COMMENTS ON PROBABILISTIC VOLCANIC HAZARD ASSESSMENT

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Probabilistic Volcanic Hazard Assessment

- Geological Perspectives
- Basic Elements
- Examples of Volcanic Hazard Forecasting
- Methods Used
- Issues Relevant to Yucca Mountain
- Comments on Work Presented Here

PVHA - Geological Perspectives

Volcanic Forecasting

Key Questions:

What? type of event

When? repose frequency, next expected event

Where? at an exicting volcano or a new location

Size ? magnitude

Anticipated effects? vulnerability

PVHA - Geological Perspectives

Conceptual Models

- Mass eruption rate (energy release rate)
- Survivor function = probability that a repose has ended up to a specified time
- age-specific eruption rate
- spatial event predictors

BASIC ELEMENTS OF GOOD PVHA

- Define the problem and test the instrument
- Set limits of acceptability
- Identify key processes, parameters, & uncertainties
- Include all possibilities in model
- Arrange according to interdependencies
- Perform Sensitivity studies on parameters

Determine interactive effects of all elements on model

ADVANTAGE OF LOGIC TREES

- Applies to a wide range of problems
- Analyzes sources of uncertainity
- Accomodates interpretations with uncertainties
- Can use probabilities from expert judgement
- Can incorporate extreme interpretations
- Feedback etween nodes is possible

survivor function

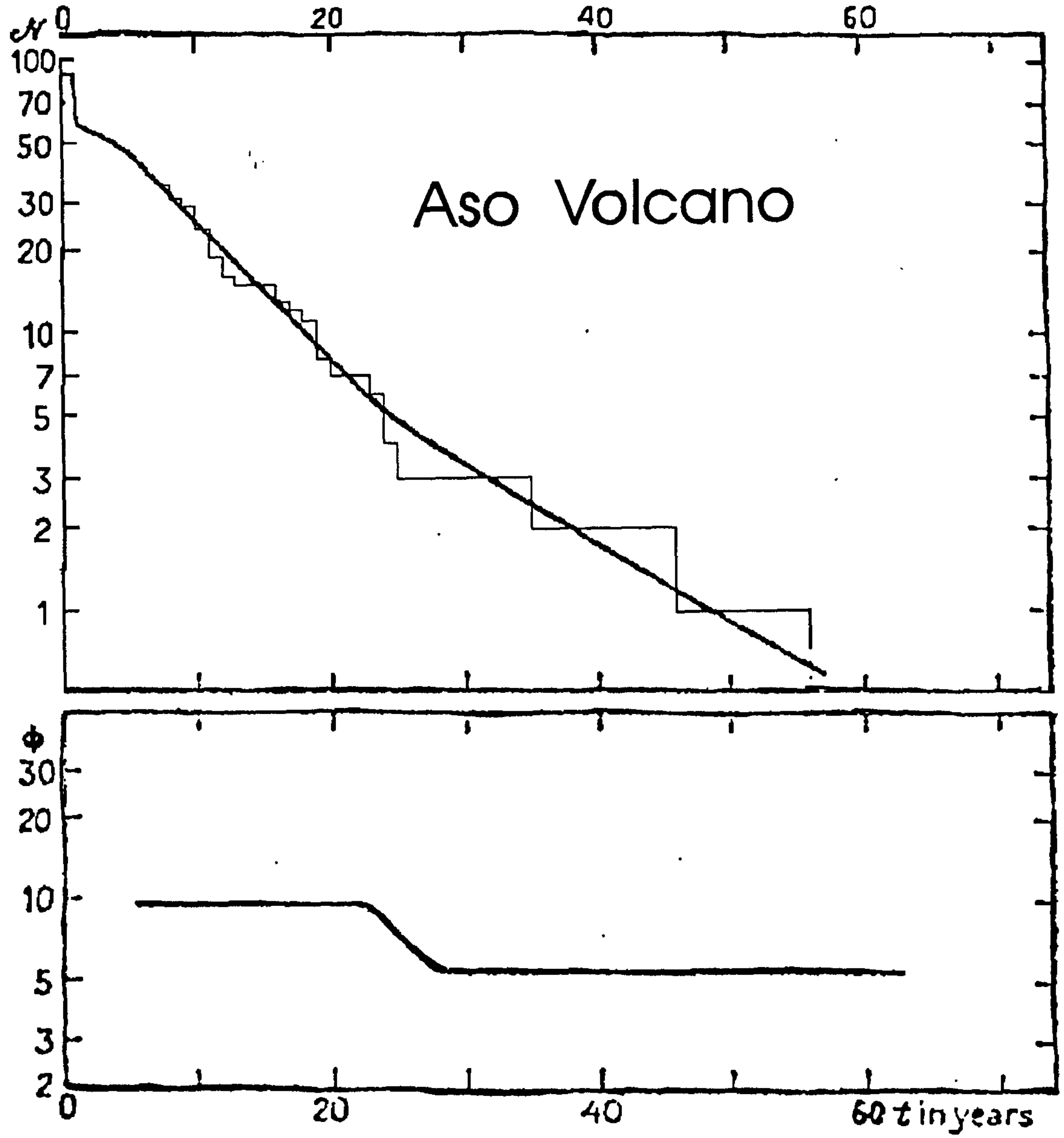
$$\mathcal{F}(x) = \text{prob}\,(X > x) = \int_x^\infty f(u)\,du$$

