

# Science Associated with Resource Identification and Development

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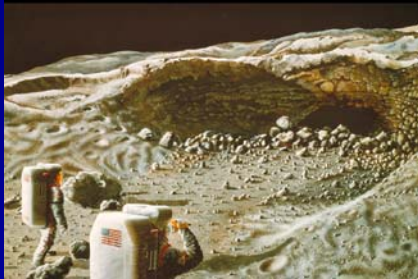


# Exploration

Settlement



Science



Resources



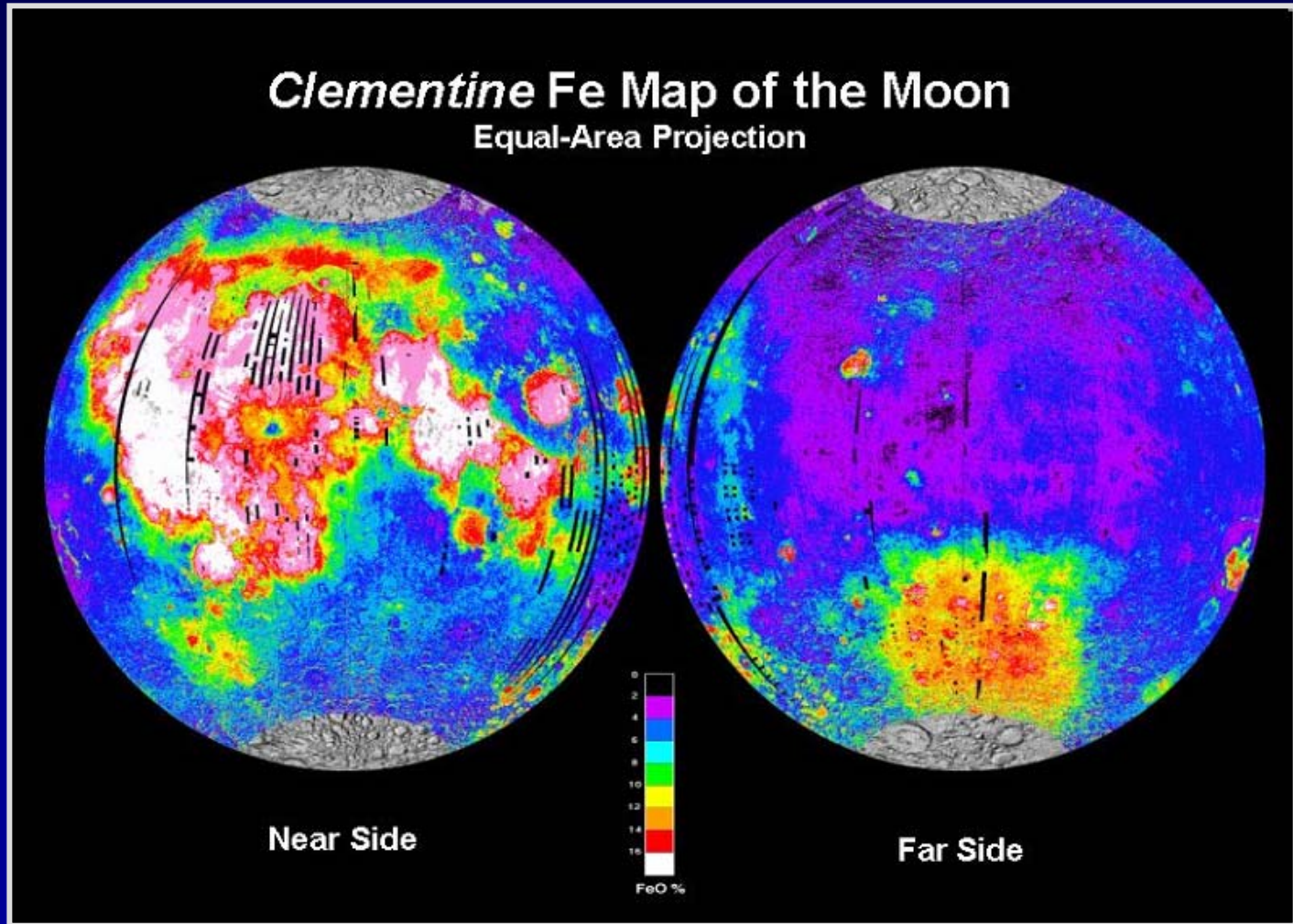
Commerce



# Science and Resources

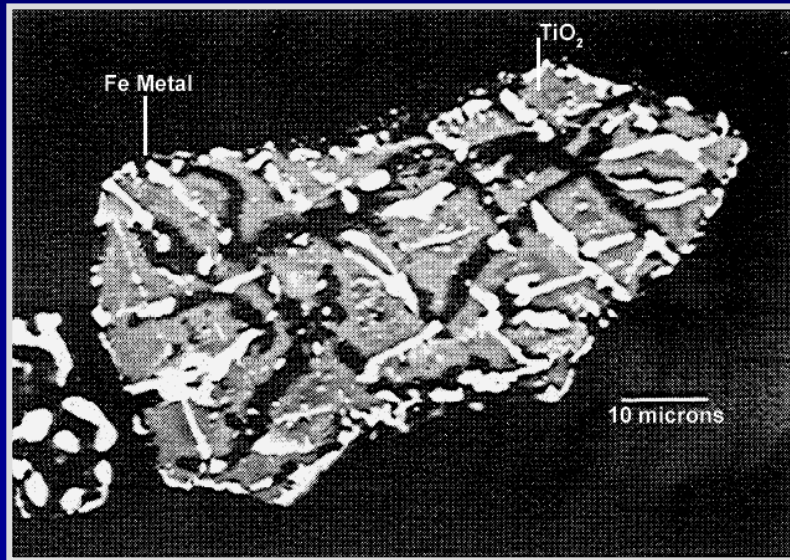
1. Science enables development of resources
