

# *DEEP MINING 2030*

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*with*

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MAN NEEDS  
MINERALS

MINERALS NEED MAN

MINING,  
EXTRACTION  
MARKETING

**2030**

**MAJOR EXISTING SURFACE  
DEPOSITS**

**GOING TO BE DEPELTED**

**HAVE TO GO DEEP AND DEEPER  
FOR THE MINERALS**

**1990, KOLAR AT 3.2 KM DEPTH  
ROCK TEMPERATURE WAS**

**76 C**

*2030*

*MINES WILL BE AT*

*5 TO 10 KM DEPTH*

*ROCK TEMPERATURE*

*125- 250 C*

*CHILLED AIR PUMPDED DOWN AT*  
*5 C*

*BUT HAS 100% HUMIDITY*

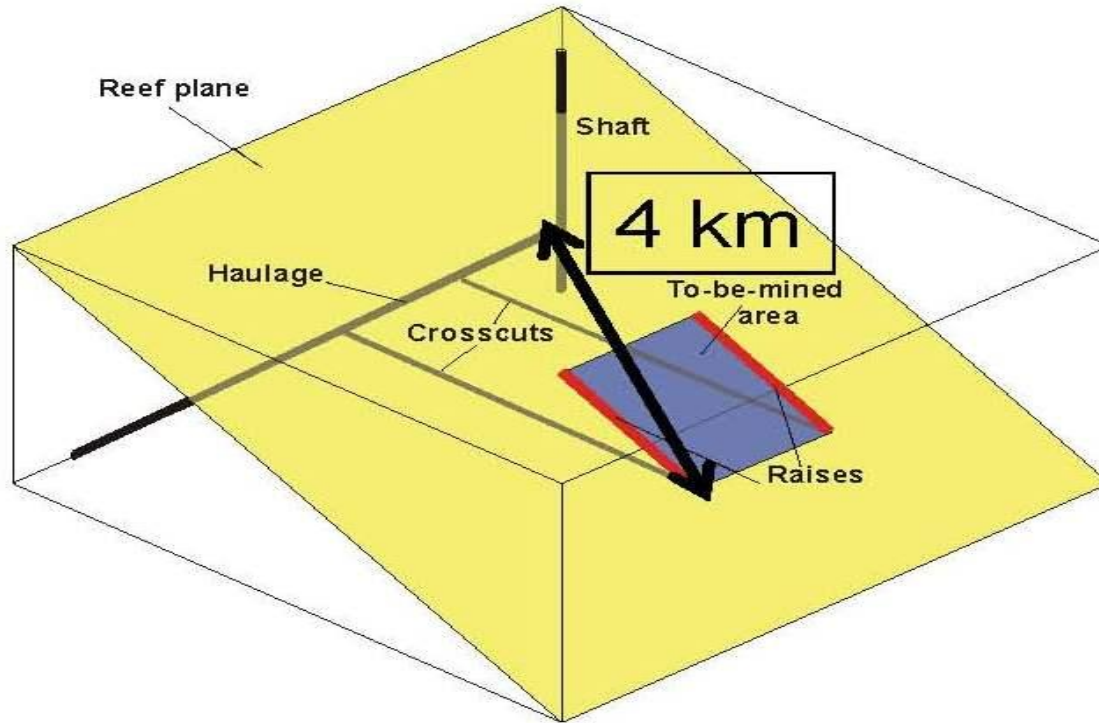
*PIPE IT DOWN TO 5 KM DEPTH*

*PROVISIONS OF FOOD, AIR,  
WATER WASTE DISPOSAL*

*HUMAN INFRASTRUCTURE  
WILL COST MORE  
60% OF THE MINING COST.*

*A 2.2 KM DEEP S. AFRICA  
GOLD MINE  
TRAVEL TIME ,  
BLAST CYCLE AND UNION REST IS  
32%*

# ***AT PRESENT 4 KM? WHAT ABOUT AT 8 KM?***



- Traveling time, 3 hours out of 8: 37.5% lost
- Vacate for blast, 8 hours: 33% lost
- 11 days out of 14: 21% lost

Total access to face: 33% of available time

*ROCK TEMPERATURE AROUND  
125-175 C*

*Conventional fuels, hydraulics, rubber  
tires, seal or any of the present material  
will not work*

*DESIGNS AND DEVELOPMENTS ARE  
REQUIRED GRAPHITE BASED DRY OR WET  
LUBRICANTS,*

*Heat shielded electric motors and well shielded  
processor and communication protocols*

