MAAR-DIATREME VOLCANOES
Description and intended learning outcomes for this module.
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13 June 2016

Maar-diatremes are one of the most common volcanic landforms on Earth, and represent an end-member type of explosive volcano whose eruptions are dominated by explosive magma-water interaction. Thus they should form an important component of volcanology courses.

Significant advances have been made in the recent decade in our understanding of maar-diatremes, through a combination of field studies, experiments and numerical modeling. In this module we begin with the field context, by describing the general characteristics of the volcanoes, then work through some experimental studies that have explored the mechanisms for these characteristics. In the end we integrate the above in a general conceptual model of how maar-diatremes work.

In addition to presenting information about maar-diatremes, the module provides an example of a path of research that begins in the field, goes into physics, and then returns to the field. A practical exercise encourages students to use the presented concepts to explore new questions.

The module consists of two 50-minute lectures and a practical, which could be done as homework or as a lab or classroom exercise. A bibliography of relevant papers is provided for instructors and students who wish to pursue the topic in more detail. High-quality versions of the videos used in the lectures can be accessed through the referenced papers at the publishing journals' web sites.

The general outline of the lectures is:

Lecture 1

1. Describe general features of a maar-diatreme – crater, tephra ring, diatreme

2. A starting-point conceptual model

4. Key questions

5. Experimental approach

6. Basics of crater formation for single explosions

7. Energy constraints

Lecture 2

8. Brief review of Lecture 1

9. Eruptive jet and ejecta dynamics for single and multiple explosions

10. Crater morphology with multiple explosions

11. Subsurface processes of single and multiple blasts

12. Integrated conceptual model and major take-away points

LEARNING OUTCOMES

1. Draw to-scale diagram of a maar-diatreme with labels for the key features of the craters, diatremes, and tephra rings.

2. Correctly use/define terminology – tephra ring, crater, reference explosion footprint, debris jets, fallback, ejecta, scaled depth.

3. Calculate scaled depths and crater sizes for single explosions, given explosion energy.

4. Understand constraints on energies and depths from nature.

5. Apply concepts to examine questions about crater morphology.

6. Understand effects of explosion dynamics on tephra ring deposits.