2. Resource exploration targets areas of scientific interest
3. Search for resources leads to development of exploration tools useful for science
4. Use of resources and creation of a complex infrastructure enables science

# Prospecting: Science Enabling Resource Exploration



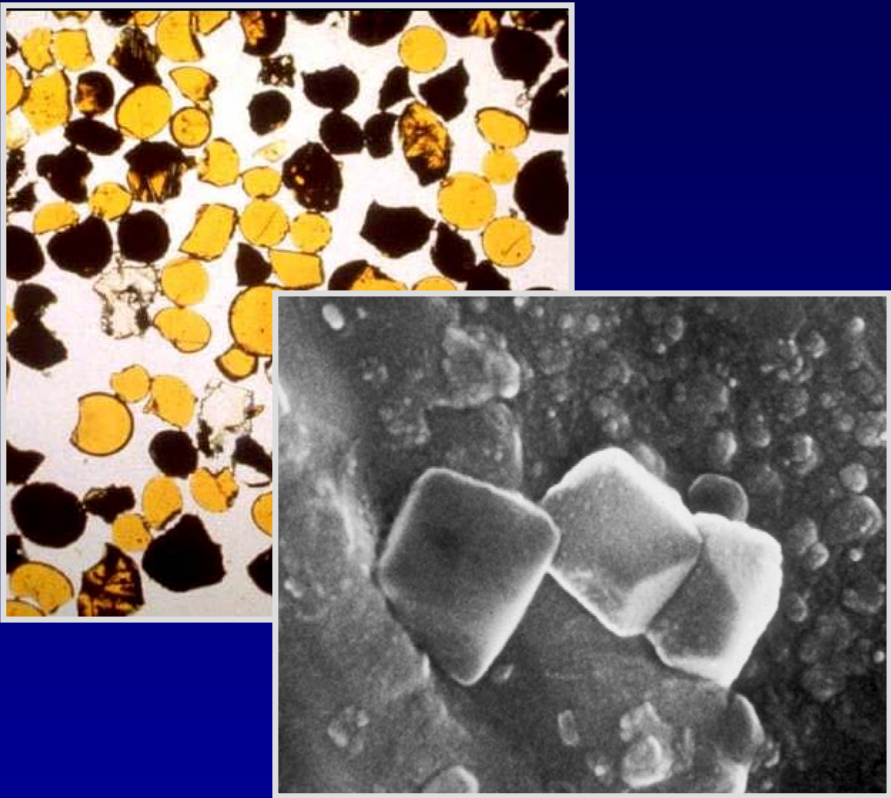
# Experiments: Science Enabling Resource Extraction

