MineralOS — Autonomous Critical Mineral Intelligence

The AI-Native Platform for the Global Critical Minerals Rush

Executive Summary

The energy transition demands unprecedented quantities of critical minerals—lithium, cobalt, rare earths, nickel, copper, and graphite. The market is projected to reach **$770B by 2030**, growing at 25%+ CAGR. Yet the industry operates with 20th-century tools: manual geological surveys, fragmented supply chains, opaque pricing, and 10-15 year discovery-to-production timelines.

MineralOS is the autonomous intelligence layer for the critical minerals industry. We combine satellite imagery analysis, geological AI, real-time market intelligence, and supply chain optimization to compress discovery timelines from decades to years and give mining companies, governments, and battery manufacturers unprecedented visibility into the world's most strategic resources.

The Problem

1. The Discovery Crisis

- **Traditional mineral exploration takes 10-15 years** from initial survey to production
- Success rates are dismally low: **<1% of exploration projects become mines**
- The industry spends **$12B annually** on exploration with declining returns
- Known deposits are depleting faster than new ones are found

2. The Supply Chain Opacity

- Critical mineral supply chains span 6+ countries with zero real-time visibility
- **China controls 60-90% of processing** for most critical minerals
- Geopolitical risks can cause 300%+ price swings overnight
- Western companies have no early warning systems for supply disruptions

3. The Sustainability Gap

- Mining causes 4-7% of global GHG emissions
- Artisanal mining involves human rights abuses (especially cobalt in DRC)
- Circular economy potential (recycling) is vastly underutilized
- Regulators are demanding full supply chain traceability

4. The Capital Allocation Problem

- Mining companies misallocate **$50B+ annually** on suboptimal exploration
- Asset valuation is based on outdated geological reports
- M&A decisions lack comprehensive geological AI analysis
- Junior miners can't access the AI tools that could transform their success rates

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The Solution: MineralOS

Core Platform Components

1. Discovery Engine — AI-Powered Mineral Exploration

- **Multi-modal geological analysis**: Combines satellite hyperspectral imagery, magnetic surveys, historical drilling data, and geological models
- **Predictive deposit mapping**: Identifies high-probability mineral deposit locations with 10x better accuracy than traditional methods
- **Automated target generation**: Ranks exploration targets by mineral type, deposit size probability, and extraction feasibility
- **Continuous learning**: Every confirmed discovery improves our models globally

2. SupplyMesh — Real-Time Supply Chain Intelligence

- **Global supply chain mapping**: Tracks critical minerals from mine to end product across all suppliers
- **Risk prediction**: AI predicts supply disruptions 3-6 months in advance using satellite monitoring, shipping data, and geopolitical signals
- **Price forecasting**: Proprietary models predict price movements with 85%+ accuracy at 30-day horizons
- **Compliance verification**: Automated ESG and conflict-free sourcing verification

3. CircularOS — Recycling & Urban Mining Intelligence

- **Urban mining identification**: Identifies optimal locations for battery recycling facilities based on waste stream analysis
- **Recovery optimization**: AI-optimized processes for extracting critical minerals from e-waste, batteries, and industrial byproducts
- **Circular supply chain**: Matches recycled materials with manufacturers needing specific mineral grades
- **Lifecycle tracking**: Full traceability from virgin material through multiple recycling cycles

4. GeoCapital — Investment & Valuation Intelligence

- **AI-powered asset valuation**: Real-time valuation of mining assets based on geological, market, and operational data
- **M&A target identification**: Identifies undervalued mining assets and optimal acquisition targets
- **Portfolio optimization**: Risk-adjusted allocation across exploration, development, and production assets
- **Investor intelligence**: Custom reports for PE firms, sovereign wealth funds, and strategic investors

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Technology Deep Dive

Data Infrastructure

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                    MineralOS Data Mesh

Satellite Data        Geological Archives    Real-Time Markets
  Sentinel-2           USGS databases         LME pricing
  Landsat 9            National surveys       CME futures
  Planet Labs          Company reports        Spot markets
  Hyperspectral        Academic papers        OTC deals

Supply Chain          Environmental          Alternative Data
  Shipping AIS         ESG databases          Job postings
  Port manifests       Incident reports       Patents
  Customs data         Satellite change       News/social
  Rail/truck GPS       Water/air quality      Expert network
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AI Model Architecture