age-specific eruption rate

$$\phi(x) = \lim_{\Delta x \to 0+} \frac{\text{prob}\,(x < X < x + \Delta x \,|\, x < X)}{\Delta x}$$

$$\phi(x) = \frac{f(x)}{\mathcal{F}(x)} = \frac{\mathcal{F}'(x)}{\mathcal{F}(x)} = -\frac{d}{dx}\,[\ln \mathcal{F}(x)]$$

Wickman, 1965



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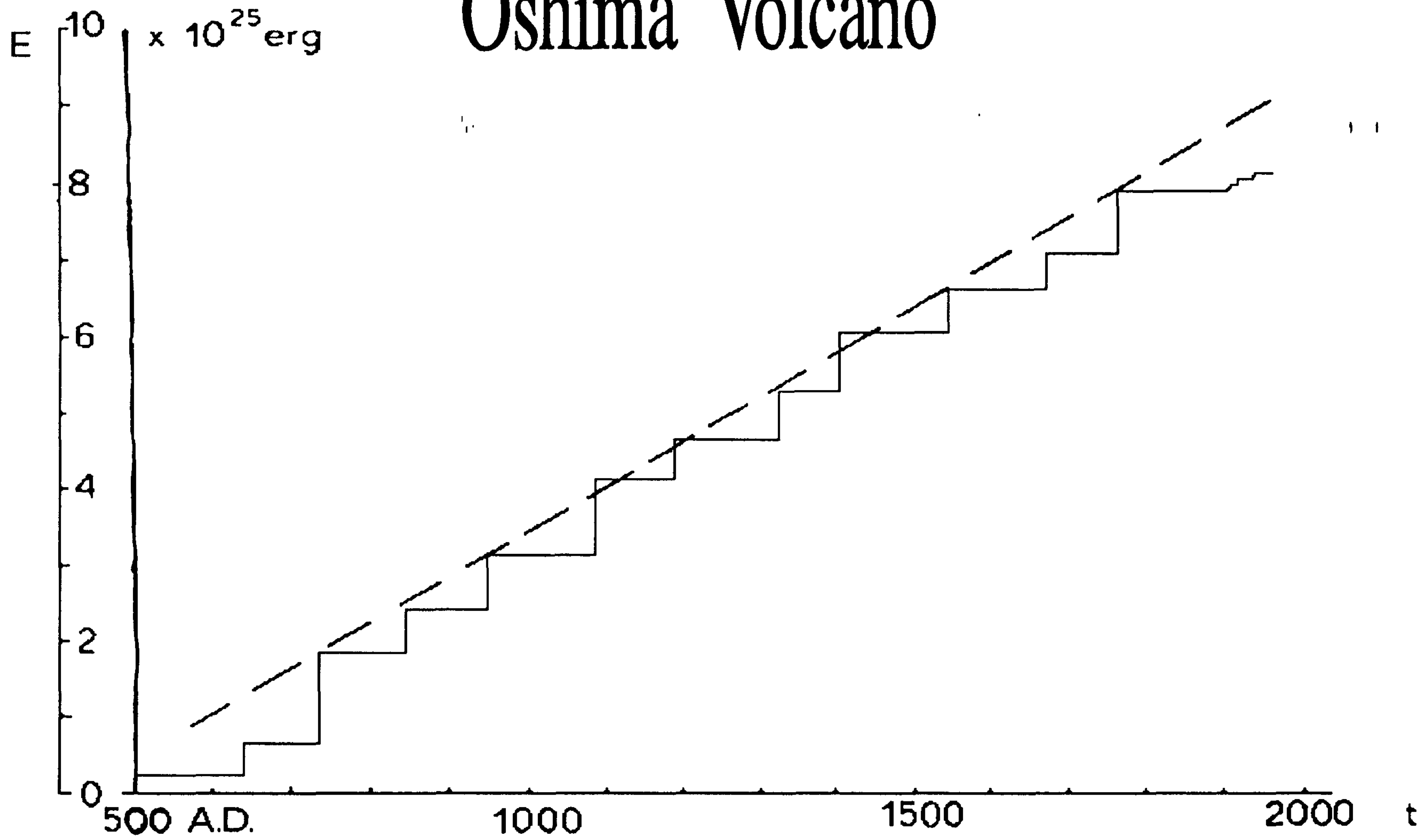
Wickman, 1965

