An Artificial Intelligence-driven Approach to Mineral Exploration in Botswana

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BOTSWANA DIAMONDS PLC

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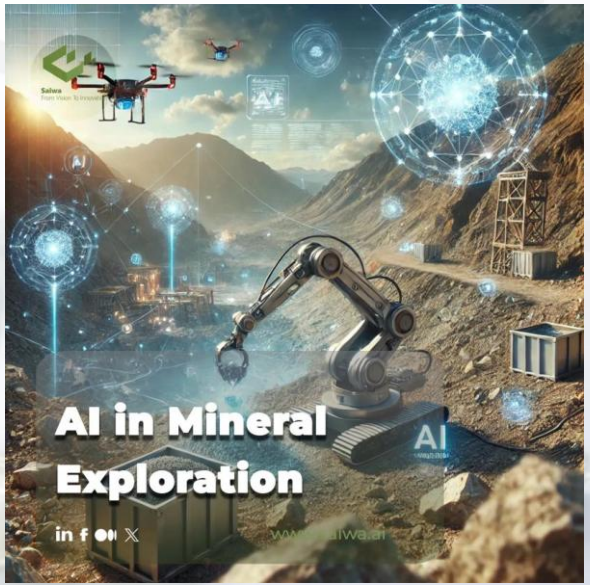
AGENDA

- Global demand: exploration crisis
- AI foundations: remote sensing, geophysics, data fusion
- Company landscape and case studies
- Cost/time benefits: juniors vs majors
- BOD strategy: dataset and AI-screened targets
- Polymetallic and kimberlite examples
- AI vs traditional methods: future of AI

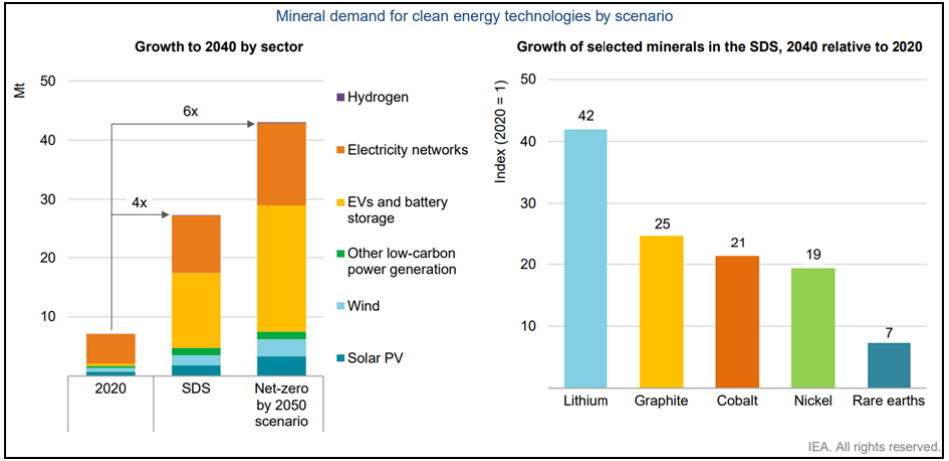


Saiwa, 2025

Global demand: exploration crisis

Global Demand for Critical Minerals

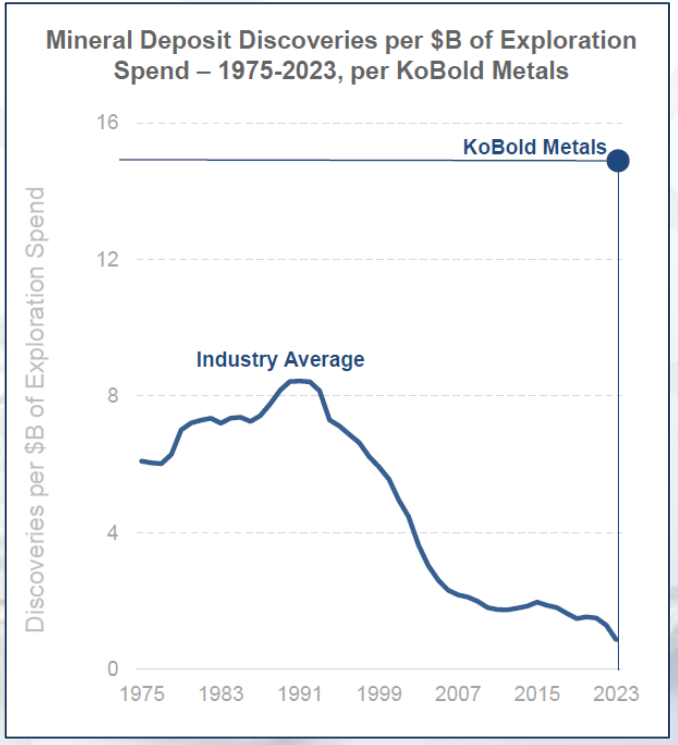
- Energy transition drives unprecedented demand for Cu, Li, Co, Ni, REEs.
- Lithium demand projected >5× by 2040; Ni/Co/REEs to at least double.
- Botswana prospective for Cu–Ni–Co–PGEs alongside diamonds.
- Forecast supply gaps of 30–40% by mid-2030s.