*ROCKS BECOME MORE PLASTIC  
AND ROCK BURST MUCH MORE  
FREQUENT*

*CONVENTIONAL EXPLOSIVES  
WILL NOT WORK*

*ROAD HEADERS,  
CONTINUOUS MINES*

*WHO WILL WORK THEM???*

*CAN MAN SURVIVE  
IN THIS HOSTILE SETUP*

*BUT ROBOTS CAN*

*SO FUTURE*

*ENVIRONMENTALLY SAFE  
TELE-ROBOTIC*

# TELE-ROBOT VIEWER AND SURFACE CONTROLLER

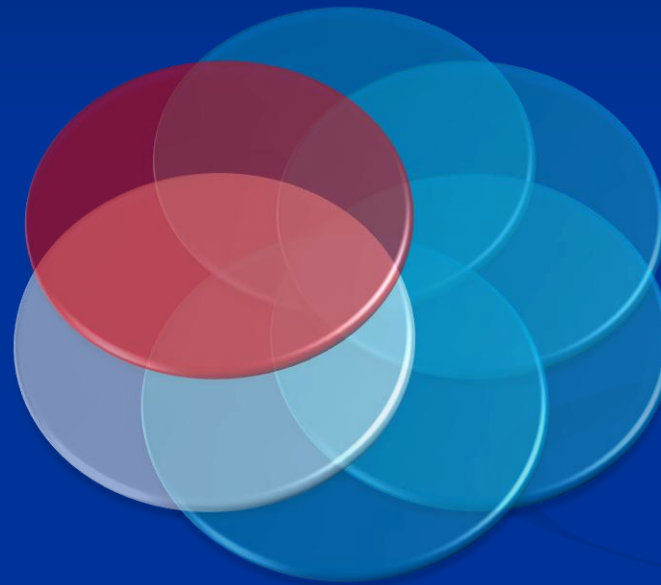


*SELF  
REPAIRING,  
MULTI  
TASKING*

*ROBOTS*

*INTERCHA  
NGABLE*

*ACID RAIN,  
EMI AND  
ABRASION  
PROCESSOR  
TERRA  
FLOPS AND  
TERRABYTES*



*MULTI  
TASKING  
APPENDAGE*

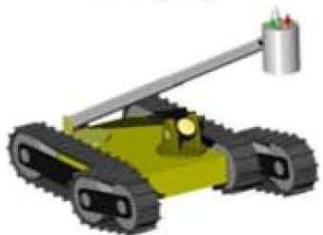
*CARBON  
COMPOSITE  
SKIN*



support



