Geological Society of Zimbabwe

Summer Symposium

8am to 5pm, Friday 16th October

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Notes

Start	End	Topic	Speaker
07:30	08:15	**Registration**	
08:15	08:35	Welcome	Edgar Chiteka - Geological Society Chair
08:35	09:15	Official Opening	Justin Bgoni - Group Chief Executive Officer, ZSE
09:15	09:45	How to find the next Big One - World Wide Trends and Zimbabwean opportunities	Gayle Hanssen
09:45	10:05	**Tea**	
10:05	**11:05**	**The importance of structural geology in mineral deposit formation**	**Mike Robertson - SEG Thayer Lindsley Visiting Lecturer**
11:05	11:35	The Diverse Mineral Deposits of Namibia's Damara Orogenic Belt: Insights from SEGF Ronald E. Seavoy Student Field Trip Excursion	Godfrey Chagondah
11:35	12:05	Linking deep lithospheric architecture to mantle-derived magmatism and associated mineralisation in the Zimbabwe Craton: insights from integrated satellite gravity and aeromagnetic data	Brian Mapingere
12:05	12:35	New Data on the Diamond Potential of the Proterozoic Sedimentary Sequences in the Save River Basin, Manicaland Province, Zimbabwe	Evgeny Nikolenko
12:35	13:00	Introduction to Ministry of Mines Cadastral System	Portia Mungate
13:00	14:00	**Lunch**	
14:00	14:20	Bill's Luck: Re-examining a Historic Gold Mine Using Modern Exploration Techniques	Dennis Tsvangira
14:20	14:40	Beyond the Surface: Integrating Structural Geometry and Thickness Interpolants for Consistent Seam Modelling in Faulted Geological Settings	Zandri Harris-Spear
14:40	15:00	Summary	Tony Martin
15:00	15:20	**Tea**	
15:20	16:50	**African Gold, Orogeny, and Zimbabwe's Contribution – Past, Present, & Future**	**Bob Foster - Macgregor Memorial Lecture**

How to find the next Big One – World Wide trends and Zimbabwean Opportunities

Gayle Hanssen

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As the price of gold steadily rises, the world responds by mining more, and Africa fights to get a larger portion of this market – but what are the trends over the past 30 – 40 years and how do we play our role in the discovery of more deposits? In the last 20 years West Africa's production has steadily increased with more and bigger gold deposits coming on stream. Worldwide trends suggest that Juniors Mining Companies play a key role in the exploration stages. Buried deposit discoveries are becoming increasing important, and the exploration time lines are becoming longer. Current figures suggest the average lead time to a significant virgin discovery is 15 years at a cost of $150 to $170 million. Drilling is the key and it averages out to a 1,000km of drilling to lead up to a discovery – probably including all the prospects which were not successful in the mining camp. Furthermore, the average is 2.5 companies will have explored the ground prior to the discovery.

In the mid 1990s, with Reunion Mining, I was involved in the discovery of Maligreen. This was a buried deposit – albeit only 6m of sand. We made the discovery after 6 years of exploration and extensive geochemical and geophysical exploration covering the entire explorations leases. It required innovative exploration techniques that could fit the company's budget and be undertaken within Zimbabwean technical expertise – trust in the team by the executive and a stable operating environment.

Currently, the conditions are different in Zimbabwe – but the opportunity and the expertise are still here. We struggle with the legal tenure, areas required and time needed to make the discovery and attracting adequate funding from those with the belief. We have recently attracted the EAXI programme to help with cutting edge gold research, and the belief is those companies invested in the programme will have the advantage of being a step ahead of the rest. Of course, we need to remember that Zimbabwe is mineral diverse, and the emerging technologies are resource hungry – and so we may have to look in different geological epochs from our usual greenstone treasure trove and of course we have almost 1/3 of our country under cover – the possibilities are endless.