Deloitte, 2024

Exploration Crisis: Rising Costs, Fewer Discoveries

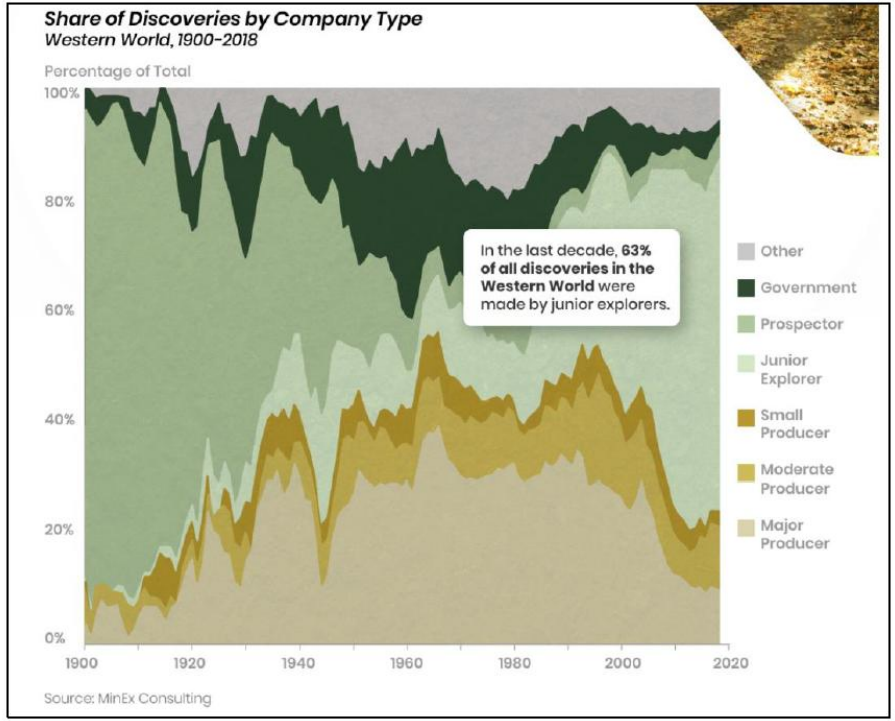
- Global discovery rates have gone down 75% since 2010 despite higher spending.
- Greenfield success rate ~0.02% (1 in 5,000 drillholes).
- Deposits under cover need new geoscience and computational tools.
- AI offers systematic, data-driven targeting.



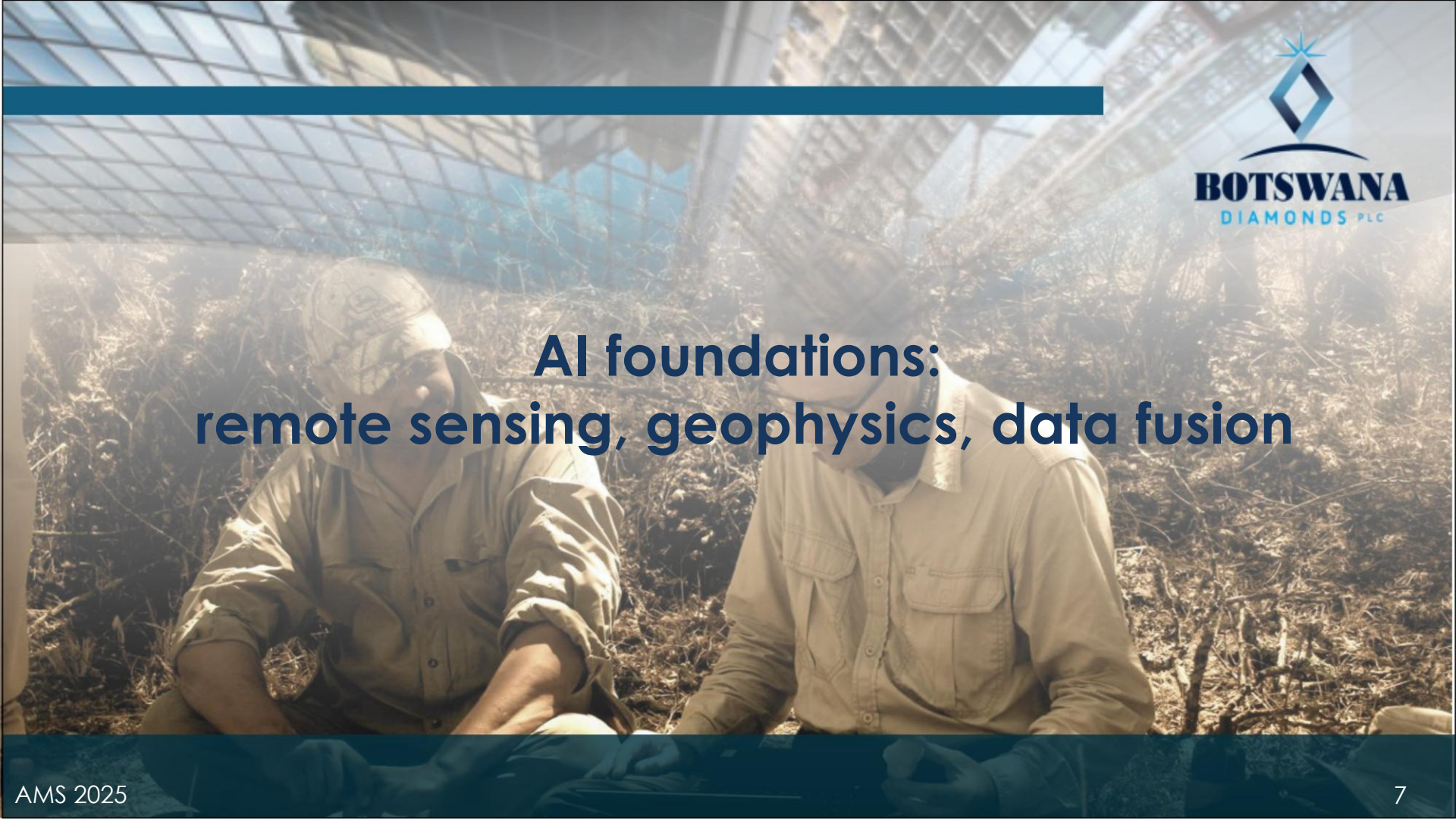
Bond, 2025

Juniors vs Majors in Discovery

- >60% of discoveries in the past 20 years by juniors.
- Majors focus on acquisitions; juniors chiefly underfunded with >90% failure rate.
  - If the junior is incubated, the failure rate is considerably lower.
- AI reduces risk and improves financing potential for juniors.
- Partnerships enable complementary strengths.



