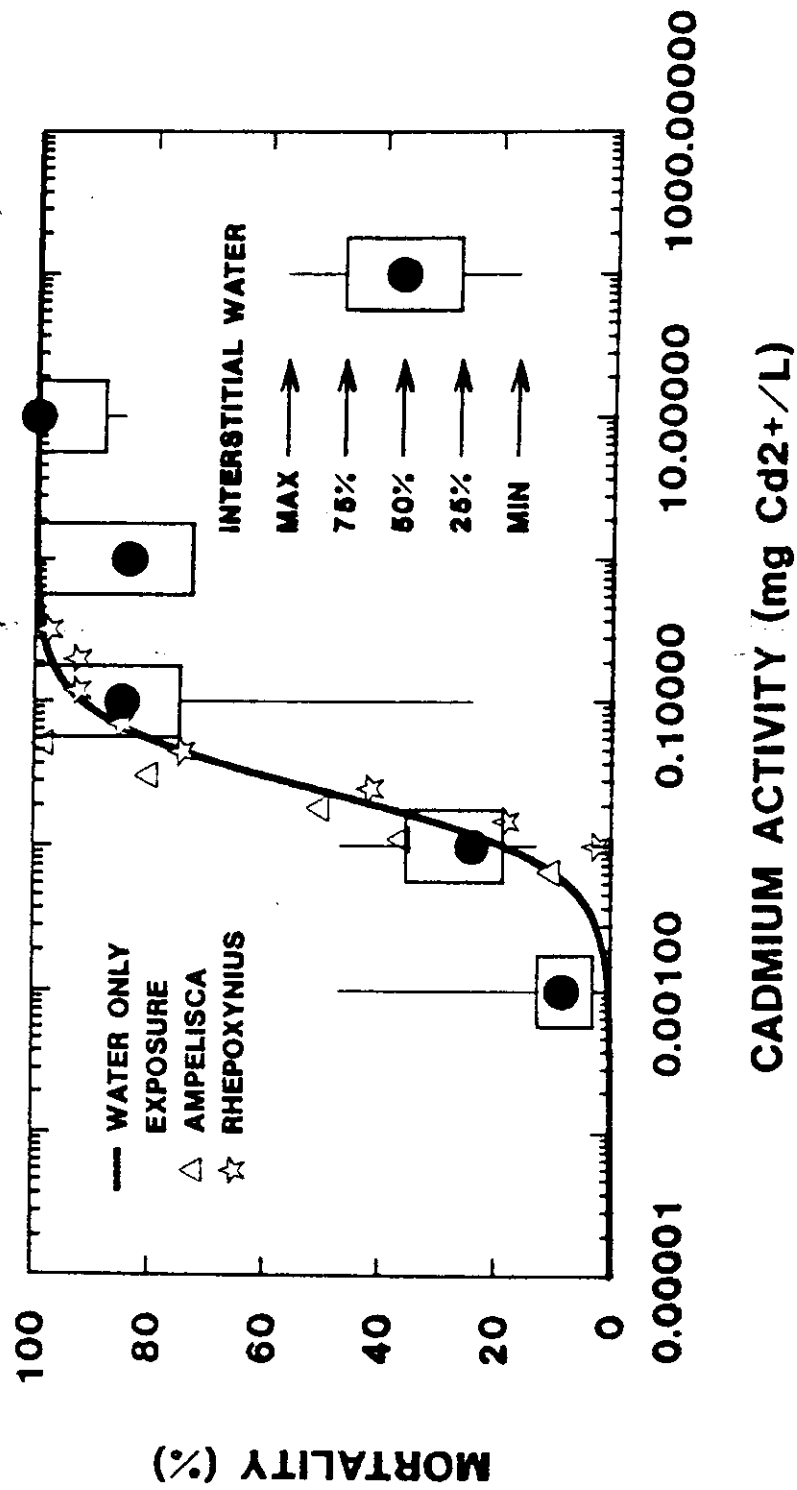
AMPHIPOD MORTALITY - CADMIUM - SEA WATER DRY WEIGHT NORMALIZATION



FOUNDRY COVE AMPHIPOD MORTALITY - Cd + Ni - FRESH WATER DRY WEIGHT NORMALIZATION



MORTALITY VS INTERSTITIAL WATER CADMIUM



WHAT DETERMINES METAL ACTIVITY IN SEDIMENTS ?

- * If there is a strong complexing agent present, it dominates, and sets the activity.**

The strongest, by far, is sulfide.