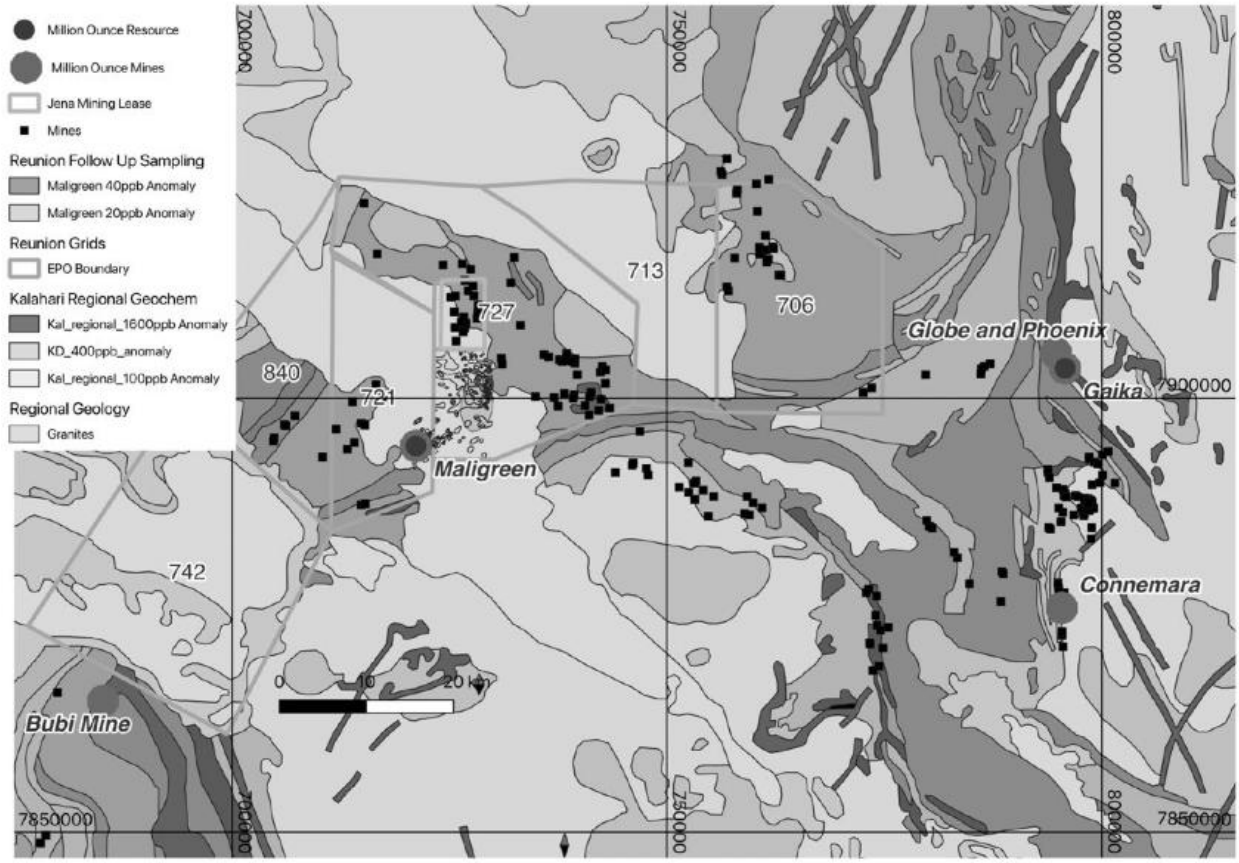


Figure 1 Figure 11990s Exploration EPOs in the Silobela area, Zimbabwe

The Importance of Structural Geology in Controlling Mineral Deposit Formation

Mike Robertson

SEG Thayer Lindsley Visiting Lecturer

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Structural geology plays a fundamental role in the formation, localization, and preservation of mineral deposits across a wide range of tectonic settings. Deformation structures such as faults, shear zones, folds, fractures, and lithological contacts strongly influence fluid flow pathways, pressure–temperature conditions, and rock permeability, thereby controlling where and when mineralizing fluids are focused and trapped.

This talk explores how structural processes operate at multiple scales—from plate tectonic setting through regional tectonic frameworks such as crustal-scale shear zones and sedimentary basin architecture, down to deposit-scale damage zones, dilational jogs and microscale fracture and cleavage networks. The evolution of these processes over time exerts a fundamental control on where, how and whether mineral deposits form and are preserved.