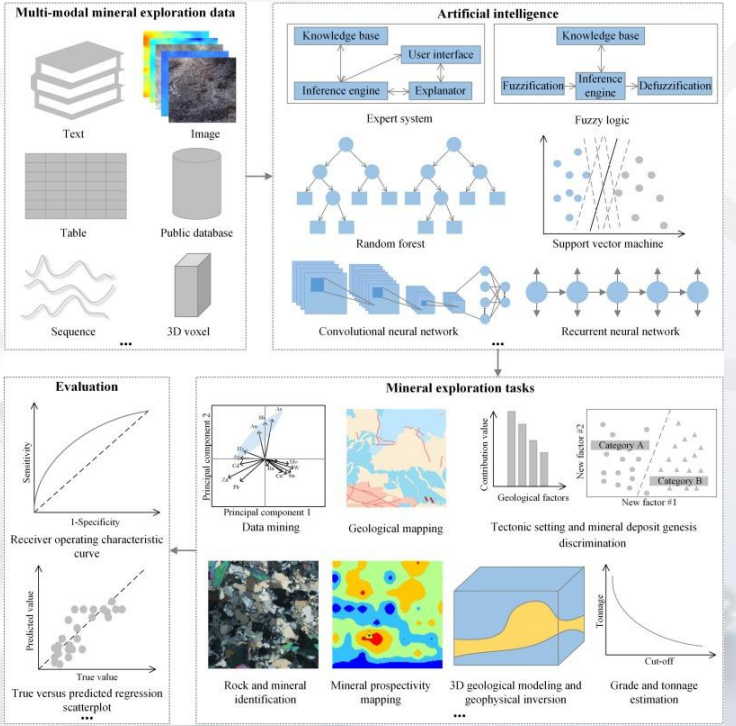
Visualcapitalist, 2024



AI foundations:
remote sensing, geophysics, data fusion

Artificial Intelligence in Mineral Exploration

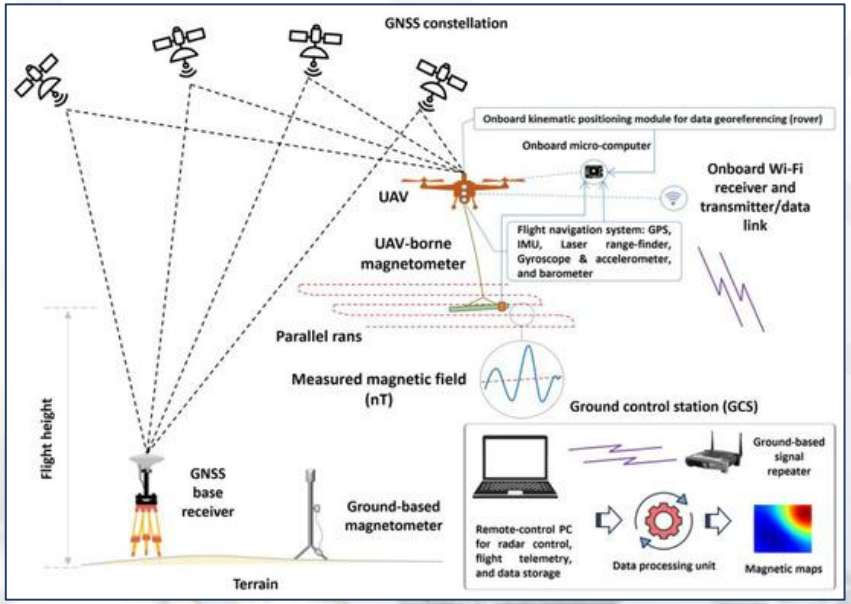
- Integrates geology, geochemistry, geophysics, and remote sensing.
- Techniques include Machine Learning, ensembles, and Bayesian frameworks.
- Outputs: prospectivity maps, ranked targets with uncertainty.
- Continuous retraining improves decision quality.



Yang et al, 2024

Remote Sensing and Geophysical AI

- Hyperspectral/UAV imagery mapped with Machine Learning.
- AI inversion of gravity, magnetics, and EM improves subsurface imaging.
- Data fusion across methods reduces ambiguity.
- Rapid screening focuses budgets on highest priority targets.



Javan et al, 2024

Data Fusion and Prospectivity Modelling

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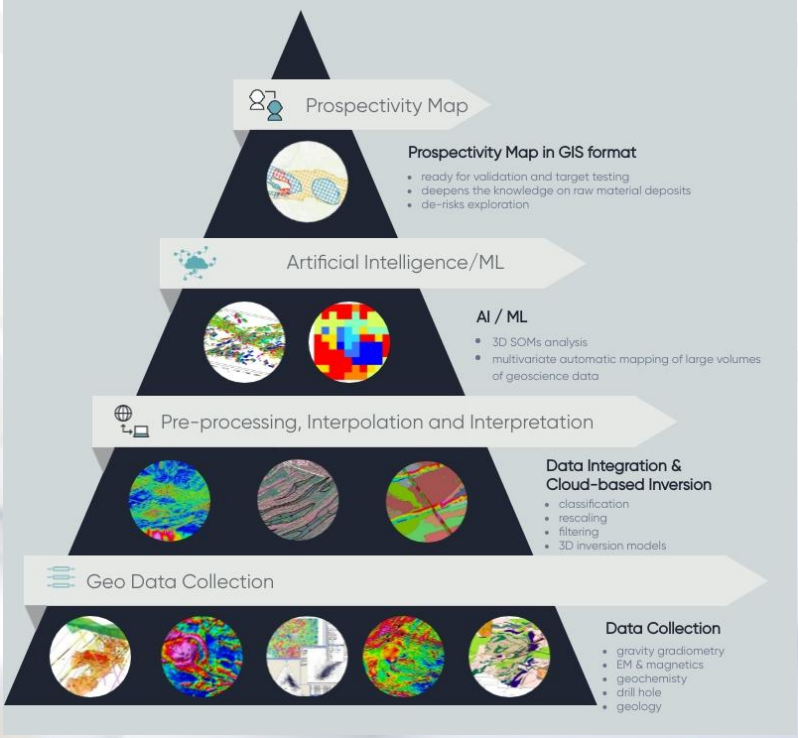
- Combines knowledge-driven models with Machine Learning.
- Features: litho-structural context, basin architecture.
- Ensembles yield class probabilities with uncertainty.
- Governance avoids over-fitting and bias.

