Proposals

Opportunities for Sharing

Compiled and presented
by

Kronberg Fine Chemicals Namibia (Ltd) + QUEDNAU & Partner
Windhoek: Namibia + Kronberg/T: Germany

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PORTEFEUILLE

Industry:

1. Recycling of lithium + by-products: Namibia
2. Recycling of cobalt/nickel: Germany
3. Processing of gold + by-products: Mozambique
4. Afforestation and land restoration: Togo
5. Water resources: Germany
6. Biodegradation of PET and derivates: Switzerland

Science:

7. Quantum based proceedings in geomicrobiology: Austria
8. Radioactive waste as precursor for microbial hydrogen production: Namibia

Asset:

9. In-/above-ground assets: Germany, Mozambique, Namibia, Togo

Auxiliary note:

Despite of the diversity in objectives and proceedings all presented proposals originate in a "*common source*": Geoscience and its subdisciplines as economic geology, geochemistry, geoengineering, geophysics, geostatistics, hydrogeology, mineralogy, and soil science at which geomicrobiology may provide supplementary data for agrogeology, astrobiology, biomining, genetic engineering, medical mineralogy, metallurgy, quantum microbiology, recycling, restoration, urban mining.

1. Recycling of Llthium + by-products: Namibia

Background + objective

Regarding the selected site of the operation there are voluminous dumps and tailings from previous tin mining for about 100 years when the lithium component in the tin ore was of no interest and was discarded as waste, *Figure 1(b)*. Currently inferred resources amount to 14.4 Mt of ore with an average content of 0.37 % lithium oxide (Li_2O) i.e. about 53,000 t of lithium oxide or 25,000 t of lithium. Beyond secondary lithium a set of additional metals, e.g. tantalum, tungsten, are geochemically detected and may be extracted. Objective of the proposal is the integration of secondary lithium into value added chains available for the chemical industry and the pharmacy, *Table 1(a)*. The location for the planned recycling/processing facility shall be Swakopmund/ Namibia, *Figure 1(a)*. Tax advantages, infrastructure, cheap material supply, *Figure 1(b)*, and a lean bureaucracy feature the business environment of the chosen location, *Table 1(b)*.

USP leverage => Bioprocessing of fine chemicals via biorecycling of mining waste.

(a) (b)

Figure 1:
Draft of the planned recycling plant in Swakopmund/Namibia (a) and lithium bearing tailings previously discarded by a tin mine as precursor for the processing of saleable fine chemicals (b).

Table 1(a): Financial benchmarks

	Entity		Feature
1.1	Value of in-ground asset	=>	More than 100 million USD
1.2	Product	=>	Fine chemicals, quantum dots
1.3	Annual turnover	=>	About 15 million USD
1.4	ROI	=>	48 months
1.5	Debt financing	=>	Loan + guarantee capital
1.6	Required working capital	=>	15 million USD

Table 1(b): Business environment: Common Monetary Area (CMA), NAD coupled with Rand.

	Entity		Feature
1.7	Country risk	=>	Sensitive risk
1.8	Government incentives	=>	*'Export Processing Zones (EPZ)*, VAT privilegs, etc.
1.9	Exchange controls	=>	In parts
1.10	Capital entry + repatriation	=>	No restrictions in capital entry + repatriation possible

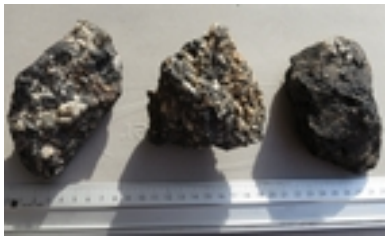
2. Recycling of cobalt + nickel: Germany

Background + objective

Numerous materials dumped by previously mining of base metals and industrial minerals are recorded nearby the location of the scheduled operation, i.e. *Taunus*/Germany. These residues of former mineral extraction and the blending of ores contain commercially interesting concentrations in i.a. cobalt and nickel (*Figure 2(a)*. According to geochemical data accessory metals such as copper, lithium, and REE are indicated. The aimed technical setting enables an additional recovery of critical metals from diverse waste materials in terms of urban mining. As precursors fit i.a., e-scrap and slags generated by metallurgical processing. Objective of the proposal is to blend the recovered metals to saleable fine chemicals available for the pharmaceutical industry, chemical industry and information techniques (IT), *Figure 2(b)*. The selected site of the planned recycling facility is Kronberg.i.T./Germany since the location combines large resources of metalliferous raw materials, highly skilled workforce, an excellent infrastructure, and nearby sales markets.