- Resource Processing
  - Processing technology
  - Materials science



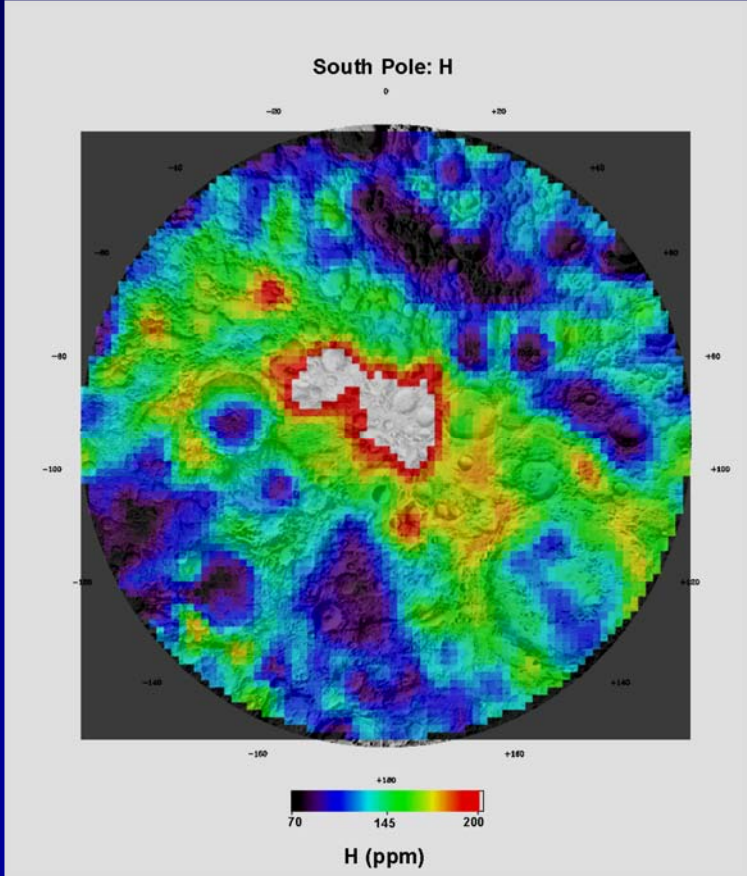
Lunar ilmenite  
( $\text{FeTiO}_3$ ) reduced with  
hydrogen  
(Allen et al., 1994)