Foundation Model: GeoGPT - Custom foundation model trained on 50 years of geological data, 10M+ drill hole records, and 1M+ academic papers - Multi-modal: Processes text, satellite imagery, geophysical data, and time series simultaneously - Specialized for geological reasoning, deposit classification, and resource estimation

Computer Vision Stack - Satellite imagery analysis for surface mineralogy indicators - Change detection for monitoring mine operations globally - Hyperspectral analysis for remote mineral identification

Predictive Models - Supply disruption prediction (LSTM + transformer hybrid) - Price forecasting (ensemble of gradient boosting + neural nets) - Deposit probability scoring (3D convolutional networks for geological data)

Market Opportunity

Total Addressable Market (TAM)

Segment	2024 Market	2030 Projection	CAGR
Critical Minerals Production	$320B	$770B	15.7%
Mining Technology	$18B	$35B	11.7%
Mineral Exploration Spend	$12B	$25B	13%
Battery Recycling	$8B	$45B	33%
Mining M&A Advisory	$5B	$12B	15%
Total TAM	**$363B**	**$887B**	**16%**

Serviceable Addressable Market (SAM)

$45B — Software, data, and analytics spend in mining/minerals sector

Serviceable Obtainable Market (SOM)

$2B by Year 5 — 4.4% of SAM through platform subscriptions and transaction fees

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Business Model

Revenue Streams

1. Platform Subscriptions (60% of revenue)

Tier	Monthly Price	Features
Explorer	$25,000	Discovery Engine, basic SupplyMesh
Enterprise	$100,000	Full platform, custom models, API access
Strategic	$500,000+	White-label, dedicated support, custom development

2. Transaction Fees (25% of revenue)

- **Discovery Success Fee**: 0.5-2% of deposit value for AI-identified discoveries
- **M&A Advisory**: 0.25% of transaction value for AI-informed deals
- **Supply Chain Matching**: 1% of transaction value for buyer-seller matching

3. Data Products (15% of revenue)

- **Market Intelligence Reports**: $10K-100K per report
- **Custom Research**: $50K-500K per engagement
- **API Access for Traders**: Usage-based pricing

Unit Economics (Year 3)

- **Average Contract Value (ACV)**: $450,000
- **Gross Margin**: 85%
- **CAC**: $150,000
- **LTV**: $2.7M (6-year average lifetime)
- **LTV:CAC**: 18:1
- **Payback Period**: 8 months

Competitive Landscape

Traditional Players

Company	Focus	Weakness
S&P Global	Market data	No AI, no geological analysis
Wood Mackenzie	Research reports	Manual analysis, months outdated
Mining consultancies	Project-specific	No platform, no real-time data
GIS vendors	Mapping tools	No intelligence layer

Emerging AI Players

Company	Focus	Weakness
KoBold Metals	AI exploration	Single use case, private
Earth AI	Exploration targeting	Limited to exploration
Various startups	Point solutions	No integrated platform

Our Differentiation

1. **Full-stack platform**: Only solution covering discovery → supply chain → recycling → investment
2. **GeoGPT foundation model**: Purpose-built for geological reasoning, not adapted from general AI
3. **Real-time supply chain**: No competitor has live global supply chain visibility
4. **Circular economy integration**: First to connect virgin mining with recycling intelligence

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Go-to-Market Strategy

Phase 1: Establish Credibility (Months 1-12)

Target: Top 20 mining companies + Major battery manufacturers

Strategy: - Partner with 3-5 major miners for Discovery Engine pilots - Publish 2-3 landmark discoveries to prove AI capability - Launch SupplyMesh beta with battery manufacturers (Tesla, CATL, LG) - Build government relationships (US DOE, EU Critical Raw Materials)

Key Accounts: - BHP, Rio Tinto, Vale, Glencore (diversified majors) - Albemarle, SQM, Livent (lithium specialists) - Tesla, Panasonic, CATL, Northvolt (battery OEMs)

Phase 2: Platform Expansion (Months 12-24)

Target: Mid-tier miners, trading firms, financial investors

Strategy: - Launch GeoCapital for mining-focused PE and hedge funds - Expand to junior mining companies with Explorer tier - Partner with commodity trading firms (Trafigura, Glencore, Vitol) - Launch CircularOS with battery recycling companies

Phase 3: Ecosystem Dominance (Months 24-36)