USP leverage => NanoTech via BioTech for HighTech in terms of the "*Green Deal*".

(a)



(b)

Figure 2:
Cobalt and nickel bearing ores disposed of previous mining of industrial minerals (a) and electronic scrap colonized by microorganisms as biobased approach for the recovery of critical metals (b).

Table 2(a): Financial benchmarks.

Item	Entity		Feature
2.1	Value of in-ground asset	=>	More than 150 million USD
2.2	Product	=>	Fine chemicals, quantum dots
2.3	Annual turnover	=>	More than 16 million USD
2.4	ROI	=>	36 months
2.5	Debt financing	=>	Loan + guarantee capital
2.6	Required working capital	=>	15 million USD

Table 2(b): Business environment.

	Entity		Feature
2.7	Country risk	=>	Low risk
2.8	Government incentives	=>	Equity capital, national and EC grants
2.9	Exchange controls	=>	No controls on purchase or sale of foreign currencies
2.10	Capital entry + repatriation	=>	Double taxation

3. Processing of gold + by-products: Mozambique

Background + objective

Various alluvial gold enrichments are currently mined by artisanal mining in the *Manica Province*/ Mozambique, *Figure 3(a)*. Severe pollutions of the environment by, for example, mercury emissions during open pit gold mining are a frequent phenomenon. These impacts are conflicting with the contemporaneous efforts of the government to save ecosystems, biodiversity and natural water resources of the *Manica Province*. Beyond gold a couple of additional metals are indicated, such as aluminum, cobalt, nickel that may be exploited as saleable by-products. Objective of the proposal is an introduction of novel competitive processing techniques, i.e. more efficient bioextraction proceedings, *Figure 3(b)*. Due to social tensions and government's employment programs the project shall support the reduction of local unemployment and shall promote the social prosperity of this province. The business environment is featured by, i.a., *Accelerated Development Economic Zones*.

USP leverage => Bioprocessing of gold and by-product extraction.

(a)

(b)

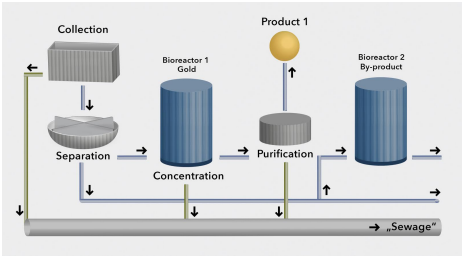


Figure 3: Artisanal mining in the *Manica Province*/West Mozambique (a) and schematic design of a gold processing flow in terms of biomining (b).

Table 3(a): Financial benchmarks.

Item	Entity		Feature
3.1	Value of in-ground asset	=>	More than 50 million USD
3.2	Product	=>	Gold and by-products
3.3	Annual turnover	=>	About 8 million USD
3.4	ROI	=>	24 month
3.5	Debt financing	=>	Venture capital, shares
3.6	Required working capital	=>	4 million USD

Table 3(b): Business environment: *Investment Law and Regulation No 43 (2009)*, *CPI* = 147/180.

	Entity		Feature
3.7	Country risk	=>	High risk
3.8	Government incentives	=>	Corporate withholding taxes
3.9	Exchange controls	=>	Purchase must be approved by *Bank of Mozambique*
3.10	Capital entry + repatriation	=>	Both parameters partially unrestricted

CPI => Corruption Perceptions index.

4. Afforestation + land restoration: Togo

Background + objective

Land degradation caused by for instance deforestation, unsustainable agricultural practices and rapid urbanization rates is a common feature in Togo, *Figure 4(a)*. Particularly forests are exploited for charcoal production that serve currently as the most important energy source. The afforestation project intends the combination of natural forest and teak plantations. All discrete steps of the value added chain, i.e. from producer to clients comprising i.a., processing plants, end-user products, chains of custody, and responsible management shall be certified by the *Forest Stewardship Council (FSC)*. A proven feasibility of the project is published by i.a. *FAO, Figure 4(b)*. The success of the project depends on geological parameters such as soil quality and water supply and thus defines the objective of the proposal. Capacity building in sustainable forest management and the substitution of charcoal by renewable energies shall accompany the project.

USP leverage => Novel biotechnical and water management strategies **in** resource restoration.

(a)

(b)

Figure 4:
Land degradation in north Togo (a) and afforestation of natural forest in central Togo (b, © Kossivi Aykoe).