# Search for Resources Involves Study of Areas of Scientific Interest

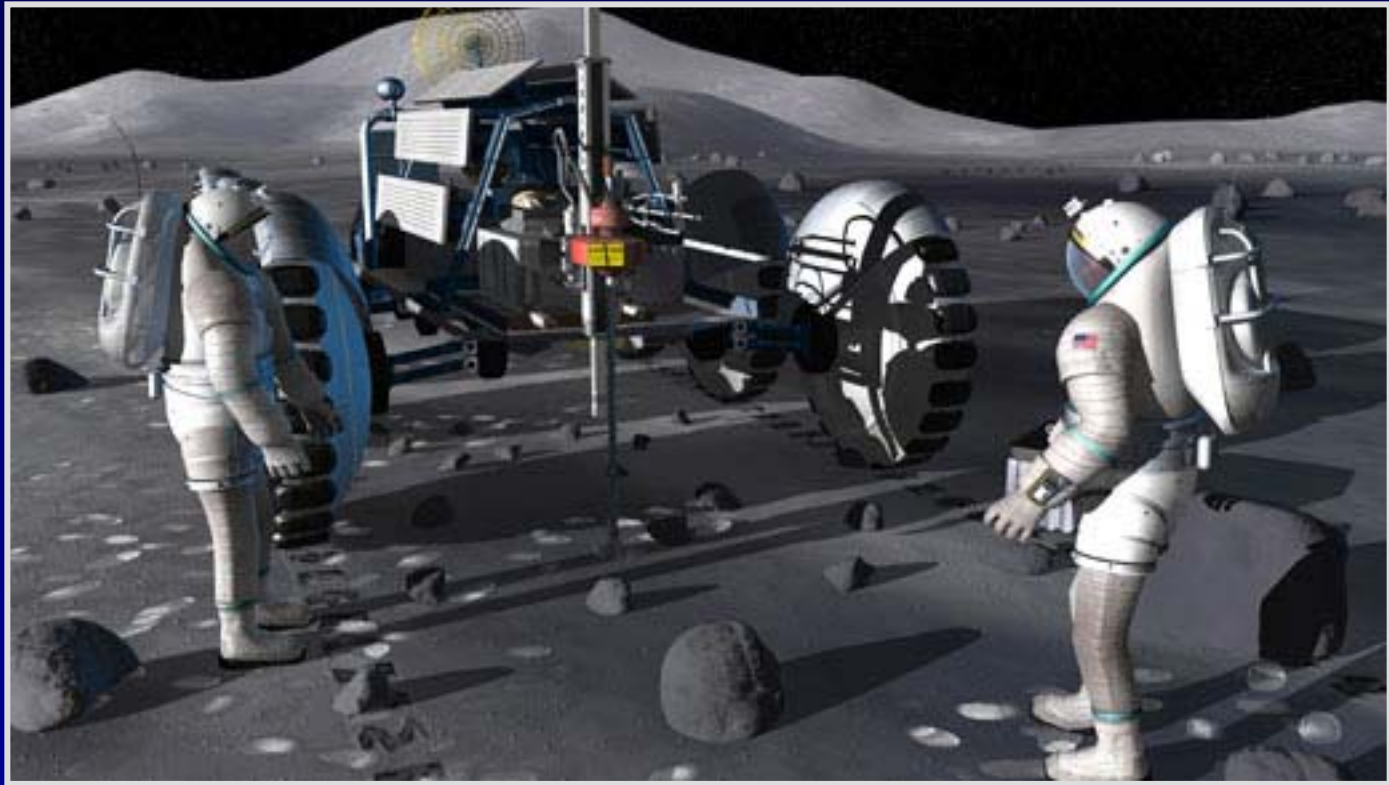


Volcanic Processes

## H<sub>2</sub>O in Polar Regions

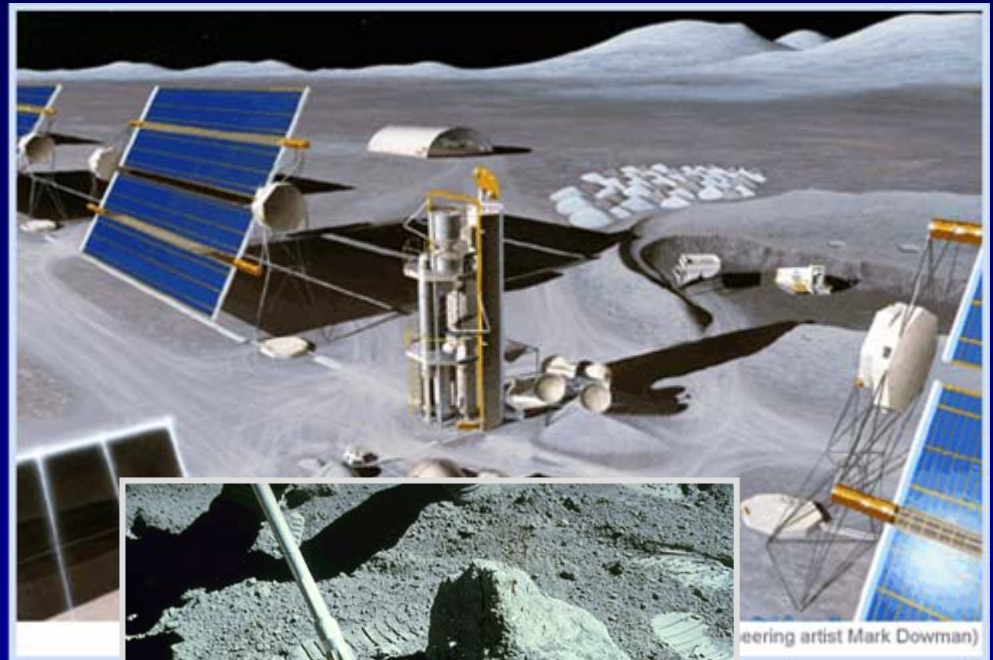
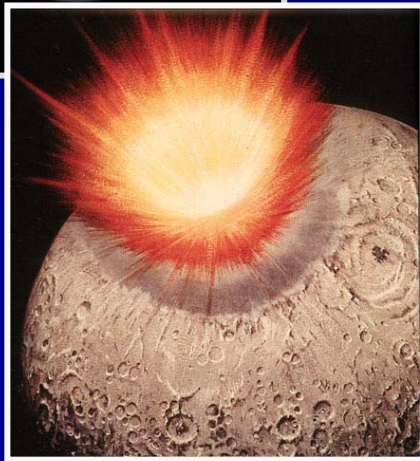
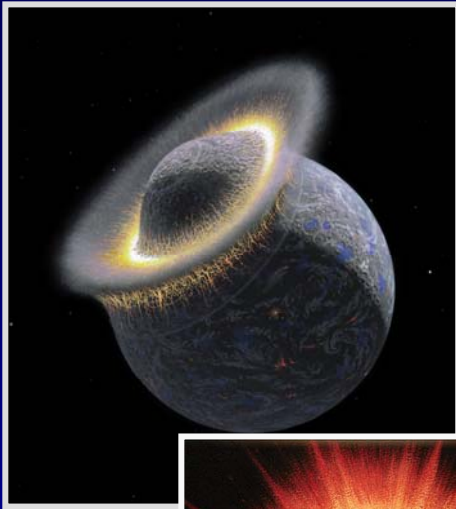