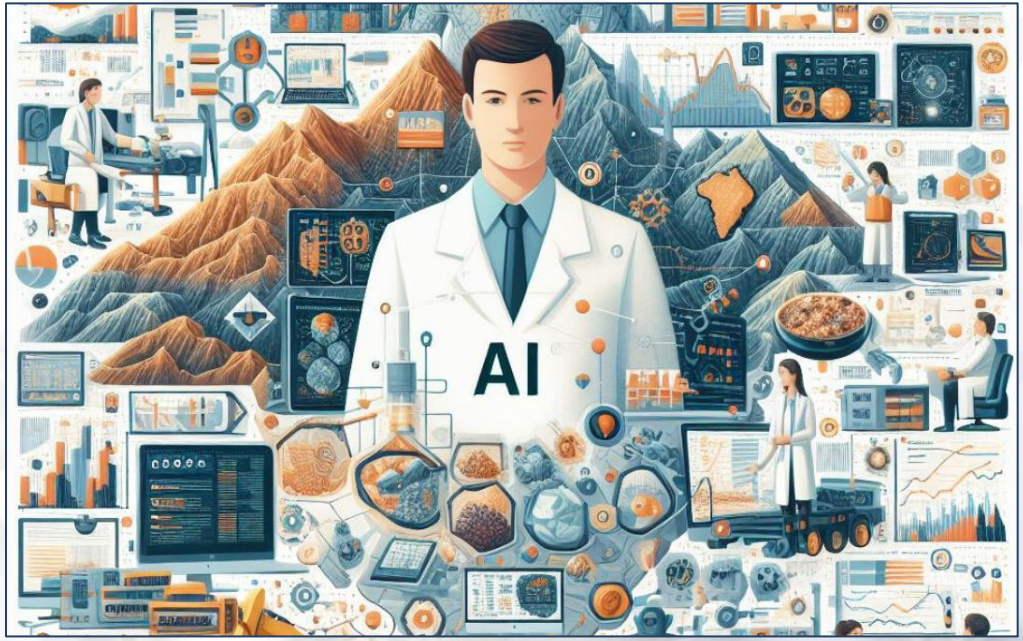


Bell Geospace, 2024

Company landscape and case studies

Select Companies Applying AI

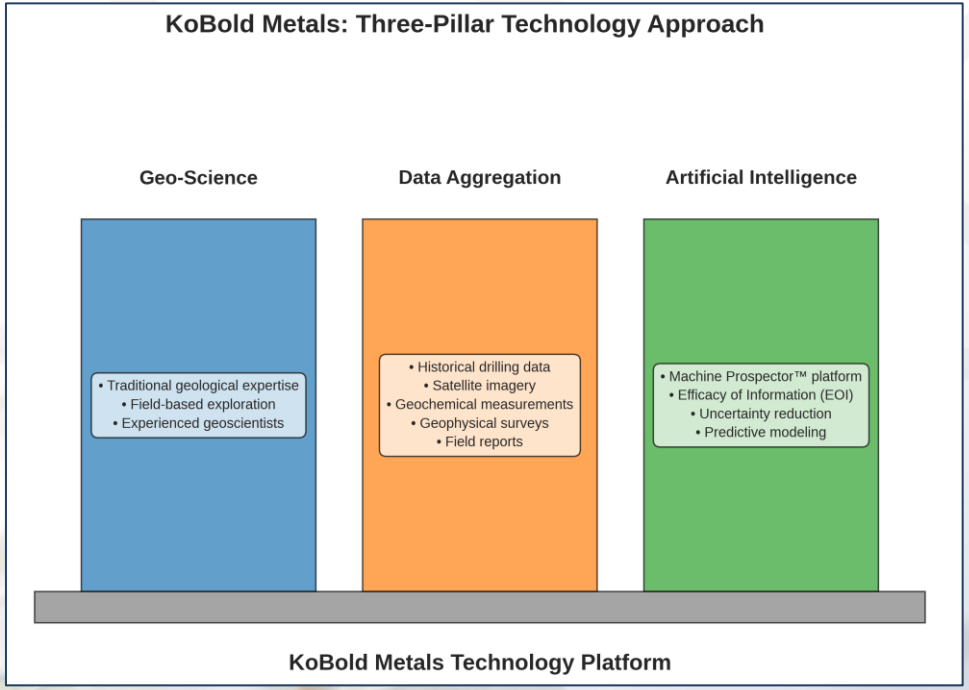
- *KoBold Metals*: decision theoretical targeting.
- *Earth AI*: vertical integration, higher hit rates.
- *Planetary AI*: Xplore method for transparent prospectivity.
- Specialists: GoldSpot, Mira (geophysics, hyperspectral).



Mining Doc, 2024

Case Study: KoBold Metals (Zambia Copper)

- Mingomba discovery: largest Cu find in Zambia in a century.
- AI targeting confirmed in ~1 year of drilling.
- Portfolio learning enables redeployment across districts.
- Algorithms prioritise drilling with maximum information.
- Funded by Gates/Bezos with $500M capital.



KoBold, 2024

Case Study: Earth AI (Australia)

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- ~75% drill-hole success on AI-generated targets.
- Satellite analytics + geological Machine Learning + rapid drilling.
- Cost reductions of ~80% via tighter targeting.
- Data + execution integration improves confidence.

Earth AI unveils six new mineral prospects in Australia

Staff Writer | March 26, 2025 | 9:07 am Exploration Australia Cobalt Copper Gold Silver Tungsten

Earth AI says it can move from detecting a prospect to drill-testing in just three to six months. (*Stock image generated with AI. By utaem2022 | Adobe Stock.*)

Mining.com, 2025

Planetary AI 'Xplore' (Botswana)