- * Sulfide in sediments.**

Dissolved sulfide

Particulate sulfide

Acid Volatile Sulfide (AVS)

Organic Sulfide

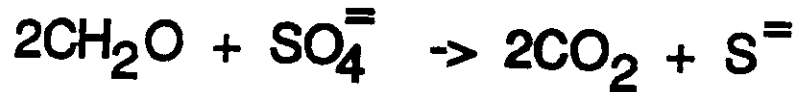
Residual Sulfide

- * We have found that AVS is the critical sulfide species.**
-

Origin of Sulfides

Organic Matter

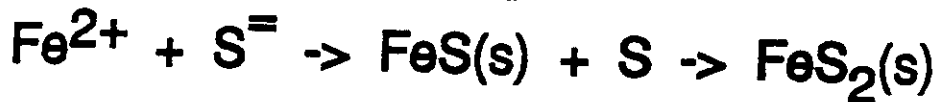
Sulfide



Iron

AVS

Pyrite



Toxic Metal

Amorphous

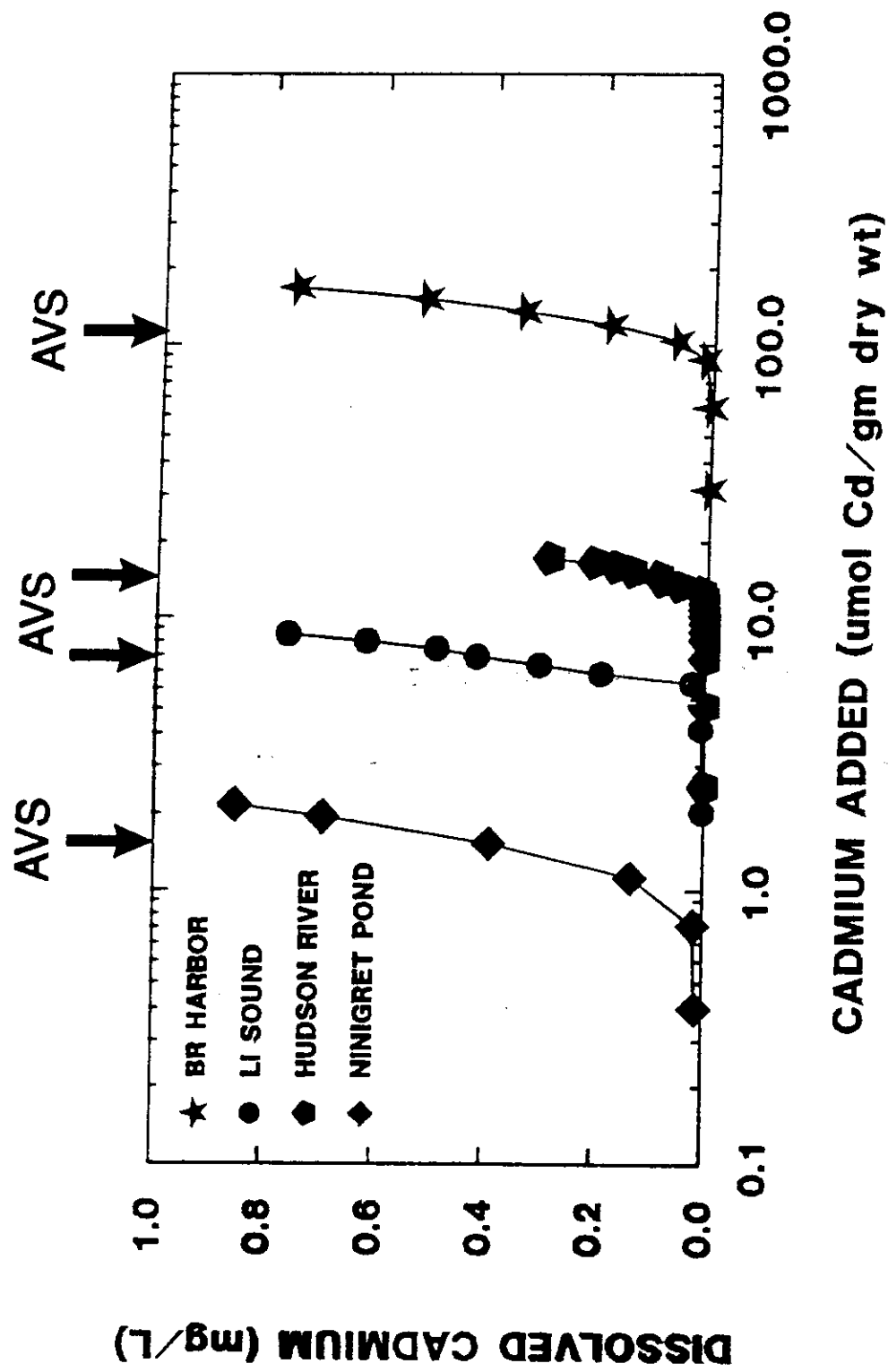
Crystal