# Development of Exploration Tools

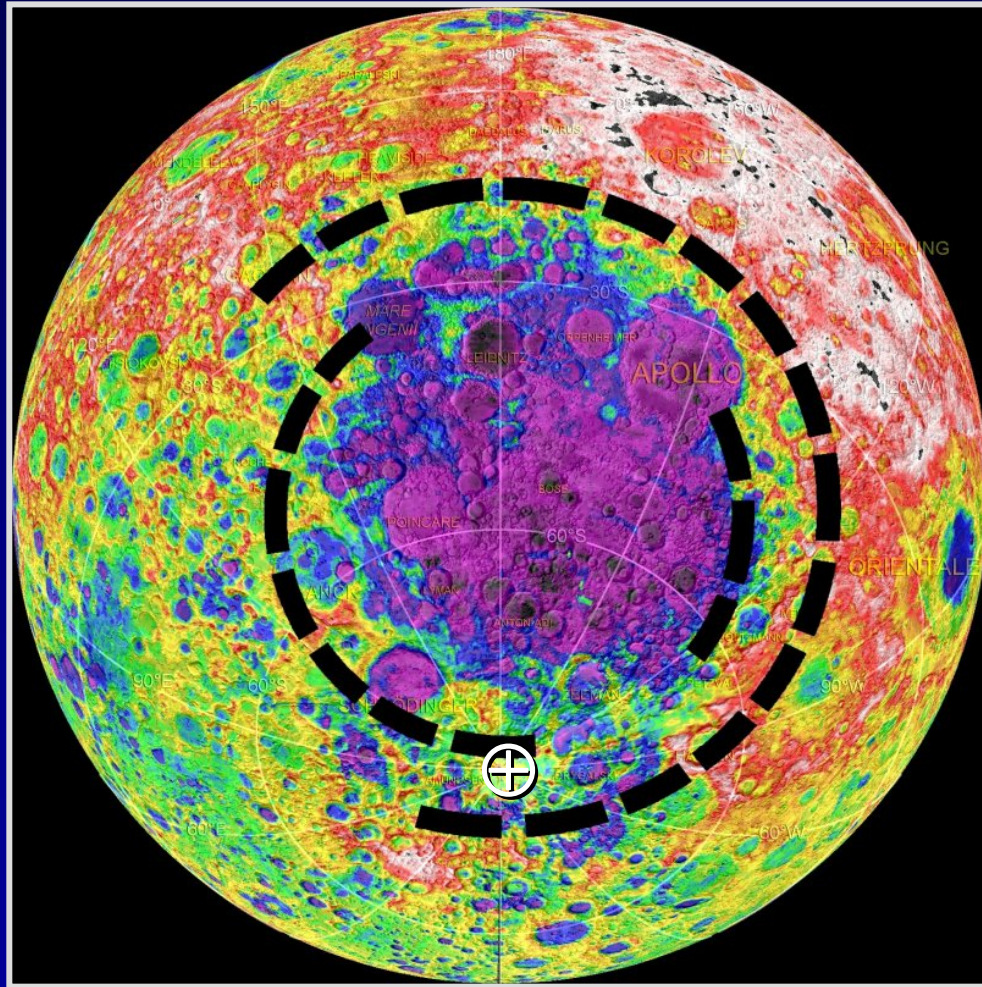


Exploration technology development will be driven by resource exploration, but benefit science