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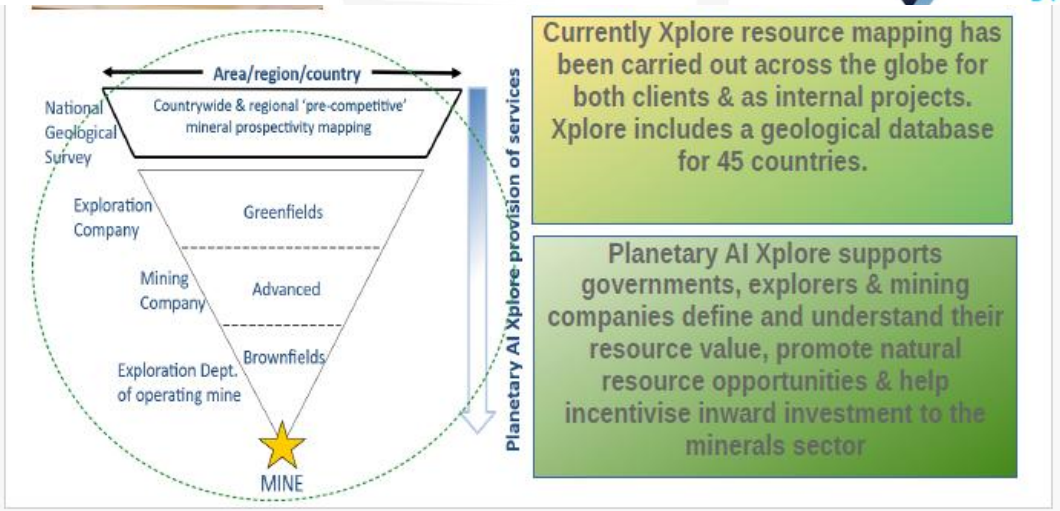
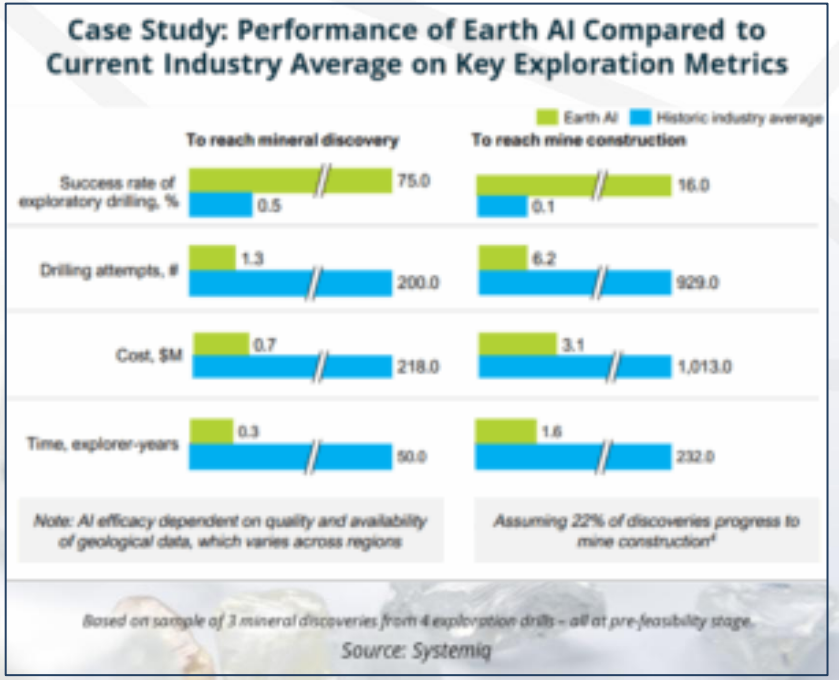


- 57+ deposit models + Machine Learning at basin/country scales.
- Semantic AI grounds Machine Learning in geological context: boosting accuracy, clarifying uncertainty and elevating confidence.
- Transparent prospectivity maps with quantified uncertainty.
- Supports governments and explorers.

AI Cost and Time Benefits

- AI narrows search space, improves hit ratios.
- Exploration cycles compress with automation (4x faster).
- Discovery cost reduction up to ~80%.
- Industry savings: $300B+ annually by 2035.



CleanTech, 2025

Differential Impact

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Juniors

- AI processes legacy datasets cheaply.
- Raises confidence, improves access to capital.
- Outputs are transparent and explainable.
- AI-ready data rooms enhance transactions.

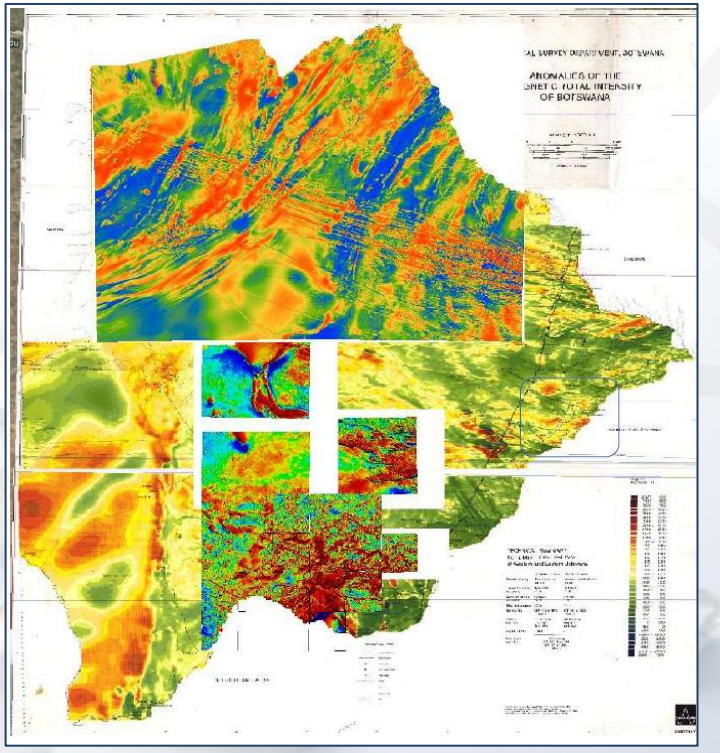
Majors

- Portfolio-scale ranking and optimisation.
- Standardised data pipelines enable comparability.
- Decision analytics quantify ESG and reserve trade-offs.
- AI extends brownfields mine life.

