



# **Importance of Methods' Selection in the Geosciences Studies and Exploration**

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# Outlines



- **Importance of Geology and Geologic Studies**
- **Steps in Scientific Methods**
- **Planning for Studies & Researches**
- **Type of Geologic Studies**
- **Motivation**
- **Factors Control Methods' Selection**
- **Step of Methods' Selection**
- **Some Examples of Methods**
- **Conclusion**

# Geology is an important subject



**Geology is an important subject that directly involves the human-being lives.**

**The Earth system includes and connects atmosphere, oceans, land, and life. It concern with origin of energy and mineral resources, the evolution of life, climate change, natural hazards, ecosystem structures and functions, and the movements of nutrients and toxicants (USGS 2011).**

**The science of geology has the power to help us understand the processes that link the physical and biological world so that we can model and forecast changes in the system**

# Importance of Geologic Studies

(USGS 2011) *Geology for a Changing World 2010–2020: Implementing the U.S. Geological Survey Science Strategy* **Six Goals Stated by USGS**

- **Goal 1.** Characterize and Interpret the Geologic Framework of the Earth Through Time
- **Goal 2.** Understand Earth Surface and Climatic Processes and Anticipate Their Effects on Ecosystem Health and Change
- **Goal 3.** Understand and Quantify the Availability of Earth's Natural Resources in a Global Context
- **Goal 4.** Increase the Resilience of Communities to Geologic and Environmental Hazards
- **Goal 5.** Apply the Most Advanced Technologies and Best Practices To Effectively Acquire, Analyze, and Communicate Our Data and Knowledge
- **Goal 6.** Develop a Flexible and Diverse Workforce for the Future

# Importance of Geologic Studies

Elisabeth Häggquist , Patrik Söderholm (2014)



- For decision-making in a wide range of societal activities (among them)
  - *Groundwater development, sustainable use and protection*
  - *Environmental impact assessments*
  - *The exploration and development of minerals and fuels*
  - *Understanding and managing the causes of geologic hazards*
  - *Construction of infrastructure projects*
  - *City planning including zoning and landscaping*
  - *Regional planning such as siting and permitting industrial facilities*



# Six steps of Scientific Methods

- Purpose
- Research
- Hypothesis
- Experiment
- Analysis
- Conclusion



# Planning for Studies and Researches

## Issues to be considered

- Objectives
- Level of study
- Expected Outcomes
- Available Resources
- Budget
- Timeframe





# GEOLOGICAL STUDIES

**ACADEMIC**

**INDUSTRIAL**



# Type of Geological Studies



**Academic**

**Applied Research**

**Theses and  
Dissertation**

**Basic Research**





# Type of Geological Studies

**Industrial**

**Projects**

**Research and  
Development**



# Nature of Studies



## Academic and Basic Research

- Based on needs and necessity
- Cost is not a major factor (if supported)
- Limited to available resources
- Always consider the local available tools first

## Industrial and Exploration

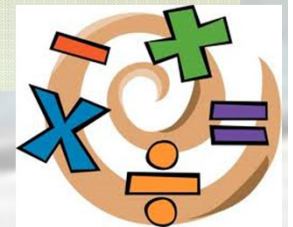
- Based on needs and applications and future forecast
- Cost is a major factor
- Not limited to available resources
- Consider the tools where they are



# Motivation



- **Previous experience in mineral exploration** (go to higher level before the basic level)
- **Supervision of several thesis and dissertation** (select method not needed for the research)
- **Observation of students work as member in the committees** (conduct higher methods although results were obtained from earlier ones)