Target: Governments, industry associations, global standard-setting

Strategy: - Become the data backbone for critical mineral supply chain regulations - Power government strategic reserve decision-making - Enable industry-wide ESG compliance and verification - Expand to adjacent commodities (steel, aluminum, rare gases)

Financial Projections

Revenue Forecast

Year	ARR	Customers	ACV
1	$8M	25	$320K
2	$35M	85	$410K
3	$95M	210	$450K
4	$220M	420	$525K
5	$480M	750	$640K

Path to Profitability

Year	Revenue	Gross Profit	EBITDA	EBITDA Margin
1	$8M	$6M	-$25M	-312%
2	$35M	$28M	-$35M	-100%
3	$95M	$80M	-$15M	-16%
4	$220M	$187M	$35M	16%
5	$480M	$408M	$115M	24%

Use of Funds ($50M Series A)

Category	Amount	Purpose
R&D	$25M	GeoGPT development, platform build
Data Acquisition	$10M	Satellite contracts, geological archives
Sales & Marketing	$8M	Enterprise sales team, brand building
Operations	$5M	Infrastructure, legal, admin
Reserve	$2M	Strategic opportunities

Team Requirements

Founding Team Needs

- **CEO**: Mining industry executive with tech vision
- **CTO**: ML/AI leader with geospatial experience
- **Chief Geologist**: PhD geologist with computational background
- **VP Engineering**: Platform infrastructure at scale
- **VP Sales**: Enterprise software sales to mining/energy

Key Hires (Year 1)

- 10 ML Engineers (computer vision, NLP, time series)
- 5 Geologists/Geoscientists
- 5 Data Engineers
- 5 Enterprise Sales
- 3 Customer Success

Advisory Board

- Former executives from BHP, Rio Tinto, Freeport
- Leading academic geologists from Colorado School of Mines, Stanford
- Battery technology experts from Tesla, CATL
- Government advisors from DOE, EU Critical Raw Materials

Risk Factors & Mitigation

Risk	Impact	Mitigation
Data access limitations	High	Multi-source strategy, synthetic data generation
Mining industry conservatism	High	Start with innovation-friendly majors, prove ROI fast
Geopolitical restrictions	Medium	Modular platform works within data sovereignty rules
Model accuracy challenges	Medium	Human-in-loop for critical decisions, continuous validation
Competitive response from majors	Medium	Network effects, data moats compound over time
Regulatory uncertainty	Low	Active engagement with policymakers, compliance-first design

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Exit Scenarios

Strategic Acquisition (3-5 years)

Likely Acquirers: - Mining majors (BHP, Rio Tinto): $3-5B for competitive advantage - Tech giants (Google, Microsoft): $2-4B for industrial AI expansion - Industrial conglomerates (Siemens, Honeywell): $2-3B for mining tech portfolio

IPO (5-7 years)

- At $500M ARR, 15x revenue multiple = **$7.5B valuation**
- Comparable to Palantir, Snowflake, Datadog trajectories
- Mining tech is underrepresented in public markets

Why Now?

1. **Energy transition creates urgency**: EVs, renewables, and grid storage require 500%+ more critical minerals by 2035
2. **Geopolitical reshoring**: Western governments are mandating supply chain visibility and domestic sourcing
3. **AI capabilities matured**: Foundation models + satellite imagery + compute costs make comprehensive geological AI finally possible
4. **Industry digitization wave**: Mining companies are finally embracing digital transformation post-COVID
5. **Regulatory pressure**: New ESG regulations (EU Battery Regulation, US IRA) require the traceability we provide

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The Ask

Raising $50M Series A to: - Complete GeoGPT foundation model training - Build full MineralOS platform - Establish partnerships with 5 major mining companies - Launch in North America, Australia, and Europe - Achieve $35M ARR by end of Year 2

Target Investors: - Climate-tech focused VCs (Breakthrough, Congruent, Lowercarbon) - Industrial/enterprise VCs (Bessemer, Insight, Sapphire) - Strategic investors (mining companies' venture arms) - Sovereign wealth funds (Abu Dhabi, Norway, Singapore)

Conclusion

The world needs critical minerals to decarbonize. The industry needs intelligence to find, extract, and manage them sustainably. MineralOS is the AI-native platform that connects these imperatives.

We're building the operating system for the trillion-dollar critical minerals industry—and the transition to a clean energy future depends on it.

Let's make it happen.

MineralOS — Intelligence for the Energy Transition

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