BOD strategy:
dataset and AI-screened targets

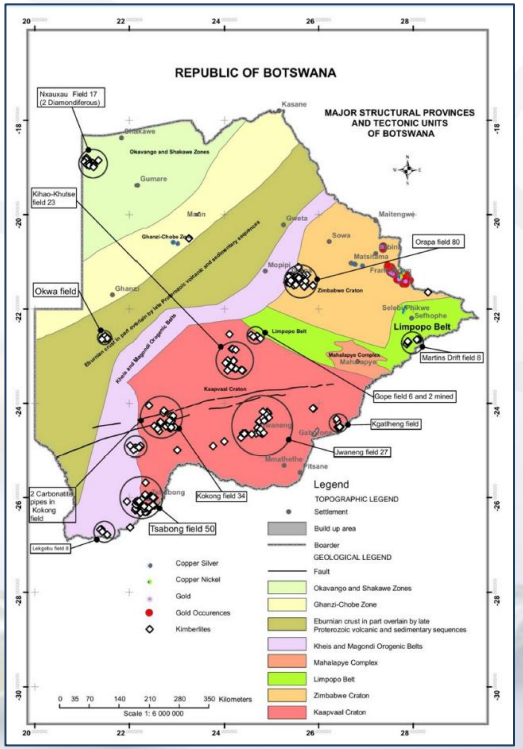
Botswana Diamonds plc (BOD): Strategy Overview

- BOD applies AI to a national-scale archive.
- Partnership with Planetary AI for ground selection.
- Focus on polymetals and diamonds.
- Objective: secure licences, drill-ready targets, JVs.



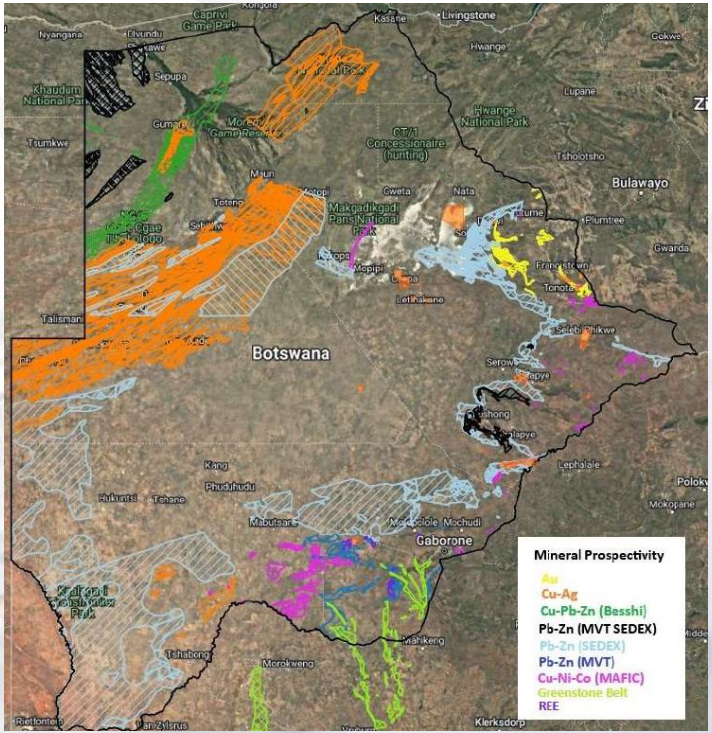
BOD Legacy Dataset (Scale & Composition)

- Covers ~225,000 km², 383 GB data:
  - ~375,000 line km airborne geophysics.
  - 606 ground geophysical surveys
  - ~358,000 soil sample results.
  - ~32,000 drill logs.
- Data standardised and fused for AI.
- Coverage: Ngamiland, SE Botswana, kimberlite terranes.
- Enables unbiased province-scale ranking.



BOD Licence Applications: AI-Screened Results

- Applications over ~7,500 km².
- 11 polymetallic + 3 kimberlite targets identified.
- Selection based on permissive geology + adjacency.
- Phased acquisition and drilling.



BOD's Competitive Advantage

Five Pillar approach

- ***Data***. BOD already has an extensive database in Botswana and proposes to acquire more across Southern Africa.
- ***AI technology***. BOD also has access to this through an alliance with Planetary AI Xplore, which utilises a proprietary platform which unlocks mineral wealth with advanced knowledge-driven prospectivity analysis combined with machine learning technologies.
- ***Government relations***. The ability to apply for and receive Prospecting Licenses. BOD has a demonstrated track record in this regard in Southern Africa.
- ***Field and commercial skills***. Once a Prospecting License has been granted, the ability to conduct field and other technical work to achieve a rapid commercial conclusion. BOD has a proven track record in this area, as well as running a very tight and lean company.
- ***Cash …***

Polymetallic and kimberlite examples

BOD Polymetallic Targeting (Example)

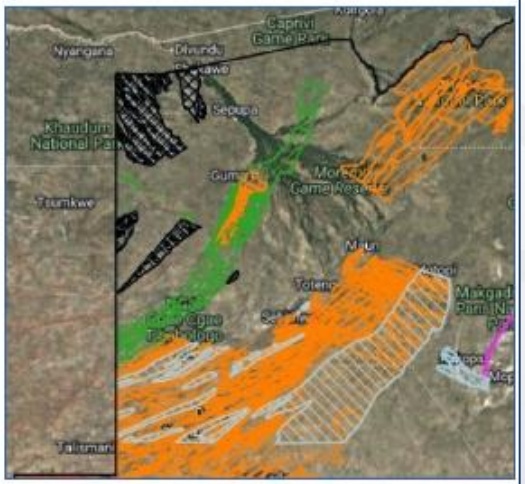
- Ngamiland: Cu-Pb-Zn-Ag ± V, Co, PGEs.
- SE Botswana: Cu-Ni-Co with ultramafic/mafic hosts.
- Historic Zn-Pb-Ag resources validate predictions.
- Next: geochem/EM to refine drill collars.

Ngamiland Copper, Zinc & Lead, Silver

Ngamiland terranes are permissive for Copper, Lead, Zinc, Silver + associated mineral potential (Vanadium, Cobalt, Germanium, gold & PGE's).
Minerals formed via 4 different deposit types enabling broad range of spatial occurrences and resource assemblages.