# Factors Control Methods' Selection

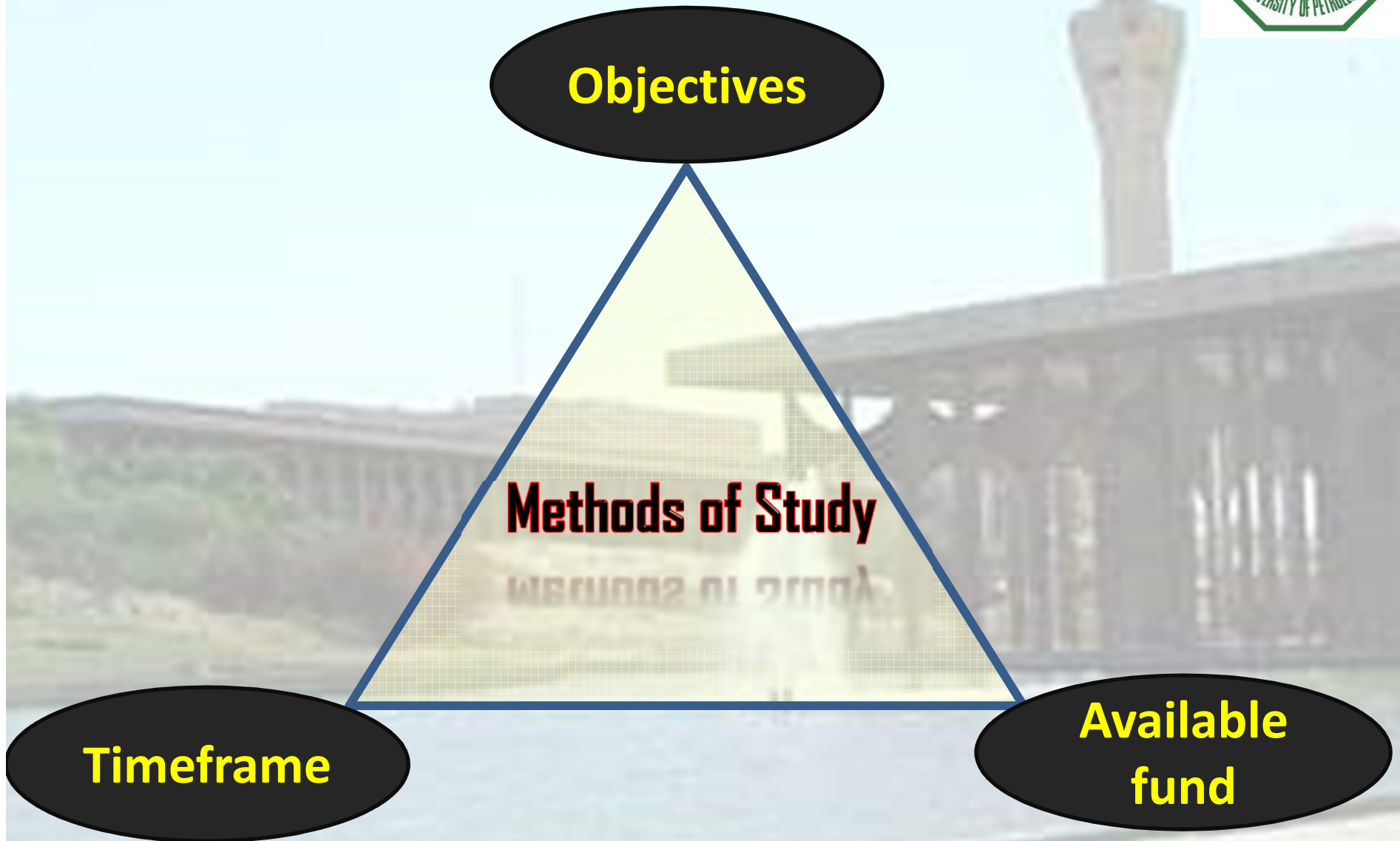


**Objectives**

**Methods of Study**

**Timeframe**

**Available  
fund**







# Objectives Effect on Method's Selection

## –General (Reconnaissance)

- Doesn't need high cost
- Can be conducted with free available resources (Google Earth)

