PEMANFAATAN PETA GEOLOGI UNTUK PERTAMBANGAN

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TALK OUTLINE

1. Mineral Exploration Process and Geology Map

2. Key Issues in Mineral Exploration – related to Geology Map

3. Suggestions
# MINERAL EXPLORATION PROCESS

<table>
<thead>
<tr>
<th>Time</th>
<th>Area of Interest</th>
<th>Odds of finding economic deposit</th>
<th>Typical Stage</th>
<th>Method</th>
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<tbody>
<tr>
<td>1-6 months</td>
<td>100-10,000Km²</td>
<td>$2-5 &lt;1:100,000</td>
<td><strong>Area Selection</strong></td>
<td>• In-house expertise</td>
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<td>1-6 months</td>
<td>• Published data review</td>
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<td>• Mineral deposit models</td>
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<td>• Literature studies</td>
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<td>3-12 months</td>
<td>100-1,000Km²</td>
<td>$100-500 &gt;1:1,000</td>
<td><strong>Reconnaissance</strong></td>
<td>• Geology</td>
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<td>• Geochemistry</td>
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<td>• Image interpretation</td>
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<td>• Geophysics</td>
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<td>6-18 months</td>
<td>10-50Km²</td>
<td>$1000-5000 &gt;1:100</td>
<td><strong>General Survey</strong></td>
<td>• Geology</td>
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<td>• Prospecting</td>
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<td>• Geophysics</td>
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<td>1-2 years</td>
<td>2-5Km²</td>
<td>$500,000-1 million &gt;1:10</td>
<td><strong>Exploration</strong></td>
<td>• Geology</td>
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<td>• Drilling</td>
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<td>• Geophysics</td>
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<td>2-3 years</td>
<td>1-3Km²</td>
<td>$3-1 million &gt;1:2</td>
<td><strong>Detailed Exploration</strong></td>
<td>• Geology</td>
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<td>3-5 years</td>
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<td>&gt;$250 million &gt;1:2</td>
<td><strong>Feasibility, Construction, Start of Mining</strong></td>
<td>• Geology</td>
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TYPICAL STAGES IN MINERAL EXPLORATION

1. **Area Selection:** to select regions with favorable mineral potential and secure exploration/mining license

   - Methods: in-house expertise, published data review, mineral deposit models, literature study
   - Geology Map used - 1:1,000,000 to 1:5,000,000
TYPICAL STAGES IN MINERAL EXPLORATION

1. **Area Selection:** example....(1)

COMMON DEPOSIT TYPES – COMMODITIES – HOST ROCKS

- Porphyry, skarn, epithermal, sediment hosted Au, VMS – MAGMATIC ARCS
- Ni laterite – OPHIOLITES
- Bauxite – OLD PLUTONIC ROCKS
- Tin – OLD PLUTONIC ROCKS (S-Type Granite)
- Mesothermal Au – METAMORPHIC COMPLEXES
- Iron sand – COASTAL AREA OF MAGMATIC ARCS

UNCONVENTIONAL DEPOSIT TYPES

- Orogenic Au – SUTURE ZONES, METAMORPHIC COMPLEXES
- Sedex Pb-Zn – OLD SEDIMENTARY BASINS (pre-Tertiary)
- IOCG – OLD ALKALINE PLUTONIC ROCKS (?)
- REE – ??
TYPICAL STAGES IN MINERAL EXPLORATION

1. **Area Selection:** example....(2)

Porphyry, skarn, epithermal, sediment hosted Au, VMS – MAGMATIC ARCS

*Tertiary Plutonics and Volcanics (Djaswadi & Yudawinata, 1995)*
TYPICAL STAGES IN MINERAL EXPLORATION

1. **Area Selection**: example....(3)

Ni Laterites – OPHIOLITES

**Ophiolite Belts** (Djaswadi & Yudawinata, 1995)
TYPICAL STAGES IN MINERAL EXPLORATION

1. **Area Selection:** to select regions with favorable mineral potential and secure exploration/mining license

2. **Reconnaissance:** to identify mineralized areas and screen out those not worth further investigation

   - **Methods:** geology, geochemistry, image interpretation, geophysics
   - **Geology Map used:** 1:100,000 to 1:1,000,000
2. **Reconnaissance**: example.... (1)

**Image Interpretation**

**Geophysics – Gravity** *(Untung & Sato, 1978)*
2. **Reconnaissance:** example.... (2)

**Geology** *(PSG/ P3G, various years)*

**Geochemistry** *(stream sediment prospecting)*
TYPICAL STAGES IN MINERAL EXPLORATION

1. **Area Selection:** to select regions with favorable mineral potential and secure exploration/mining license

2. **Reconnaissance:** to identify mineralized areas and screen out those not worth further investigation

3. **General Survey:** to locate, sample, and outline mineralized zones in the field, and screen out those not worth further investigation