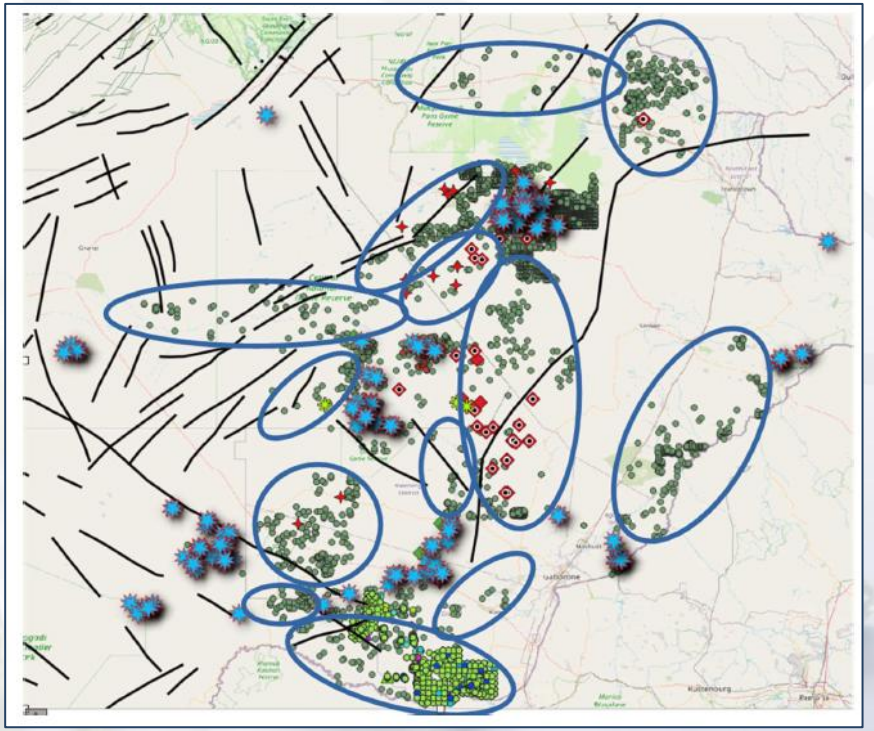
Historically less well explored part of Botswana but interest in the region is rapidly expanding with some promising results to data.

Region example:
Zinc/Lead/Silver/Germanium and Vanadium 2004 JORC compliant resources of 25 million tonnes @ 3% Zn/Pb together with 3.3 million ounces of Silver.



BOD Kimberlite Targeting (Example)

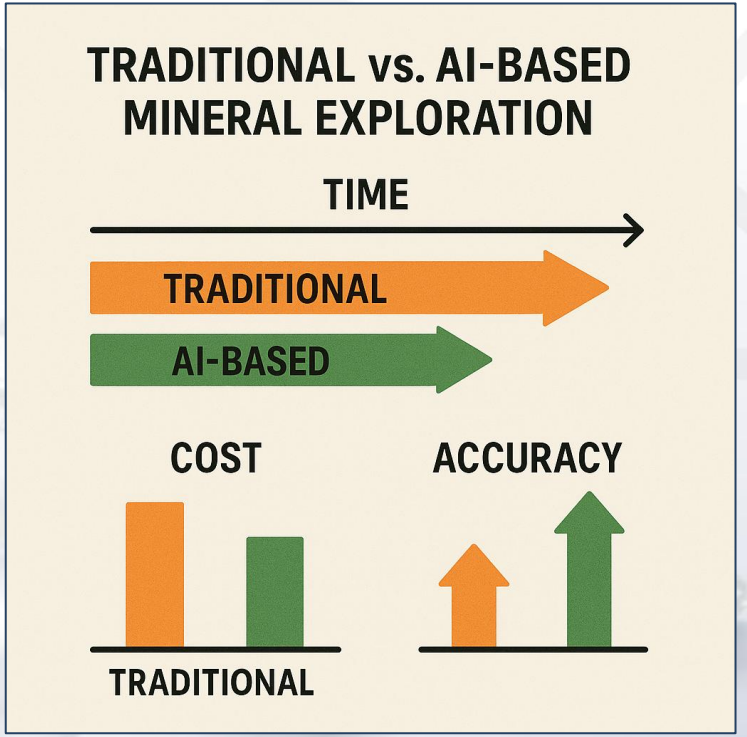
- KIM populations differentiated to guide dispersion.
- Gravity lows + magnetics identify prospective zones.
- Clusters distal from known fields suggest new pipes.
- Captured in licence applications for drilling.



AI vs traditional methods: future of AI

AI vs Traditional Exploration

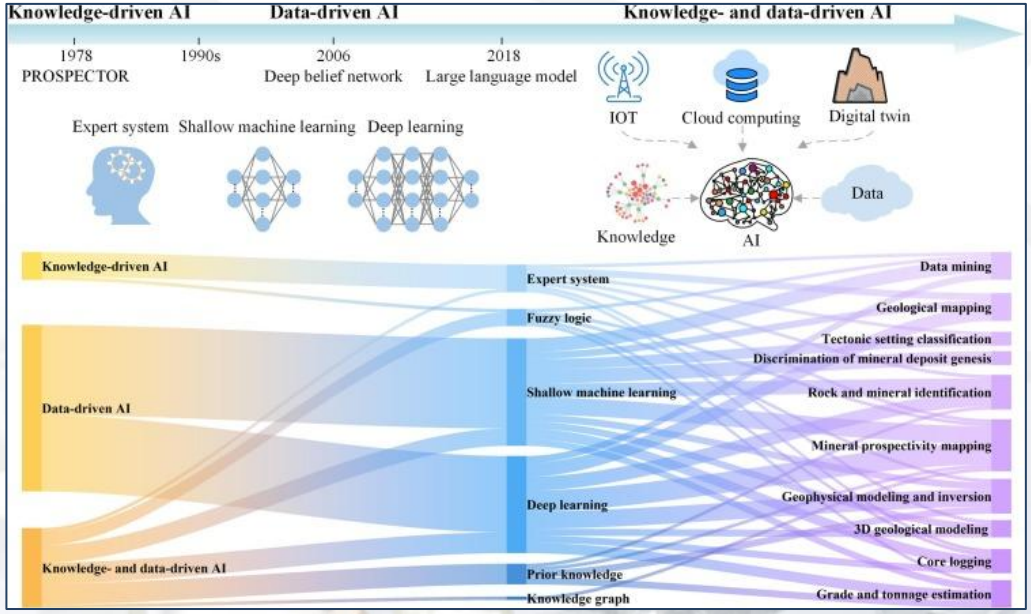
- Traditional: sequential activities, slow feedback.
- AI: parallel hypotheses, probabilistic ranking.
- Explainability supports disciplined budgets.
- Higher conversion, lower discovery cost.