Table 4(a): Financial benchmarks.

Item	Entity		Feature
4.1	Value of in-ground asset	=>	more than 100 million USD
4.2	Product	=>	High quality timber, restoration of degraded land
4.3	Annual land productivity	=>	1,000 hectares
4.4	ROI	=>	15 years
4.5	Debt financing	=>	Guarantee, shares
4.6	Required working capital	=>	9 million USD

Table 4(b): Business environment: *West African Economic and Monetary Union* (*WAEMU*), FCA Franc.

	Entity		Feature
4.7	Country risk	=>	Sensitive risk
4.8	Government incentives	=>	Export processing zone (EPZ)
4.9	Exchange controls	=>	Currencies pegged to the EURO
4.10	Capital entry + repatriation	=>	Unrestricted + repatriation possible

5. Water resources: Germany

Background + objective

The consequences of increasing atmospheric temperature and the decreasing precipitation amount provoke an alteration of virtually all environmental entities, e.g. forest dieback/"*Waldsterben*" which can be tracked in an array of forests in Germany, *Figure 5(a)*. Due to sinking groundwater tables the agriculture is producing a reduced yield of crops. Furthermore, clients from industry and power plants are increasingly affected by restrictions in water supply. An intensive "*water sink*" is generated by the *Frankfurt Rhine-Main* area and its adjoining regions, e.g. *Taunus*/Germany reasoned by the water consumption of the high population density and intensive industrial operations. The objective of the proposal shall maintain efforts by i.a. municipallties, to mitigate the challenges that are coupled with the water supply for more than 2.5 million residents, large scale industry, and power plants. A set of measures for resource recovery such as water circle management, the installation of injection wells, the re-activation of swamps for "*sponge effect*", the use of abandoned adits utilized as cisterns, etc. shall be carried out, *Figure 5(b)*.

USP leverage => Geo.Bio.Engineering for land rehabilitation and for resource preservation.

(a)

(b)

Figure 5:
Vegetation dieback in the Taunus forest ("*Waldsterben*") and land degradation (a) and a draft of networked injection wells in geologically favorable rock units at Taunus (b, © *STRATA LLC*).

Table 5(a): Financial benchmarks.

Item	Entity		Feature
5.1	Losses of in-ground assets	=>	Water, soil fertility
5.2	Rate of land degradation	=>	More than 80 %
5.3	Product	=>	Conceptual framework for water storage and cycling
5.4	Debt financing	=>	Loan
5.5	Required working capital	=>	14 million USD

Table 5(b): Business environment: Clients from industry, municipality, government.

	Entity		Feature
5.6	Country risk	=>	Low risk
5.7	Government incentives	=>	Equity capital, national and EC grants
5.8	Exchange controls	=>	No controls on purchase or sale of foreign currencies
5.9	Capital entry + repatriation	=>	Double taxation

6. Biodegradation of PET and derivates: Switzerland

Background + objective

Polyethylene terephthalate (*PET*) is one of the most abundant thermoplastic that is used by the global consumer markets. The annual *PET* production adds up to 70 million tonnes and a compound annual growth rate (*CAGR*) amounts to about 10 % (source: *European Commission*). Central Europe and particular Germany are the greatest exporter of used *PET*, *Figure 6(a)*. The raw materials for *PET* production are compounds that are processed from petroleum that provide, i.a. the required carbon. *PET*'s carbon can be exploited by a diverse spectrum of recently discovered microorganisms. Objective of the project is the biodegradation of *PET* via reversal processes that are commonly related to the reaction sequences that run during the evolution of hydrocarbons. The envisaged array of microorganisms can be optimized by genetic engineering, *Figure 6(b)*. In terms of circular economy the biodegraded *PET* may be again synthesized to *PET* and fine chemicals. According to its favorable business conditions the planned facility shall be installed and run at Basel/Switzerland.

USP leverage => Geo.Bio-Engineering: PET from PET, i.e. circular economy.

(a) (b)

Figure 6:
PET "deposit" (a) and *PET* degrading microorganisms producing raw materials for biotechnological purposes (b).

Table 6(a): Financial benchmarks.

Item	Entity		Feature
6.1	Annual production volume	=>	70 million tonnes
6.2	Annual growth rate	=>	10 %
6.3	Product	=>	Feedstock for biotechnology
6.4	Debt financing	=>	Loan, shares
6.5	Required working capital	=>	15 million USD

Table 6(b): Business environment: Clients from industry and municipality.