   - **Methods:** geology, image interpretation, prospecting, geochemistry, geophysics
   - **Geology Map used:** 1:10,000 to 1:100,000
3. **General Survey:** example......(1)

- **Geological Prospecting**
- **Geochemistry – Stream Sediment Prospecting**
- **Geophysics – Airborne Magnetic**
3. **General Survey**: example......(2)

**Image/ Air Photo Interpretation**

**Geology Map**

Enlarged from Geology of Sheet Cikarang, 1 : 100,000
(Sudana & Santosa, 1992)
1. **Area Selection:** to select regions with favorable mineral potential and secure exploration/mining license

2. **Reconnaissance:** to identify mineralized areas and screen out those not worth further investigation

3. **General Survey:** to locate, sample, and outline mineralized zones in the field, and screen out those not worth further investigation

4. **Exploration:** to preliminary define deposits in 3D (by scout drilling), estimate indicated resources, and screen out those not worth further investigation

- **Methods:** geology, drilling, geochemistry, geophysics
- **Geology Map used:** 1:1,000 to 1:10,000
4. **Exploration:** example......(1)

- **Geological Mapping**
- **Trenching**
- **Geochemistry – Soil Sampling**
- **Scout Drilling**
- **Geophysics – Groundmag**
4. Exploration: example.....(2)
TYPICAL STAGES IN MINERAL EXPLORATION

1. **Area Selection**: to select regions with favorable mineral potential and secure exploration/mining license

2. **Reconnaissance**: to identify mineralized areas and screen out those not worth further investigation

3. **General Survey**: to locate, sample, and outline mineralized zones in the field, and screen out those not worth further investigation

4. **Exploration**: to preliminary define deposits in 3D (by scout drilling), estimate indicated resources, and screen out those not worth further investigation

5. **Detailed Exploration**: to delineate ore bodies in detail, estimate measured resources, provide sufficient data for reserve estimation and for making decision whether to proceed to feasibility study

- **Methods**: geology, drilling, resource estimate, metallurgy, geotechnical, mine design, environmental, financial
- **Geology Map used**: 1:100 to 1:1,000
5. **Detailed Exploration:** example ......(1)

**Drilling – Logging - Modelling**
5. **Detailed Exploration**: example .....(2)

**Detailed Map 1 : 1,000**
KEY ISSUES IN MINERAL EXPLORATION – related to Geology Map

1. Various commodity targets → various geology and tectonic environment
   • Igneous – sedimentary – metamorphic rocks
   • Magmatic arc – metamorphic complex – sedimentary basin – suture zone

2. Various geological maps - depending on the exploration stages
   • 1 : 5,000,000 for regional area selection – 1 : 100 in mining operation
   • Reliable base map – very essential
PROBLEMATIKA – (beberapa contoh)

1. Volcanostratigraphy – Formasi Semilir (Pegunungan Selatan)
(Surono et al, 1992)
PROBLEMATIKA – (beberapa contoh)

1. Volkanostratigrafi – Formasi Semilir (Pegunungan Selatan)

2. Rekonsiliasi antar lembar peta
Peta Geologi 1 : 100.000 Lembar Sindangbarang, Bandung, Cianjur dan Garut
Peta Geologi 1 : 100.000 Lembar Arjawinangun dan Tasikmalaya
PROBLEMATIKA – (beberapa contoh)

1. Volkanostratigrafi – Formasi Semilir (Pegunungan Selatan)

2. Rekonsiliasi antar lembar peta

3. Peta dasar
Problem Peta Dasar

Datum/ sistem koordinat peta geologi vs peta dasar (?)
SARAN-SARAN DAN MASUKAN MGEI-IAGI (1)

1. Volkanostratigrafi – perlu diterapkan
   • Piroklastik - Volkaniklastik – Epiklastik VS Batuan Sedimen (tufaan)
   • Volkaniklastik laut dangkal/ danau vs sedimen kipas laut dalam

2. Perhatian/ penekanan pada “batuan intrusi”
   • Lokasi dan penyebaran
   • Jenis batuan
   • Tipe intrusi (intrusi dalam vs sub-volkanik)

3. Litogeokimia batuan beku (intrusi dan lava) – dan interpretasinya

4. Perhatian pada struktur geologi
   • Lebih detil dan komprehensif – berdasar data lapangan maupun data interpretasi citra (foto udara, satelit, SRTM, dll)
   • Rekonsiliasi struktur permukaan dan bawah permukaan
5. *Peta dasar standard – sama dengan yg dipakai di instansi lain (Bakosurtanal, Kehutanan dll)*

6. **Rekonsiliasi antar lembar peta:**
   - *Batas Formasi/ satuan batuan termasuk nama Formasi*
   - *Struktur geologi*

7. **Format Digital** *(isu: hak cipta dan penggandaan ilegal?)*
Terima kasih