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Analysis of Concentric Growth Rings in Hydrothermal Epidote

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Putting a Ring on Geological Research: What mineral growth can tell us about underground systems

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Advisor: Dr. Pete Stelling, Assistant Professor, Department of Geology College of Science and Engineering

Introduction
This project is giving a new meaning to “put a ring on it” with examining strange chemical growth rings in minerals. The minerals were collected from rock cores on Akutan Island, Alaska. This island is home to a volcano which has led to a hydrothermal (heated ground water) system underground.

Discussion
• Since the zones do not grade into each other, a rapid change in the system is causing the distinct boundaries between zones
• There is a trade off between Al and Fe in the bands. (Figures 2, 4c, 5). This supports changes in available free oxygen (oxygen fugacity)
• Trace elements change a lot between bands. This supports changes in fluid chemistry
• Conclusion: Bands are likely result of both changes in available oxygen and fluid composition

Outstanding Questions
• Concluding question: What causes the fluid to change?
  • Boiling? Changing fluid flow direction? Variable contributions of different fluids?

Methodology: analyzing microscope slides of rocks
• Images and chemistry using WWU's scanning electron microscope (SEM)
• Chemical maps of sample 2-49-319-2 were made on WWU's SEM (Figure 5)
• Cathodoluminescence (CL) analysis at WWU (combines optical and SEM techniques; Figure 6)
• Laser ablation analyses of sample 2-49-319-2 was conducted on WWU’s LA-ICP-MS (Figure 4)
• Electron Probe microanalysis (EPMA) at U. of Washington (Figures 1, 2, and 4A)

Results
• Zoning patterns were found in each type of analysis
  • Zoning occurs when there is a change in chemical composition throughout a crystal
  • Found many zoned crystals but used crystals with the widest, most distinct bands for microprobe, laser analysis
  • Data from UW revealed the light bands have a higher Fe content than the dark bands (Figure 1) and in chemical maps (Figure 5)
  • Trace elements vary substantially between different bands

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