A PLANETARY SCIENCE FIELD TRAINING AND RESEARCH PROGRAM AT THE ZUNI-BANDERA VOLCANIC FIELD, NM

Jacob Bleacher, David Kring, Brent Garry, Larry Crumpler

Inner Solar System Impact Processes Center for Lunar Science and Exploration
BACKGROUND: ZUNI-BANDERA, NM

Figure 1. Geologic map of El Malpais and surrounding area, New Mexico.
LAVA FLOWS

Channels

Tubes

Sheets
SHEETS

- Tabular units
- Large surface areas
- Inflation
- Emplacement over low slopes
• Flow textures:
  • ‘a‘ā
  • pāhoehoe
  • disrupted pāhoehoe
BACKGROUND: BASALTIC VOLCANOLOGY

• **Inflation**
  • Observed inflating lobes at flow fronts, HI
  • Enables 10s cm thick flows to attain thicknesses of meters in days to weeks
McCARTYS, NM

- Tholeiitic basalts
  - Quartz normative near vent
  - Olivine normative away from vent
- 48 km
- 189 km²
- 7.9 km³
- ~ 3000 YBP
  - Cosmogenic
  - Radiocarbon
- Compound, tube-fed, pahoehoe flow field
PLATEAUS
MARGINS

- Steeply dipping plates
- Occasionally overturned
- > 10 m in relief based on DGPS measurements
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McCarty’s Lava Flow Platform

Basal Width: 232 m
Thickness: 6.5 – 14 m
Platform Change: 0.6 m
CLEFTS

- Dipping margins and horizontal plateaus separated by deep cracks
- Meters deep
PITS

- Vary from flat floored to conical
- Abrupt drop with overhanging roof to gradual increase in slope
- Floors covered in rubble, younger flows, or pre-flow surface
Lineated

- Parallel 10s cm grooves
- Aligned with flow direction
- Results from shear during flow
Coils
• Also consistent with sheer zones within forming crust
Pahoehoe

- Pahoehoe ropes
- Also weathered away
**Slabby/Rubbly**
- Tilted plates, sometimes reverse imbricated
- ~10 cm thick
- Ropes and lineations present on upper slabs
- Disrupted original crust
Wedges

- Blade-like features located in base of inflation clefts and along base of upper crust in pits
- Sometimes display downward sagging
- Found commonly in pit walls and clefts
INTERIOR

- Massive core
- Vesicle Layers near crust (10s cm depth)
- Disconnects core from surface texture
PLATES

• Pre-inflation plates that rafted apart
• Plates typically separated by fields of lava balls or rougher textures
PLATE MARGINS

- Plates also bound by slabby texture (compression) or upwelled lava (tensile)
TEXTURE CHANGES

- Abrupt
- Not necessarily embayment
- No change of massive interior
Emplacement History

• Questions:
  • Did inflation occur at McCartys
  • Did pits form by inflation or collapse
  • Which features are characteristic vs. diagnostic
  • What was the flow pathway
• Initial sheet, development of original crust (lineations, coils, ropes)
• Continued flux into sheet disrupts surface crust and causes inflation (plates, slabby, rubbly, balls)
• Vesicles focused along base of crust
• Breakouts can feed new inflated lobes
• Most textures could form regardless of inflation
• Squeeze-outs are our diagnostic for inflation
PIT FORMATION

- Inflation pits display a sense of collapse
- Critical point is to determine if inflation has occurred in the flow field
PITS

• Overhanging roof and flat floors are not necessarily diagnostic features of:
  • Lava tubes
  • Volcanic caves
FLOW CONTACTS

- Flows were originally horizontal
- Working to differentiate between breakouts and uplifted embayment relationships
Field Conclusions

• Squeeze-outs diagnostic of inflation
• Plateaus, irregular pits, and terraced margins characteristic of inflation
Conclusions

• Inflation enables emplacement over long distances
• Occurs in all styles of basaltic terrain development
• Planetary inflation can be inferred from characteristic features
• Rough, slabby planetary lava flows not necessarily A’ā flows