RASonly, 2025

Possible Future State (2030–2035)

- District digital twins update in real time.
- Autonomous UAVs/robotic drills with active learning.
- Next-generation sensors probe deeper cover.
- Geologists as data scientists.



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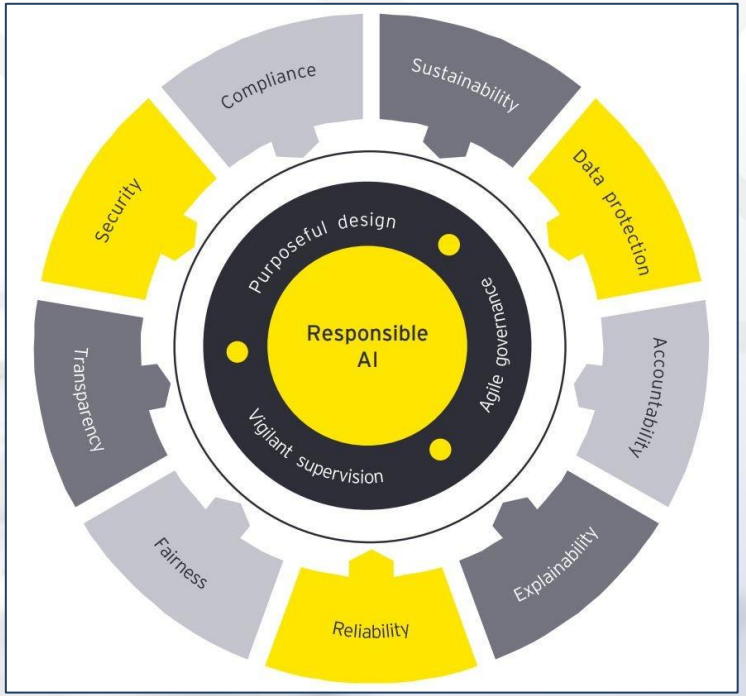
Policy, Investment and ESG Context

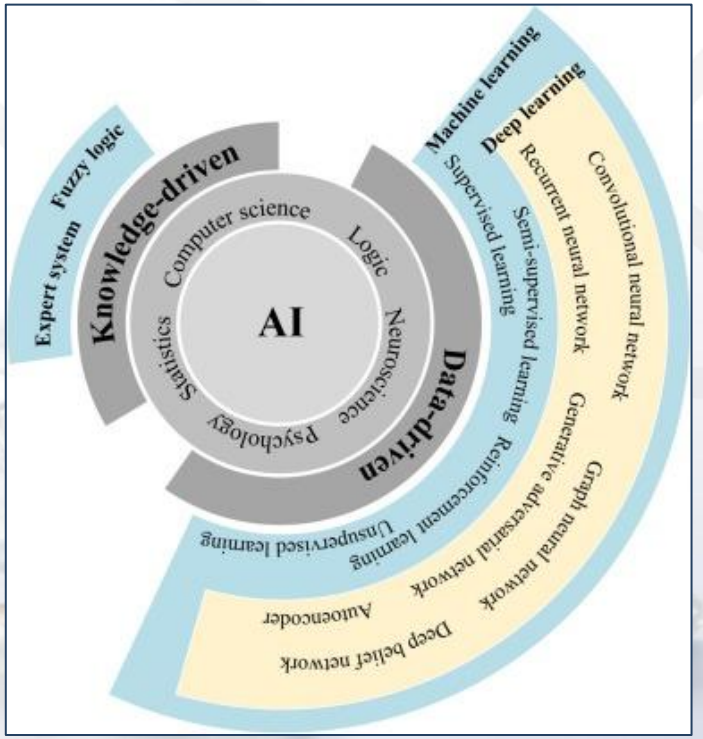
- Strategic finance favours efficient and successful commercial discovery.
- AI reduces footprint by focusing on the best targets.
- Auditable models aid permitting and engagement.
- Botswana's stable jurisdiction enhances the case.



EY.com, 2024

Conclusions and Strategic Outlook

- AI reshaping discovery economics.
- Botswana is an ideal testbed given the geology/data.
- Juniors increase financing potential, and majors gain optimisation.
- Early adopters will dominate the next cycle.



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Thank You

Questions & Discussion

Photo: Andreas Stelzer

About the Author

- James Campbell is Managing Director of Botswana Diamonds plc (a diamond development company active in Botswana, South Africa and Zimbabwe and listed on London AIM and the Botswana Stock Exchange). He has spent over forty years in the diamond industry in a variety of leadership roles both in major and junior companies.
- Previous roles include Non-Executive Director of Shefa Gems (where he is still Technical Advisor); Chief Executive Officer and President of Rockwell Diamonds Inc; Non-Executive Director of Stellar Diamonds plc; Vice President - New Business for Lucara Diamond Corp, Managing Director of African Diamonds plc; Executive Deputy Chairman of West African Diamonds plc and Director of Swala Resources plc and Bugeco sa.
- James also worked at De Beers for over twenty years; his roles included General Manager for Advanced Exploration and Resource Delivery and the Executive Chairman Nicky Oppenheimer's first Personal Assistant.
- James holds degrees in Mining and Exploration Geology from the Royal School of Mines (Imperial College, London University) and an MBA with distinction (and top student prize) from Durham University. He is a Fellow of the Geological Society of South Africa, Institute of Mining, Metallurgy and Materials, South African Institute of Mining and Metallurgy and Institute of Directors of South Africa. He is also a Chartered Engineer (UK), Chartered Scientist (UK) and a Professional Natural Scientist (RSA).
- James is also chairman and founding director of Common Purpose South Africa NPC (a not-for-profit organization that develops leaders who can cross boundaries and is synonymous with the terms '*cultural intelligence*' and '*leadership beyond authority*'). CPSA celebrated its twentieth anniversary in 2020. He was also a director, trustee and chairman of the Joburg Ballet for almost fifteen years.

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https://www.youtube.com/JamesCampbell_JAC

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- Earth AI technical briefs and public case studies (Australia).
- NASA Earth Observatory. Botswana diamond mines satellite imagery (contextual).
- Cleantech/industry analyses on AI in exploration and discovery efficiency.

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