Oshima Volcano



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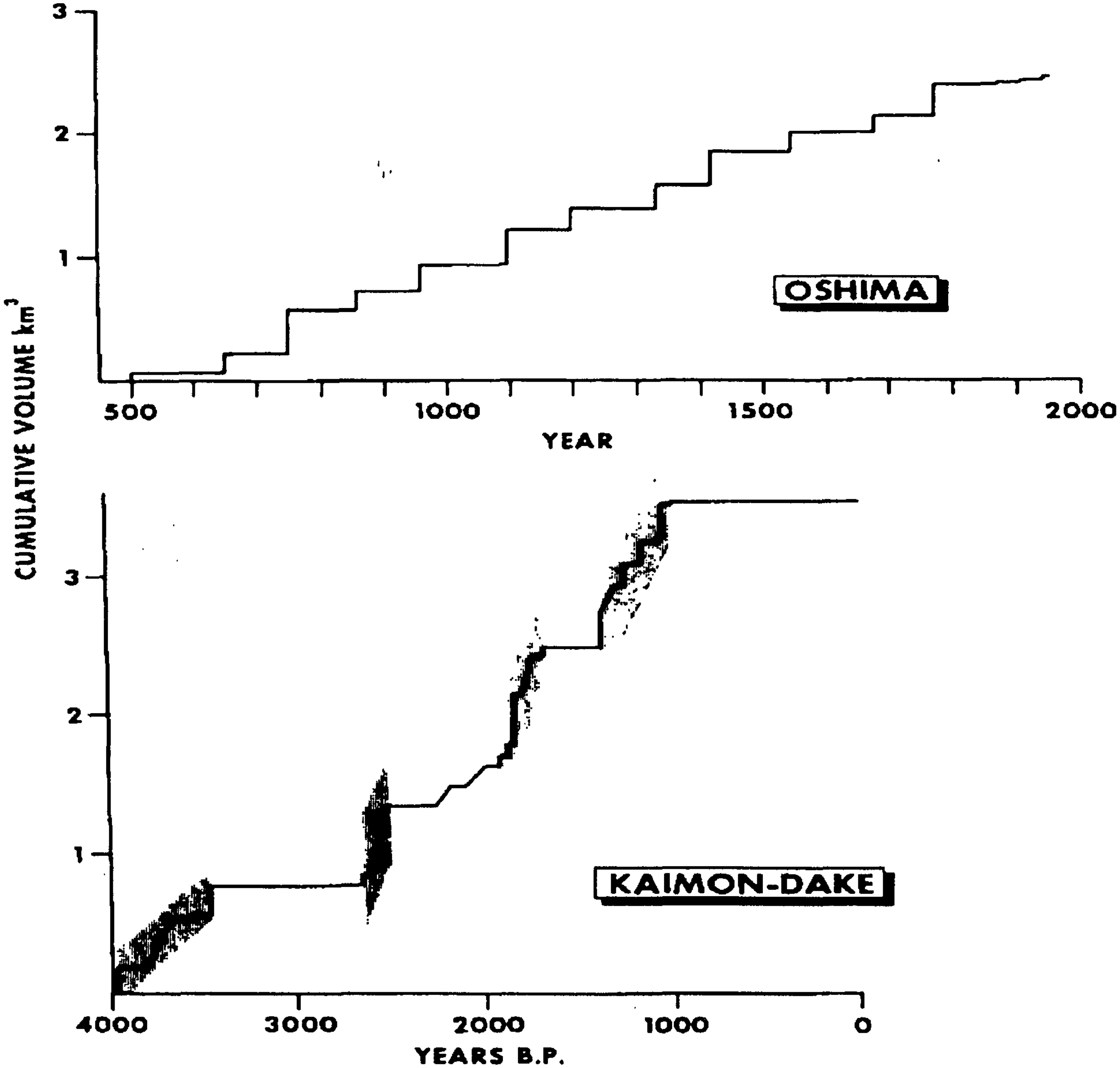
Scandone, 1981



Wadge , 1982

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LONG-TERM VOLCANIC HAZARD ASSESSMENT

Scandone (1979) Mexico

Very active volcanoes

Popocatepetl	2.4 x 10-2 yr-1
Colima	5.0 x 10-2 yr-1

Volcanic fields and regions

Mexican volcanic belt		7.0 x 10-2 yr-1
Chichinautzin	236/7000,000	3.1 x 10-4 yr-1
Tlapacaya	12/23,000	5.3 x 10-4 yr-1

YUCCA MOUNTAIN ISSUES

Geologic Questions to be Answered

1. Vulnerability problem:

- What is the minimum sized volcanic event that would present unacceptable safety hazards?
- What is the temporal probability of such an event or a larger one in the relevant volcanic system?
- What is the probability of such an event being close enough to effect the repository?

YUCCA MOUNTAIN ISSUES

Geologic Questions to be Answered

2. Problem resolution

- Put the volcanism problem into a "global" framework. For example: Compare local forecast with that of larger regions (entire Great Basin and larger volcanic fields)

- Give relatively more weight to qualitative scientific issues. For example: in determination of expected mass eruption rate for volcanoes near Yucca Mountain.

- Use expert judgment to evaluate conceptual issues. For example: the relative probability of various spatial models. or the likelihood of a new volcanic center.