	Entity		Feature
6.6	Country risk	=>	Low risk
6.7	Government incentives	=>	Equity capital, national grants
6.8	Exchange controls	=>	No controls on purchase or sale of foreign currencies
6.9	Capital entry + repatriation	=>	Double taxation

7. Quantum based proceedings in geomicrobiology: Austria

Background + objective

Proceedings in applied geomicrobiology are always confronted with phenomenons such as photo-/ chemotaxis, genetic re-adjustments, microbial information exchange, enzymatically lowered energy barriers, supramolecular self-assembling and recognition, signal processing. In accordance with the most recent data bases all these phenomenons imply quantum effects. The possibility of quantum processing in microbial biomatter is attaining an emerging interest by several disciplines such as biophysics. Since *Erwin Schrödinger's* lectures "*What is Life.-The physical aspect of life*" the intersections between physics and biology triggered research in quantum effects in i.a., microbial biomass. Topics such as quantum microbiology report from vibronic/excitonic phenomenons during DNA regulated data compilation, wave functions and superposition in photosynthesis, fluorescence quantum yield, wave conducting ion channels, spin-based biocatalysts, quantum beads, quorum sensing, *Figure 7(a)*. The firm's research & development (*R&D*) objective shall be particularly focussed to quantum entanglement as it presumed for mechanisms such as "*bacterial swarm intelligence*", bacterial social behaviour, manipulation of biomass conduct. The firm's endeaver in *R&D* shall act as a contribution to the survey of quantum based proceedings via microbial biomatter including quantum devices as microtubes, antenna. Eventually the *R&D* activities shall evaluate models for quantum based bioprocessing units achieved by *Schrödingers bacterium*, *Figure 7(b)*.

(a) (b)

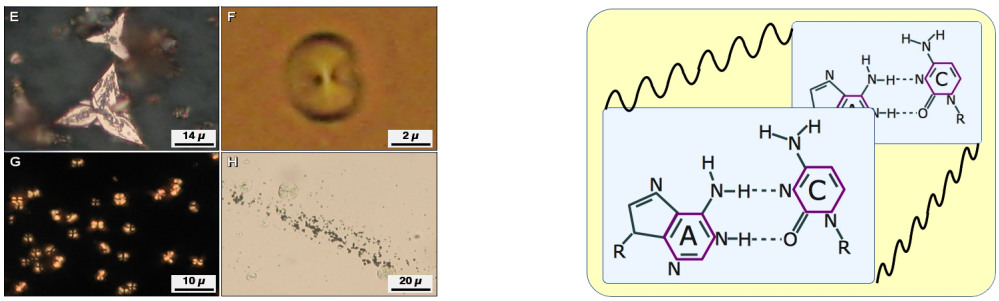


Figure 7:
Quorum sensing act as a bioprocedure for cell to cell communication for i.a, gene regulation (a), and a model of a quantum based bioprocessing unit/modul, e.g. *Schrödingers bacterium* (b).

Table 7: Work schedule for the design and modeling of a quantum based bioprocessing unit.

Workpackage | Months	3	6	9	12	15	18	7	21	24	27	30	33
1.1 Design												
1.2 Modeling												
1.3 Defining processing method												
1.4 Test phase												
1.5 Environmental impact assessment												
1.6 Feasibility study												
1.7 Legal policies												

8. Radioactive waste as precursor for microbial hydrogen production: Namibia

Background + objective

Namibia hosts one of the greatest open pit mine for uranium mineralisations at global scale, i.e *Rössing* uranium mine, *Figure 8(a)*. According to its mining history an extensive volume of residues had been deposited and is still processed. The extraction causes environmental impairments such as emission of radiogenic dust and contamination of groundwater. The expenditures for waste disposal encompass ground, technique, and health care. Since its discovery a considerable research of radiotolerant microorganisms launched and comprehensive arrays of data bases has been compiled, *Figure 8(b)*. According to this information the microbial resilience against radiogenic stress may be exploited for technical purposes. Objective of the presented proposal, i.e. research and development (*R&D)*, is to design and to engineer procedures that harness and copy this particular microbial property. The advantages of this strategy are characterized by a twofold benefit, i.e. (1) decreased quantity of radioactive waste and (2) subsequent synthesis of hydrogen. The development of an intellectual property (*IP*) is scheduled. The utilized materials and methods may act as an expedient for the presently operating mining company at *Rössing* uranium mine. The selected site of *R&D* activities shall be established in Swakopmund/ Namibia.