Metal Displacement Reaction



CADMIUM TITRATION OF SEDIMENTS



Metal Species

Exchangeable
Carbonates
Fe, Mn Oxides
FeS
Amorp MeS
Organic Matter
Residual

Adsorbed

0.5M HCl

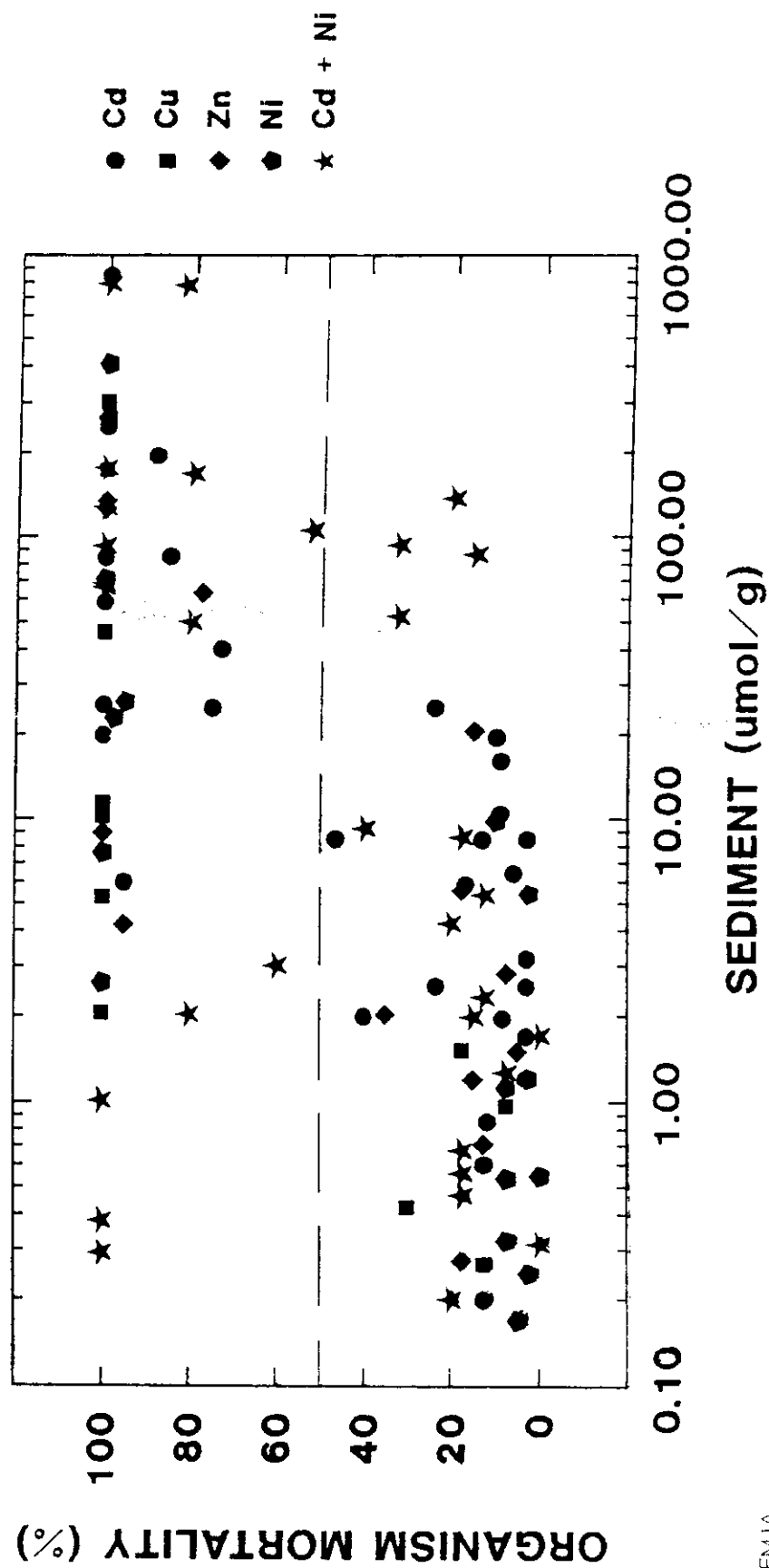
Extraction

SEM*
Adsorbed + MeS
AVS
MeS + FeS

* Simultaneously Extracted Metal

ACUTE TOXICITY OF METALS TO AMPHIPODS

DRY WEIGHT NORMALIZATION



ACUTE TOXICITY OF METALS TO AMPHIPODS ACID VOLATILE SULFIDE NORMALIZATION