The degree of control varies by deposit type, from the almost entirely structurally controlled orogenic gold systems and fault-focused porphyry copper corridors, through magmatic systems where structures guide magma emplacement, to sediment-hosted deposits where faults define basin geometry, fluid pathways and redox traps.

Two case studies illustrate these themes. At Sheba Mine in the Archaean Barberton Greenstone Belt, gold is localised by the Sheba Fault and its second- and third-order structures, by rheological contrasts between infolded ultramafics/chert and metaturbidites, and by dilational jogs created during refolding — producing ore shoots traceable more than 2,000 m down plunge at grades exceeding 40 g/t Au. In the Chu-Sarysu Basin (Kazakhstan) and at Kamoa-Kakula (DRC), interference folding, growth faults, fault density and basement topography control brine migration and copper deposition.

Applied structural analysis reduces exploration risk, sharpens targeting and improves resource evaluation, particularly when integrated with geochemistry, geophysics and 3D modelling.

The Diverse Mineral Deposits of Namibia's Damara Orogenic Belt: Insights from SEGF Ronald E. Seavoy Student Field Trip Excursion

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A global selection of eighteen post-graduate students, mentors and trip leaders participated in the Ronald E. Seavoy Student 2026 Field Trip Program organized by the Society of Economic Geologists Foundation (SEGF). The program was undertaken from April 7–19, 2026, focusing on the mineral wealth and ore deposits in the Damara Orogenic Belt in Namibia. The Pan-African Damara Belt is endowed with a diverse wealth of world-class mineral deposits including uranium, rare metals (Li & Sn), Cu, REE & Au formed by orogenic and alteration processes. The aim of the trip was for students to have a first-hand appreciation of the geology, ore formation, mining methods and metal recovery processes in operational, developmental and exploration stage projects. The Neo-Proterozoic to Paleo Paleozoic orogenic belt is a product of the assembly of the Gondwana supercontinent during the Pan-African Orogeny.

Linking deep lithospheric architecture to mantle-derived magmatism and associated mineralisation in the Zimbabwe Craton: insights from integrated satellite gravity and aeromagnetic data

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Lithospheric architecture exerts an important control on mineral systems genetically linked to the subcontinental lithospheric mantle (SCLM), and its characterisation is critical for improving predictive exploration targeting strategies. In this study, we investigate the spatial associations between lithospheric-scale structures and mantle-derived intrusions and related mineralisation across the Zimbabwe Craton (ZC), its marginal Neoarchean–Paleoproterozoic Limpopo and Paleoproterozoic Magondi orogenic belts to the south and northwest, respectively, and the Karoo rift basins to the northwest and southeast of the ZC. The occurrences comprise Neoarchean magmatic Ni–Cu mineralisation hosted in greenstone-belt komatiites; kimberlites sensu lato spanning Mesoproterozoic, Ediacaran–Cambrian, Paleozoic and Mesozoic episodes; and Mesozoic carbonatites. We integrate enhanced aeromagnetic, XGM2019e-2159 satellite gravity, and legacy geological datasets to characterise near-surface structures, interpreted SCLM domain margins, and their interactions.

Gradient-based edge enhancements on aeromagnetic data and a continuous wavelet transform ("worming") of pseudogravity data (derived from aeromagnetic data through vertical integration) highlight significant crustal-scale features that closely match surface-mapped domain margins, regional structures within the craton and orogenic belts, N–S and NW–SE faults transecting the ZC as well as edges of the Karoo rift basins. Edge-enhanced long-wavelength gravity depth slices reveal coherent lithospheric-scale structures that persist across multiple depths beneath the ZC and its marginal orogenic belts. Prominent SCLM domain margins, interpreted from laterally persistent contrasts in long-wavelength gravity across depth slices, include one that broadly coincides with the surface-inferred ZC margin and is interpreted as the margin of the ZC lithospheric keel, as well as other margins south and northwest of the ZC beneath the marginal orogenic belts.