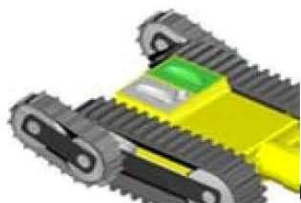
cleaning



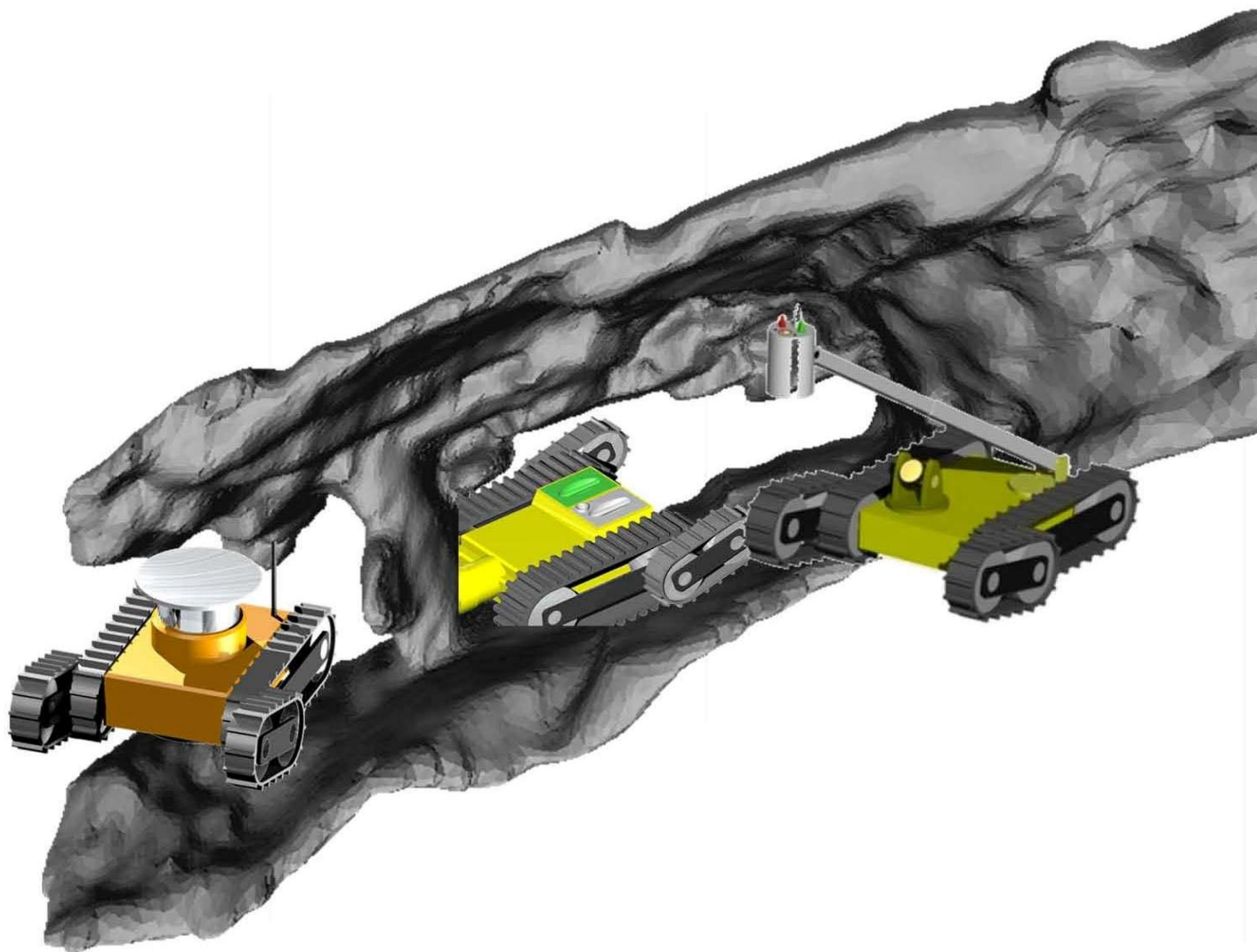
Stope Recon



recovery



miner



*UG PROCESSING OF ORES AND WASTE  
BACK FILLING*

|

*CONVENTIOAL*

*PYRO -METALLURGICAL PROCESS  
OR*

*BIOMINING DIRECTLY*

*CRUSHED OR CHEMICALLY TREATED  
ORES*

*NOT POSSIBLE*

*TRANSPORTATION ORE TO SURFACE  
MANDATORY*

*ORE PROCESSING*

*BACTERIAL LEACHING  
AT SUB-SURFACE*

*SUPER CRITICAL  
STEAM & CARBON DIOXIDE*

*AND A PART OF THE ENERGY*

*GEOTHERMAL DEVICES.*

# ***BACTERIAS***

## ***WHAT THEY LOOK LIKE***



# *SEM IMAGES OF TWO BACTERIAS*

*Mesophilic, Autotrophic Bioleaching Bacteria: Description, Physiology and Role* 231

