Geology of Kadunce Creek and Surrounding Areas

By
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Instructor – Terry Boerboom
TA  Lucy M
Index of 1:24,000 bedrock mapping along the North Shore of Lake Superior

MGS Miscellaneous Maps (1:24,000 quadrangles) funded by COGEO/MAP
M-65 — Silver Bay/Split Rock Pt. NE
M-66 — Illgen City
M-72 — Finland/Doyle Lake
M-81 — Silver Island/Wilson/Toohy Lk.
M-82 — Cabin Lake/Cramer
Area geology prior to detailed remapping
Geologic detail after remapping of Grand Marais quadrangle
General Overview
Eric ponders over the lack of fish.
We were forced to rough it out.
Finding outcrop proved difficult.
Our Objectives:

• To map the outcrops of major creeks including Kadunce, Kimball, Durfee, and Cliff.
• To identify and measure structural features such as flow parting, dikes, and faults.
• To locate and correlate contacts between different rock units and flows.
Regional Geology of the Grand Marais Area – Tectonic Setting

• Mesoproterozoic
• Midcontinent rift (1.1 Ga)
• Contact between mantle plume and lithosphere
• Lower sequences have reversed polarity (1.108-1.107 Ga), upper sequences have normal polarity (1.099-1.094 Ga)
• 30 km deep basin
• Lower 20 km volcanics, rest fluvial

Miller et al. 2002
Midcontinent rift

Laurentia

Extent of Mantle Plume Head

Inner Laurentia

Midcontinent Rift

Grenville Mountains
Regional Geology of the Grand Marais Area - Volcanics

• Grade from primitive basalts to rhyolites with increasing iron enrichment
• Basalts derived from mantle plume, rhyolites from partial melting of Archean basement
• Subaerial plateau lavas

Miller et al. 2002
Volcanics continued

• Olivine tholeiites most primitive
• Continuous grading between Andesite ( > 52% SiO$_2$), Icelandite (60-68% SiO$_2$) (7% FeO), and Rhyolite ( > 70% SiO$_2$)
• Rhyolite most evolved, less FeO than Icelandite.
Regional Geology of the Grand Marais Area - Stratigraphy

- Schroeder-Lutsen sequence highest
- Crustal high, divides North Shore Volcanics into Northeast and Southwest limbs
- Units cannot be correlated between limbs
- Upper and lower sequences of limbs determined by polarity
- Hydrothermal and burial metamorphism
- Deposition of amygdule minerals, alteration of primary minerals in fractured/vesicular flow tops and bases.

Miller et al. 2002
Regional Geology of the Grand Marais Area - Clastics

- Interbedded redbed sandstone
- Centimeters to 100 meters thick
- Fluvial
- Matrix in flow top breccias/aa
- Clastic dikes in lava flows

Miller et al. 2002
Fault breccia in icelandite. Note sandy matrix.

Sample from breccia dike.
Basalt

• Oldest measured rock unit
• 2 units; Red Cliff and Kadunce
• Dark grey to red
• Identifying features:
  – ophitic texture
  – altered red olivine
  – pahoehoe flowtop
Basalt

Locally porphyritic basalt containing plagioclase phenocrysts. Hammer for scale.

Plagioclase phenocryst, approximately 15 cm long.
Basalt

Vesicle cylinder surrounded by amygdaloidal zone.

A vesicle cylinder in massive basalt.
Basalt flow top. Note reddish sand in matrix of brecciated zone. Flow tops are blocky with an overall pahoehoe surface.
Massive basalt typical of flow interiors. Note vesicle cylinder to the right of the scale card.
Andesite

- One mapped unit; Kadunce Andesite
- Brownish in color
- Identifying features:
  - highly magnetic,
  - breccia flow top
  - stretched amygdules in flow base
  - mafic oxides and pyroxenes
Icelandite

- Pink to maroon coloration
- 2 mapped units; Kadunce and Upper Kadunce
  - Very similar units
- Identifying features:
  - slightly magnetic
  - prismatic apatite
  - “felty” matrix texture
Typical flow banding in Icelandite.
Icelandite outcrops are usually exposed along stream banks
Taking a break. Kyle refreshes himself while Eric smiles for the camera.
Rhyolite

• Most abundant measured rock unit
  – 4 different units mapped
  – Varied mostly by grain and porphyroclast size

• Light grey to dark red in color, maroon

• Identifying features:
  – sugary texture
  – kaolinite in amygdules
  – no magnetism
  – Quartz, feldspar, and green altered mafic phenocrysts
Curved flow banding in rhyolite. Hammer for scale.
Terry and Kyle study the curved flow banding.
Rhyolite on Kimball Creek. Note superficial similarity to icelandite flows.
Corey uses his pen magnet to check for magnetism. Rhyolite (pictured above) is non-magnetic while icelandite has a weak magnetism.
Diabase

• Youngest rock unit
• Light green to grey color
• Identifying features:
  – Dark grey
  – Medium grained
  – Sub-ophitic
  – Cross-cutting intrusion
Contact between breccia dike (left) and diabase dike (right) on Kadunce creek.
Contact between the diabase dike from D1 and icelandite further upstream.
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Reference