Mantle-derived intrusions and associated mineralisation show a notable spatial association with the interpreted SCLM domain margins. Within a 50-km horizontal buffer of the interpreted SCLM domain margins, ~72% of the compiled kimberlites, compared with ~45% of carbonatites and ~58% of magmatic Ni–Cu deposits, fall within this buffer. This association is also evident at relatively smaller structural scales, with some kimberlites and carbonatites localised along prominent NE- and ENE-trending lineaments in the Limpopo and Magondi orogenic belts, along terrane boundaries between the ZC and its marginal orogenic belts, and adjacent to Karoo rift-basin margins. Some of these smaller structural features broadly parallel segments of the ZC lithospheric-keel margin and other SCLM domain boundaries, suggesting that regional lithospheric architecture may have influenced the location of crustal-scale pathways for the magmas. Notably, the economically significant Dorowa and Shawa carbonatites occur along the southern ZC lithospheric-keel margin segment that is crosscut by N–S transverse faults, highlighting the possible interaction between deep SCLM structures and upper-crustal faults in localising emplacement.

Our observations are consistent with previous studies linking cratonic lithospheric-keel margins imaged by seismic tomography [1,2] and transcontinental structural corridors [3] to mantle-derived magmatism and mineralisation. These relationships suggest that the distribution of mantle-sourced mineralisation may be influenced by the geometry and complexity of lithospheric boundaries and their interaction with upper-crustal structures. Integrating satellite gravity with other geophysical and legacy geological datasets provides a regional framework for mapping lithospheric-scale structures that can support predictive targeting of mantle-sourced deposits.

References

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2. Griffin et al. (2013), DOI: https://doi.org/10.1038/ngeo1954
3. Jelsma et al. (2009), DOI: https://doi.org/10.1016/j.lithos.2009.06.030

New Data on the Diamond Potential of the Proterozoic Sedimentary Sequences in the Save River Basin, Manicaland Province, Zimbabwe

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Eastern Zimbabwe is of considerable interest for diamond exploration owing to the development of Mesoproterozoic sedimentary successions of the Umkondo Group, which host significant palaeoplacer diamond occurrences and deposits, including the Marange–Chiadzwa and Chimanimani deposits. The diamondiferous nature of the Marange area is primarily associated with basal conglomerates of the Umkondo Group, while subsequent weathering and erosion of these rocks resulted in the formation of secondary eluvial, deluvial and modern alluvial diamond concentrations. In this context, the Proterozoic sedimentary collectors of the Save River Basin represent a distinct and prospective target for diamond exploration. Published geological information confirms that diamondiferous conglomerates occur at the base of the Umkondo succession in the Marange area, whereas the Chimanimani diamondiferous sediments occur higher in the stratigraphic succession.

During 2022–2024, ALROSA(Zimbabwe)(Private)Limited conducted diamond exploration within the Save River Basin and adjacent areas of Manicaland Province. The exploration programme comprised geological mapping, bulk sampling of coarse-grained basal deposits of the Umkondo Group, heavy-mineral sampling and mineralogical studies, microprobe determination of the chemical composition of kimberlitic indicator minerals (chromites, picroilmenites and clinopyroxenes), as well as drilling.

As a result of the geological mapping, areas of widespread occurrence of potentially diamond-bearing coarse-grained rocks were identified within the basal part of the Umkondo sedimentary succession in the Save River Basin. Mining and excavation works were subsequently undertaken to obtain bulk samples from the identified areas where coarse-

grained basal Umkondo deposits are widely exposed. A collection of diamonds was recovered, documented and assessed, including an evaluation of the recovered diamond production.

Mineralogical sampling of alluvial sediments from drainage systems, followed by geochemical investigation of the recovered minerals, also identified several mineralogical anomalies represented predominantly by chromites and picroilmenites. The results indicate prominent spatial heterogeneity in the distribution of kimberlitic indicator minerals (KIMs) within the Save River Basin. This heterogeneity may reflect local zones of KIM concentration and, potentially, areas containing elevated concentrations of diamond-bearing material within the Proterozoic sedimentary collector. However, the available data are currently insufficient to delineate boundaries of zones characterised by demonstrably high diamond potential.