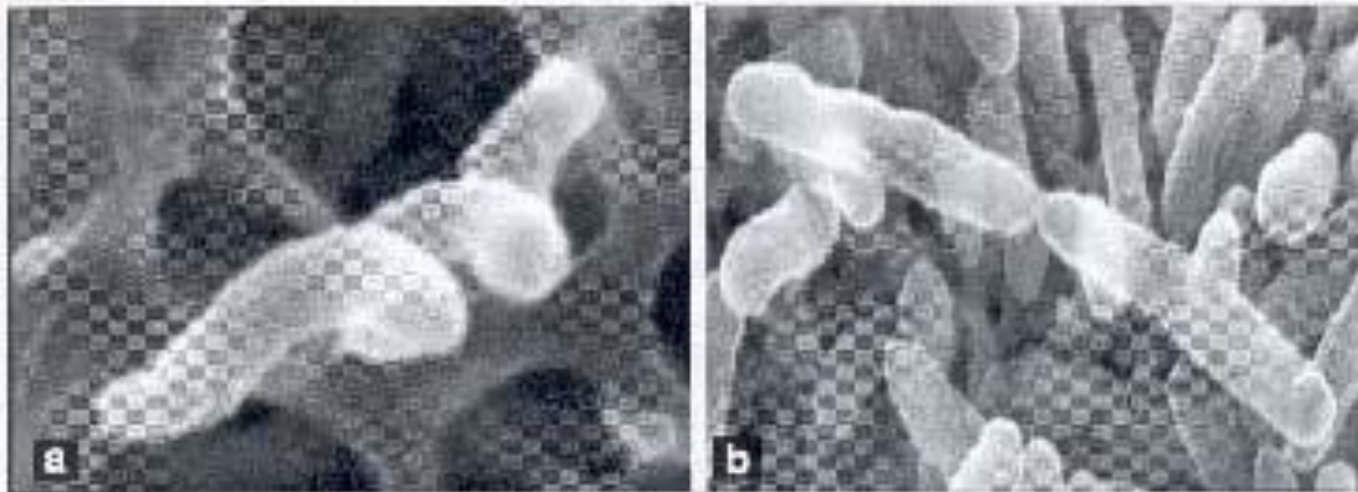
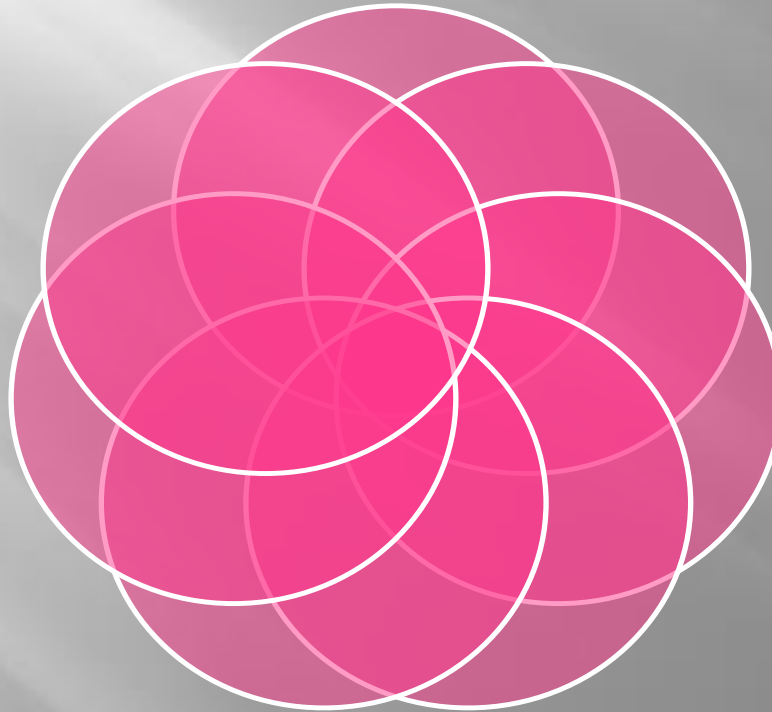


Fig. 11.1. A scanning electron microscope image of (a) *L. ferrooxidans* DSM2705 (magnification  $\approx 18,000\times$ ) and (b) *T. ferrooxidans* ATCC33020 (magnification  $\approx 15,000\times$ ).