## –Detailed (should be justified)

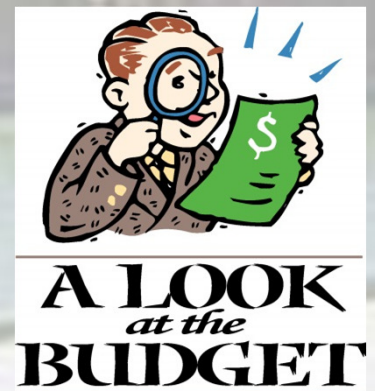
- More applied methods
- Larger budget and higher cost





# Funds Effect on Methods' Selection

- **Limited fund**
  - Will probably force using available resources more efficiently
- **Limited fund can be an obstacle to conduct highly sophisticated methods unless they are essential**





## Timeframe Effect on Methods' Selection

- **Time factor (how fast the results are needed?)**
  - Limited time available force selecting fast results method
  - Fast needed results may result in excluding longer time needed methods



# Observation Rational



- Nature of study is **controlling the type** of methods selection
- Stage of study is important (**reconnaissance or advanced exploration or production**)
- Objective of study is an essential base for selecting the method/s of study
- Budget some times **force less cheaper and semi quantities methods**
- If all methods are available and budget is sufficient a **wise decision should be taken based on real need**





# Planning for Studies and Researches

## Issues to be considered

- Objectives
- Level or stage of study
- Expected Outcomes
- Available Resources
- Budget
- Timeframe





# Steps for Methods' Selection

Careful Analysis of Objectives



Consider the methods from Initial planning stages based on Goal



Select methods that fit with budget and time frame



Consider the available less cost methods



Availability of sophisticated highly cost methods does not mean that should be used

# Why Methods Selection is important?

- Selection of right method **leads to right results** and interpretation
- Optimization of the **cost** and avoid loses
- Wise utilization of the **time frame**

# Some Examples of Methods



Regular /or Costly Methods	Available /or Less Cost	Remarks
Mapping in the field	Mapping through Remote sensing and Google Earth	Most features can be defined specially for structural and tectonics
Borehole Drilling	Geophysical Methods	Selecting the right method
Geochemical Methods XRD, XRF, EM	Petrographic	When should go to the costly ones



# Conclusions

- Geologic studies as other scientific studies based on several steps among the selection of **analysis and test**
- **Methods of analysis and tests are important and integral part of study and should be considered from planning stage of the project based on objectives and goals**
- Careful selection of methods based on **objective, funds and timeframe**





# Conclusions

- Optimization of cost can be **achieved through careful selection of the methods**
- Available free and less costly **methods should be considered first**
- Availability of different analysis methods **doesn't mean that should be used**
- Goals and objectives **of study should not be changed from the initial ones**





**Finally Cost Optimization and  
Financial Efficiency  
ARE THE TARGET**

**Thank  
You**

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- . Financial cost and effectiveness of the methods are the most important issues. Additionally, integration between different methods and their application order are very essential to reach the best cost effectiveness and optimization. Methods such as remote sensing, mapping, various geophysical and geochemical surveys, and drilling are among the methods that were used for long time. Those methods were also integrated, recently, with more sophisticated and advanced techniques such as petro-physics, and wireline logs analysis in hydrocarbon industry, and organic bound and electro-geochemical behavior in minerals studies. To optimize the cost and efficiently utilize the resources careful selection of applied method is essential. Moreover, the phase that selected method will be used needs to be clearly defined and justified. The careful selection of specific method should be based on the needs and targeted results. Recently available free and low cost methods and tools should also be considered as a substitute for the higher cost conventional ones. New tools such as Google Earth, DEM, LIDAR and GIS can be used very effectively in revealing information that used be obtained by more costly methods such as mapping and field surveys.
- This paper highlights the importance of selecting the different methods for geosciences studies and exploration. The paper emphasizes the fact that selecting the method and utilizing it in the exact phase will help in reaching the right decision and obtaining results with low cost. Moreover, the recent available free or low cost techniques should also be considered in the geosciences studies in place of traditional high cost methods.