The chemical composition of the KIMs indicates a potential genetic relationship between the recovered material and mantle-derived and kimberlitic sources; however, KIM chemistry alone does not provide a direct estimate of diamond grade, stone size distribution, diamond preservation within the sedimentary collector, or the potential economic significance of the occurrence. Moreover, the mineralogical and geochemical association is not fully diagnostic. The available dataset is dominated by chromites and ilmenites, whereas clinopyroxenes are rare, and a consistent assemblage comprising several independent kimberlitic indicator minerals has not been identified across all investigated areas. Therefore, at the present stage of exploration, it is more appropriate to define these areas as zones of enhanced exploration interest based on KIM distribution, rather than as proven zones of high diamond potential.

For a Proterozoic sedimentary collector, the possibility of multiple episodes of sedimentary reworking represents a critical exploration consideration. Kimberlitic indicator minerals may have been introduced directly from primary bedrock sources, previously concentrated within Umkondo conglomerates, and subsequently released again through weathering and erosion of these conglomerates and redeposited in younger alluvial and colluvial sediments. Consequently, the present-day spatial distribution of a KIM anomaly does not necessarily coincide either with the location of the primary kimberlitic source or with the area of maximum diamond concentration.

Accordingly, an important exploration objective is to distinguish between two possible sources of the indicator minerals: (1) direct input from local primary bodies related to kimberlitic or allied magmatism, and (2) secondary liberation of KIMs through the erosion of Proterozoic conglomerates, followed by their subsequent redeposition within younger unconsolidated sediments. The absence of prominent mechanical abrasion in some chromite grains is consistent with the possibility of relatively short transport distances; however, this feature alone cannot be regarded as conclusive evidence for a nearby primary bedrock source. Overall, the available evidence indicates that the southern part of the Save River Basin within Manicaland Province warrants continued diamond exploration, particularly in relation to diamonds hosted by Proterozoic sedimentary collectors and their younger reworked derivatives. However, the current dataset should not be interpreted as direct evidence of established diamond-bearing zones at specific localities. Rather, the results define a number of areas of elevated exploration potential that require further systematic investigation, including integrated sedimentological, mineralogical, geochemical and bulk-sampling programmes.

Implementation of the Mining Cadastre Information Management System

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The Ministry of Mines and Mining Development (MMMD) initiated the MCIMS project to modernize mining title administration, transitioning from manual to computerized systems. The project began in 2014 with pre-cadastral work and a pilot in Manicaland.

Key Achievements:
The Landfolio system was installed at the National Data Centre, supported by the procurement of required hardware, software, vehicles, and equipment. Workflows were aligned with the Mines and Minerals Act, staff and stakeholders were trained, and bulk data from 2021-2022 was captured and uploaded. System testing, spatial data capture, and clean-up of legacy claims, SGs, and EPOs were undertaken. The back-office system is operational, while the public portal is pending launch.

Core Functions at Rollout:
At rollout, the Landfolio system is expected to introduce an online mining portal for applications, renewals, notifications, and returns; an interactive cadastre map displaying active titles and available ground; digital QR-coded title certificates; automated overlap checks; integrated payment processing for fees and rentals; and faster, more transparent GIS-based title validation.

Infrastructure Needs:
Successful implementation depends on high-accuracy DGPS data referenced to the UTM Arc 1950 coordinate system, validated beacon coordinates and statutory survey plans, certified title and company documentation, reliable ICT infrastructure and internet connectivity, and integration with environmental, land administration, revenue, and judicial authorities.

What will happen to Legacy Records & Disputes:
Legacy paper records were reconciled with GIS data, while title overlaps were resolved using the principle of title priority and DGPS surveys. Unresolved cases were addressed through formal dispute hearings, and disputed titles were flagged in the system to prevent transfers until resolution.

Role of Mine Surveyors:
Mine Surveyors play a critical role in supporting the cadastral system through the adoption of survey-grade DGPS technology, auditing and re-verifying beacon certificates, and ensuring that all survey data complies with established cadastre standards and regulatory requirements.

Risks & Challenges:
- Title forfeiture if rentals/inspections missed.
- Loss of priority in disputes due to incomplete records.
- Limited rural IT infrastructure.
- High DGPS costs for small-scale miners.
- Resistance to digital adoption.

Support & Capacity Building:
- Training workshops, helpdesks, online support.

- SOP manuals, tutorials, fee schedules.
- Transitional grace period under Mines and Minerals Amendment Bill.