***PRESENT  
SITUATION***

***ONLY THERE  
ARE THREE***

***LEPTOSIRILLUM  
FERROXIDAN***



***THOPBACILUS  
FERROOXIDANS***

***THIOBACILLUS  
THIOOXIDANS***

*MICROBIAL METABOLISM  
PRODUCE CITRIC ACID  
THAT LEACHES*

*TIME TAKEN  
WEEKS TO MONTHS*

*NOT POSSIBLE UG  
NO WATER*

*CUPRIAVIDUS METALLIDURARS*  
&  
*DELFTIA ACIDOVORANS*

*YES THEY RELEASE*

***GOLD***

*NOT ORE*

*BUT FROM*

*CHLORIDE SOLUTION*

*MORE THAN THE MARKET COST*

*( EVEN IN India )*

*FOR RECOVERY OF OTHER METALS*  
*THE FUNGI*

*ASPERGILLUS NIGER*  
*PENICILLIUM SIMPLICISSIMUM*

*CAN EXTRACT*  
*Cu Sn (65%) Al, Ni, Pb Zn*

*FROM E- WASTE,*  
*CAR CATALYTIC CONVERTERS*  
*AND*  
*MUNICIPAL WASTE FLY ASH.*

# *OTHER METALS*

*Mn , V, P, Cd*

*Ti , SILVER , TUNGSTEN*

*THE REE*

***NO BODY TOLD***

***FOR THE OTHER  
METALS***