# Resources Enable Sustained Presence, Giving Time for Science



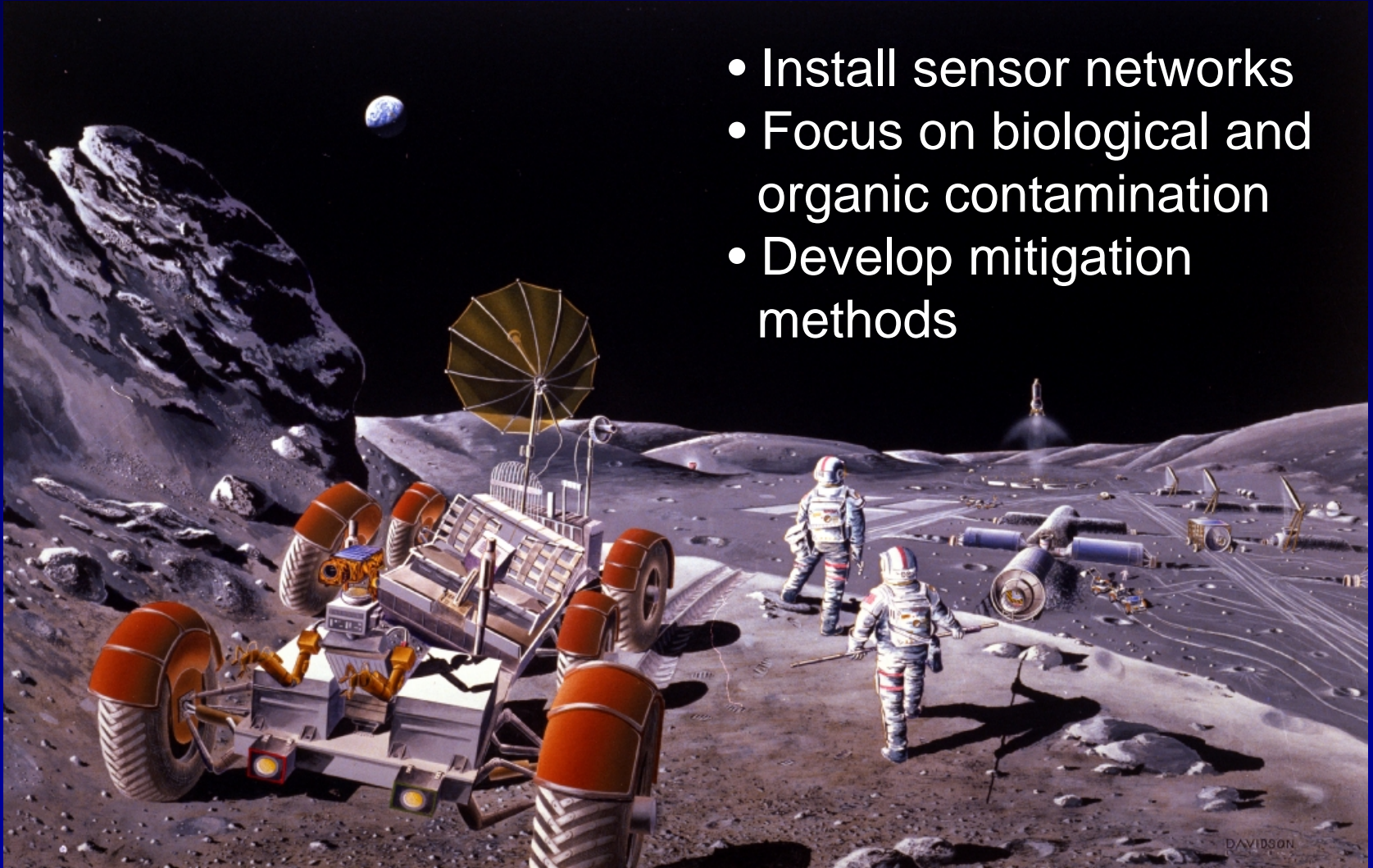
# Can Test the Cataclysm from a Single South Polar Site



South Pole site on rim of Shackleton Crater is within the outskirts of South Pole–Aiken basin, the oldest basin on the Moon. Its study will require extensive field work, which means time and capabilities

# Lunar Environmental Science

- Install sensor networks
- Focus on biological and organic contamination
- Develop mitigation methods



## Materials Science

- Resource extraction technologies
- Manufacturing processes in 1/6 gravity and vacuum
- Effects of lunar environment on materials
- Problems with dust and highly-reactive surfaces
- Use of highly-reactive surfaces of regolith grains
- Important point: Materials science is central to lunar resource development

## Link to Architecture

- ISRU requires:
  - Laboratory experiments/engineering models
  - Robotic missions for prospecting, perhaps testing; lack of robotic missions after LRO is a major mistake
  - Experiments at an outpost
  - Large-scale development
- Science and applied science are related and should be integrated to the extent possible

# Science and Resources