Expected Benefits for Miners:

- Remote access to services.
- Faster processing, reduced bureaucracy.
- Transparent title issuance and dispute resolution.
- Reduced overlaps and improved tenure security.
- Enhanced ease of doing business.

Bill's Luck: Re-examining a Historic Gold Mine Using Modern Exploration Techniques

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Bill's Luck is a historically significant gold mine within the Filabusi Greenstone Belt of Zimbabwe, with recorded production of approximately 17,000 ounces of gold between 1916 and 1950 at an average grade of about 7.7 g/t Au. Although the mine has a long history of gold production, its geological understanding has largely been shaped by the extent of the historic underground workings and the exploration methods available at the time. Today, modern exploration provides an opportunity to revisit Bill's Luck, build on the knowledge left by earlier miners and geologists, and develop a broader understanding of the geological and structural controls on mineralisation.

The re-evaluation of the Bill's Luck mineralised system integrates historical mine plans with geological mapping, structural interpretation, geochemical data, contemporary diamond and reverse-circulation drilling, underground sampling, and three-dimensional geological modelling. Particular attention has been given to the structural controls of gold mineralisation, including anastomosing shear zones, quartz-vein development, high-strain domains, and favourable lithological contacts. Modern drilling has also been used to investigate parallel reef structures, assess grade variability beyond the historically exploited areas, and test the continuity of mineralisation along strike and down dip.

The work demonstrates that historical mine workings are more than records of past production; they are valuable geological datasets that can guide modern exploration. By combining historical observations with contemporary exploration data, the geometry, continuity, and structural controls of mineralisation at Bill's Luck can be better understood and incorporated into a contemporary mineral resource model. More broadly, Bill's Luck illustrates how brownfields exploration can breathe new life into mature gold districts by transforming historical geological knowledge into a predictive exploration model. This approach provides a practical framework for targeting extensions of known mineralisation as well as identifying previously unrecognised mineralised structures.

Beyond the Surface: Integrating Structural Geometry and Thickness Interpolants for Consistent Seam Modelling in Faulted Geological Settings

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Beyond the Surface: Improving Seam Thickness Modelling in Faulted Geological Settings
Accurate seam thickness modelling is critical for developing reliable geological models and resource estimates, particularly where tabular geological units are disrupted by faulting. In faulted settings, apparent variations in seam thickness between adjacent fault blocks can arise, especially where data coverage is limited. If not appropriately addressed, these variations may introduce geological artefacts and contribute to the over- or under-estimation of seam volumes and tonnage.

Where faults exhibit limited lateral displacement, the true thickness of a geological unit would generally be expected to remain relatively consistent across adjacent fault blocks. However, modelling based solely on 3D surface elevation can result in artificial thickness variations as the model attempts to honour structural geometry.

This presentation explores an integrated approach that combines 3D surface elevation with a thickness interpolant to better constrain the geometry and continuity of tabular units across faulted domains. By incorporating thickness as an additional modelling control, the approach aims to preserve geological continuity while maintaining the structural relationships defined by the fault framework.

Additionally, the presentation highlights practical considerations for applying thickness constraints in 3D geological modelling workflows and demonstrates how integrating geological understanding with modelling techniques can improve the consistency and robustness of resource models.

The 2026 Macgregor Memorial Lecture

A.M. Macgregor: A Remarkable Man, a Remarkable Country – Together
Re-shaping Our Understanding of Earth's Evolution and Gold Metallogeny:

African Gold, Orogeny, and Zimbabwe's Contribution – Past, Present, & Future

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Since the turn of the 20th Century, Zimbabwe has been the focus of intense and sustained exploration and development of its mineral resources, reflecting the country's remarkable gold endowment in particular, and building upon a history of enquiry and endeavour dating back 2,000 years. Gold was the prime driver of the post-1900 exponential growth of the mining industry but the much wider mineral endowment of the country was also soon realised.

Critical to ongoing exploration success was the founding of the Geological Survey in 1910, which rapidly established itself as one of the premier Survey organisations worldwide through publication of its comprehensive geological bulletins that documented and interpreted the geological history of some of the oldest geological terrains known – and its mineral deposits. The work of Dr A.M. Macgregor and very many members of the Survey, past and present, provided a platform not only for successful exploration but also for insights to Archean crustal evolution that were at the forefront of geoscientific debate internationally. That position remains so today thanks to the contributions of a considerable number of academic geoscientists building upon the Geological Survey database.