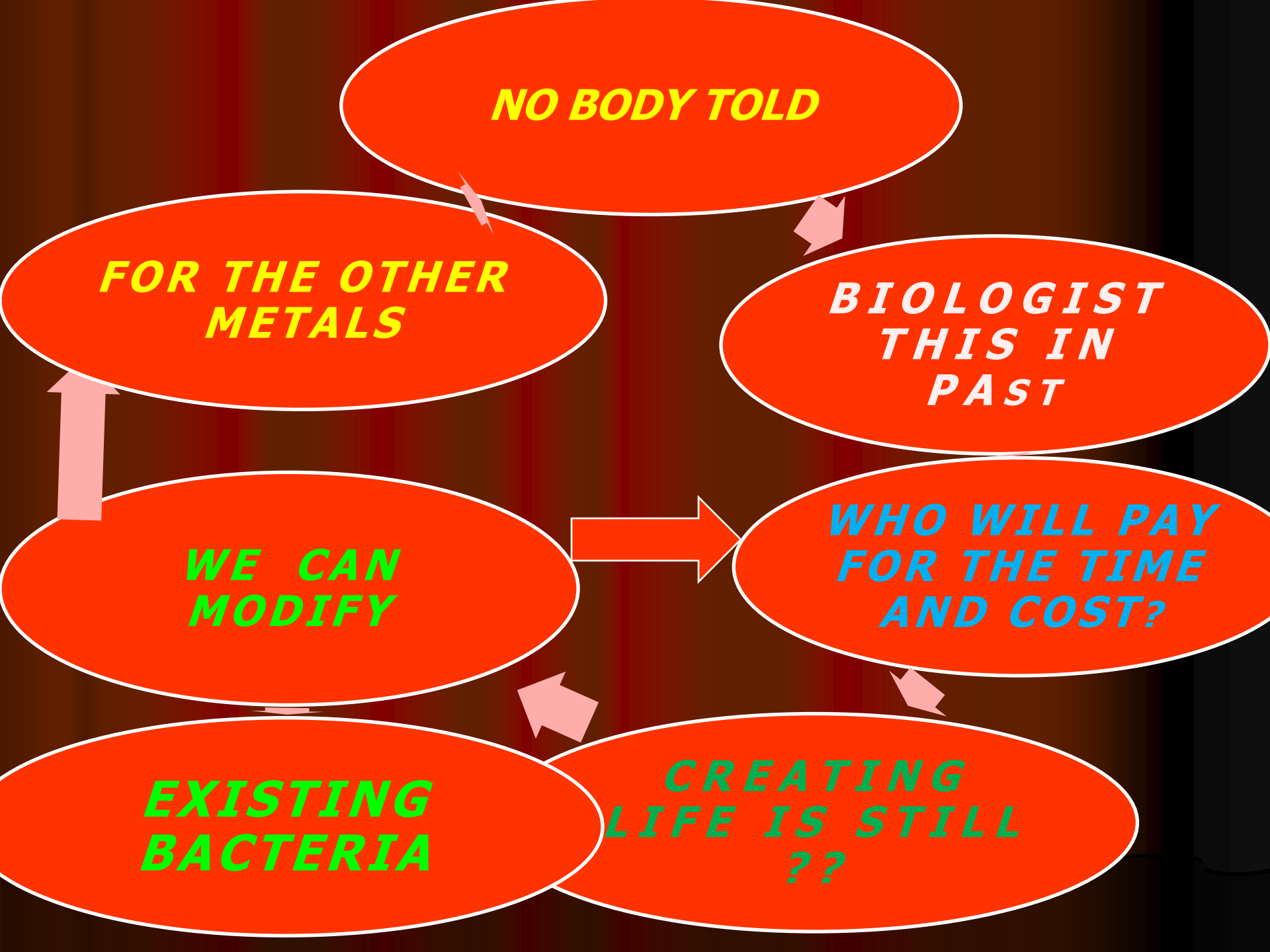
***BIOLOGIST  
THIS IN  
PAST***

***WE CAN  
MODIFY***

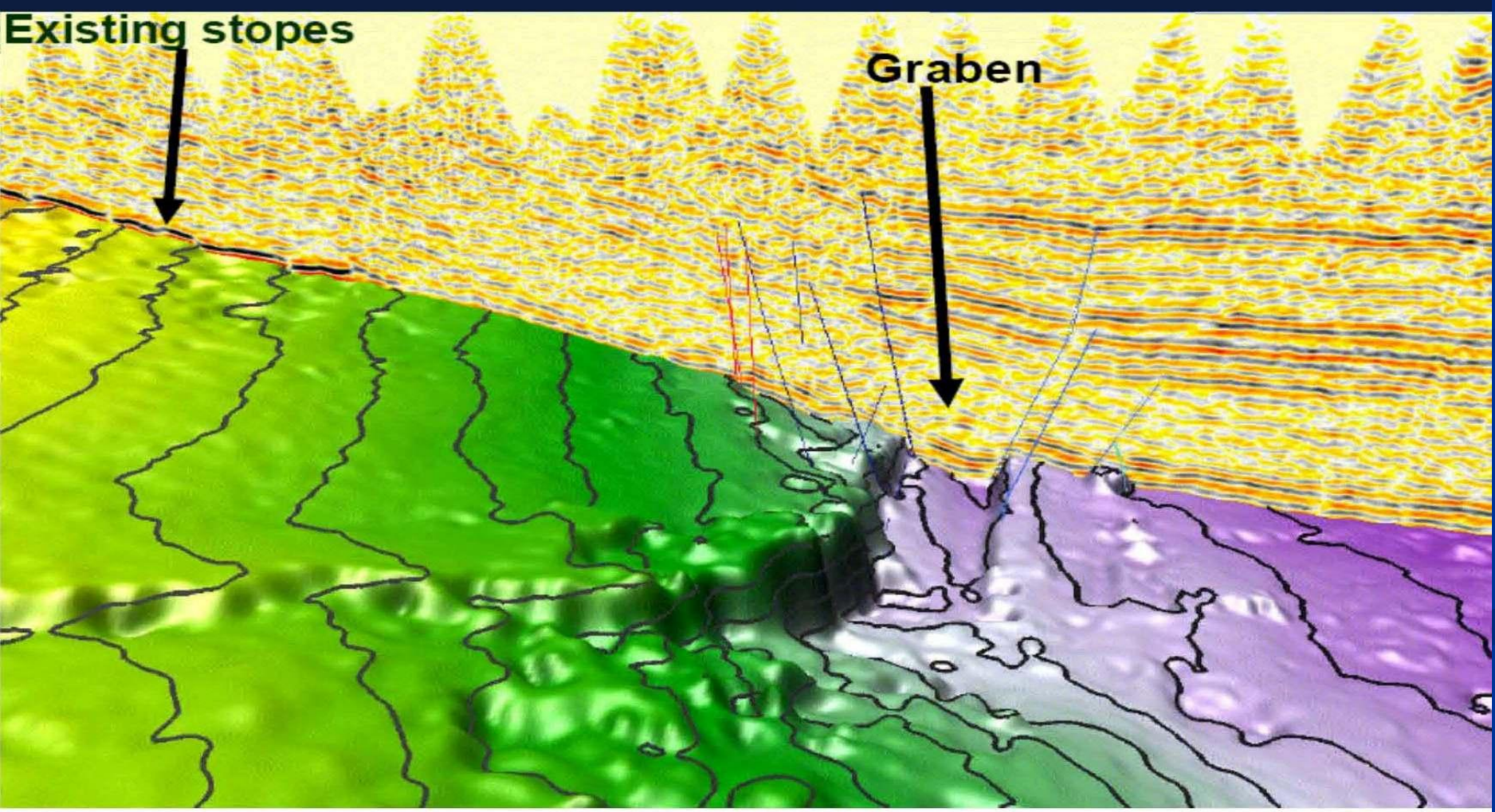
***WHO WILL PAY  
FOR THE TIME  
AND COST?***

***EXISTING  
BACTERIA***

***CREATING  
LIFE IS STILL  
??***



# COMBINED SECTION AND 4D VIEW OF ORE BODY FROM REAL TIME GEOPHYSICAL DATA



*REQUIRED  
INTERACTIVE DEPOSIT  
MODELLING*

*EXPLORATION DATA  
INTERPRETATION  
MINE PLANNING  
AND PRODUCTION CONTROL*

*S/W FOR THE ROBOTS*

*ALL ON REAL TIME BASIS*

*PICKMAN IS UNEDR DEVELOPMENT*

*UG COMMUNICATION*

*VERY HIGH SPEED AND  
ULTRA BROAD-BAND  
BI-DIRECTIONAL  
DATA NETWORK*

*INTERFACE PROTOCOL  
OPTICAL FIBRE , WI- FI  
LASER CONNECTION*

*PACKET COMMUNICATION  
TO WORK UNDER VERY HOSTILE  
ENVIRONMENT*

**THIS IS  
THE END  
OF  
THE  
STORY**

REMEMBERING

**STEVE**

POONAM

IRENE