USP leverage => Bioprocessing of hydrogen via radiogenic waste.

(a) (b)

Figure 8:
Rössing open pit mine for uranium mineralisations (a, © *Rössing Mine*) and radiotolerant microorganisms for the production of hydrogen at which radioactive matter acts as precursor (b).

Table 8: Work schedule for the research and the development of an intellectual property.

Workpackage | Months	2	4	6	8	10	12	14	16	18	20	22	24
1.1 Design												
1.2 Modeling												
1.3 Defining processing method												
1.4 Test phase												
1.5 Environmental impact assessment												
1.6 Feasibility study												
1.7 Certification												

9. In-/above-ground assets: Germany, Mozambique, Namibia, Togo

Background + objective

The term "in-ground asset" stands for an economic value, i.e. worth of ground, in terms of a bankable asset and may be considered as the starting point of value added chains that may result in mining. The range of in-ground assets comprises geological entities such as mineral, potable water, natural hydrocarbon, and soil. The amount of the value depends on the type, quantity and quality of the geological entity. Beyond these geological entities and boosted by novel techniques and markets secondary sources such as landfills of metalliferous waste and *'brown fields*' are attracting an increasing economic interest. This new type of commodity source designated as '*Urban Mining*' is classified as above-ground asset may be converted to a product for commercial purposes. For instance, discarded mining residues deposited in tailings processed by a formerly tin mine in Namibia contain economically interesting concentrations in lithium. In-ground assets can be presently sold at the stock exchange markets operating in London, Singapure, and Vancouver. The funding of an in-ground asset requires a bundle of prerequisites. One of the most essential prerequisite is the compiiation of a proper technical report. Disclosure issues, internationally accepted, must be ruled by instruments as *NI 43-101*, *JORC*, *SAMREC*. The sales value of an in-ground asset depends on the classification in terms of the standard reporting codes. An increasing value may be achieved by the grade of geological information, i.e. mineral resource and ore reserve, *Figure 9(a)*. An asset valuation may capitallize projects for further developments. Unrestricted access to the in-ground assets legally documented and confirmed acts as a further indispensable prerequiste. Objective of this proposal is to upgrade ground by geological data and it shall be realized by techniques such as satellite supported GIS, due diligence studies, bankable feasibility studies, digitalized data bases filed in *Cadastre Map Portals*, *Figure 9(b)*. At present the company is busy to acquire exclusive prospection licenses (*EPL*) in four countries, *Table 9*.

(a) (b)

Figure 9:
Standard classification scheme of the standard reporting codes, e.g. *NI 43-101*, *JORC* indispensable for the valuation and/or an upgrading of the commercial value of in-/above ground assets (a, © *JORC*) and satellite image of the lithium bearing Cape Cross Belt/Namibia and data depicted via *GIS* and provided by *Cadastre Map Portals* (b).

Table 9: In-/above-ground assets.

	Country		Asset	Type
9.1	Germany	=>	Cobalt, nickel, water	Above-ground
8.2	Mozambique	=>	Aluminum, coltan, lithium	In-ground
9.3	Namibia	=>	Lithium, rare earth elements (REE), water	In-/above-ground
9.4	Togo	=>	Gold, phosphorus	In-/above-ground

i. Company profile

Business model	Globally acting service in *Applied Geology* in terms of the "*Green Deal*".
Service	Mining, recycling, restoration.
Implementation	Geo.Bio.Engineering.
Dept capital	More than 150 million USD held out in prospect.
Sites of traction	City of London/England + Frankfurt a.M./Germany
Reference	*https://www.barnesandnoble.com/w/anwendungen-michael-quednau/1128317834*
Team & Expertise	An interdisciplinarily skilled team of experts from applied geology, mineralogy, and engineering with an expertise acquired in business and science.

Contact	***QUEDNAU & Partner*** attn. Dr. Michael S. Quednau Hartmuthstr. 1A 61476 Kronberg/T. **GERMANY** Phone: +49 (0) 6173 9948453 Mobile: +49 (0) 170 3164638 Email: info@drquednau.eu	***Kronberg Fine Chemicals Namibia Ltd.*** attn. Volker Fischer-Buder 37 Beethoven Str. Windhoek **NAMIBIA** Phone: +264 61 228502 FAX: +264 61 228490 Email: volker@vfbce.com