This Lecture draws heavily on the many important contributions by the Zimbabwe geological community in relation to the country's gold metallogenic endowment and suggests where future studies might build on this knowledge via international research collaboration and sharing of scientific and technical knowledge between companies and academia.

The majority of the country's Archean craton-hosted gold deposits conform with what are now widely recognised as "orogenic gold systems", generated by metamorphic devolatilization at upper greenschist and amphibolite facies P-T in an orogenic setting. Major interconnected crustal and even transcrustal structural networks are key to the focused flow of the mineralising fluids and the generation of gold-endowed districts. Critical factors at the "sink" end of the system include the rheology of the host rocks, whether brittle failure or more ductile response, and the chemical reactivity of the rocks, with fluid-rock interaction being the most effective control on gold precipitation. Areas of debate around the orogenic system "model" and the concept of a crustal continuum include the potential contribution of mantle-sourced fluids, the concept of a metal- and fluid-enriched "fertile" mantle, and the role of granites as possible sources of fluids and metals.

Synthesis of key elements of the greenstone belt-hosted gold deposits in Zimbabwe highlight a number of broadly consistent features. Mineralised shear zones rarely extend more than ca.3-

5 km in length whereas more extensive shear zones, such as evident in the Midlands Greenstone Belt, are structural "corridors" up to 100 km long and 5 km in width but rarely host significant mineralisation. Important deposits commonly occur in lower-order shear zones where the rheology and mineral composition of host lithologies are important factors. Transpressional strike-slip and reverse dip-slip fault systems are dominant, and spatial association with intrusive granitoids relates primarily to brittle failure within plutons or focusing of strain along pluton margins.

The importance of major crustal fault zones to gold metallogeny continues to be debated, with focus more on their roles in crustal growth and subsequent orogenic events. Major terrane boundaries delimiting "superterranes" in the Yilgarn Craton extend the 500 km N-S breadth of the craton, and a similar recognition of major terranes has been suggested for the Tanzanian Craton. However, these seem to have little direct bearing on the localisation of major concentrations of gold mineralisation, although the broadly N-S elongation of the Yilgarn greenstone belts is indicative of craton-wide crustal shortening and the consequent thrust-stacking of complex greenstone-granite terranes. Deep-sensing studies of the Yilgarn terranes have demonstrated the importance of shear zones down to mid- and lower-crustal depths. Individual greenstone belts have very different mid-crustal architecture, which is also reflected in the internal architecture of the belts themselves – and these can have very different gold endowments. Recent studies of modern back-arc basins have also drawn comparison with the greenstone belts of Canada's Superior Province and the proposal that some greenstone belts could be products of microplate migration.

Our understanding of the development of the Zimbabwe Craton has advanced considerably over the past thirty years and the relevance to gold metallogenesis should be considered. This includes the recognition of the early/mid-Archean Tokwe and Sebakwe proto-cratons, the broad differences between the rift-dominated evolution of the mostly gold-poor "Eastern Succession" greenstone belts and the subduction-accretion development of the gold-enriched "Western Succession", and the potential importance of a late-Archean "switch" from E-W crustal shortening (thrust-dominated) to N-S transpressional tectonics – and how this might relate to the structural complexities than can accompany the onset of craton-craton docking. This naturally leads to questions about the Archean-Palaeoproterozoic transition and its implications for further mineralisation.

Zimbabwe's geoscientific community now has the opportunity to take its comprehensive knowledge of the country's Precambrian geology and its metal endowment to the next level and it is hoped that the fledgling East Africa Exploration Initiative (EAXI) can provide the momentum to achieve this. There seems little doubt that the Archean cratons of Zimbabwe, Tanzania, Dharwar, Yilgarn, and Pilbara share a very similar evolution and gives some support to the concept that these were all part of a suggested ca.3 Ga "Ur Craton". The fact that the Kaapvaal Craton was also likely a component of "Ur" suggests that it should be included in this exciting new initiative.

Notes