Uranium Exploration - Nigeria and Canada

SPEAKER: GEORGE TSANG

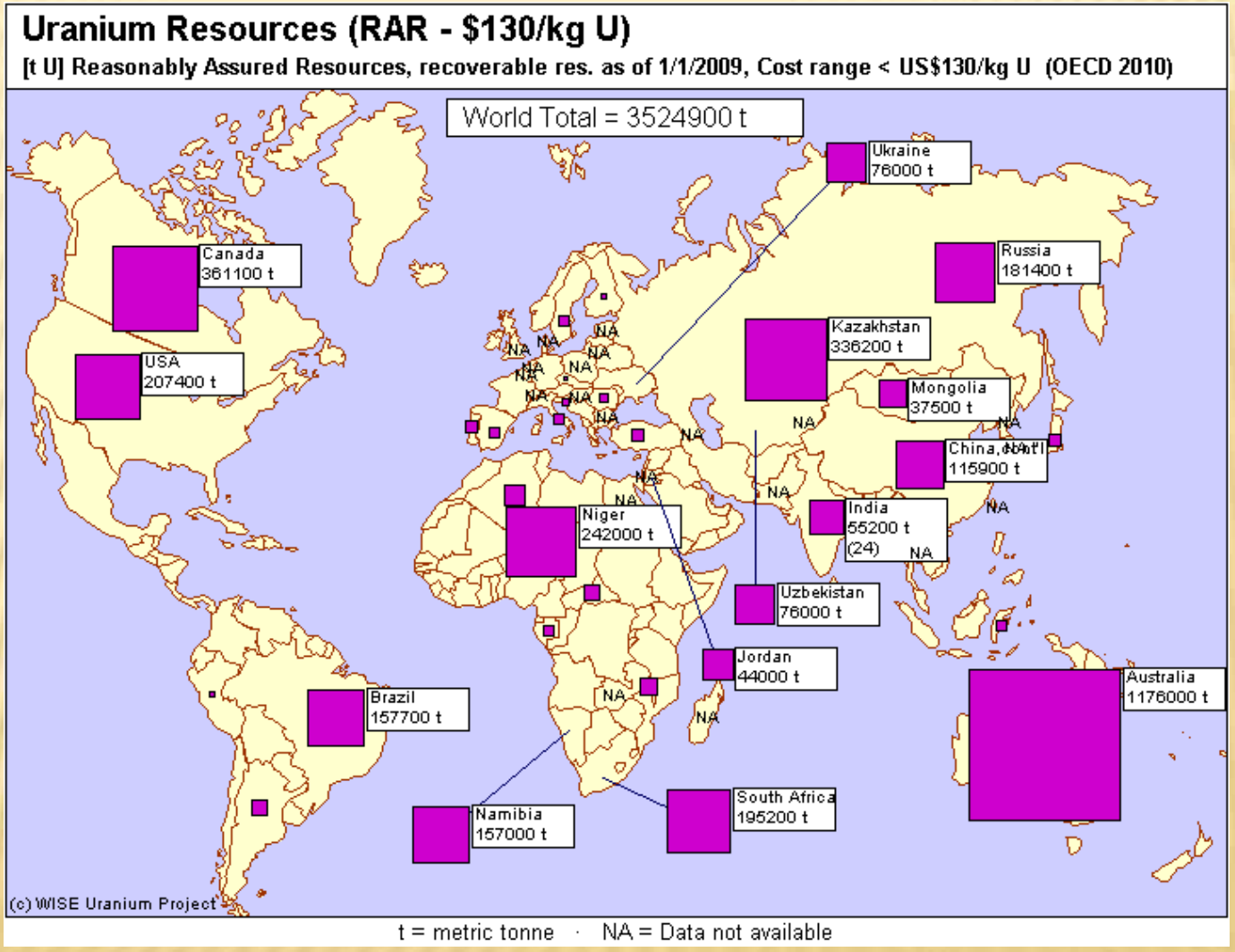
MA, MSC, CPG, M AUSIMM, CMA, PHD CANDIDATE

LOCATION: ROOM 702, JD MALL, 233 NATHAN ROAD, KOWLOON

DATE: 18, MARCH, 2016

TIME: 7:00 PM- 9:00 PM

URANIUM RESOURCES



TOP 10 COUNTRIES BY URANIUM RESERVE

MARCH 12, 2013 IN NATURE & GEOGRAPHY

- 10- China – 166,100 tonnes / 3% of world reserve
- 9- United States – 207,400 tonnes / 4% of world reserve
- 8- Namibia – 261,000 tonnes / 5% of world reserve
- 7- Brazil – 276,700 tonnes / 5% of world reserve
- 6- South Africa – 279,100 tonnes / 5% of world reserve
- 5-Niger – 421,000 tonnes / 8% of world reserve
- 4- Canada – 468,700 tonnes / 9% of world reserve
- 3- Russia – 487,200 tonnes / 9% of world reserve
- 2- Kazakhstan – 629,000 tonnes / 12% of world reserve
- 1- Australia – 1,661,000 tonnes / 31% of world reserve

THE 10 BIGGEST URANIUM MINES IN THE WORLD

MINING-TECHNOLOGY.COM; 4 NOVEMBER 2013

- More than half of the world's uranium production comes from just 10 mines.
- Canada, the second biggest uranium producer in the world, hosts the world's biggest - the McArthur River uranium mine;
- Olympic Dam mine- Australia, the second biggest;
- Ranger uranium mine- Australia, the world's third largest;
- Arlit- Niger; the fourth largest;
- Tortkuduk uranium mine-Kazakhstan, the fifth;
- Rossing uranium mine, Namibia, the sixth;
- Budenovskoye 2, Kazakhstan, the seventh;
- Kraznokamensk, Russia, the eighth;
- Langer Heinrich uranium mine, Namibia, the ninth;
- South Inkai – Kazakhstan, the tenth

TOP 10 URANIUM PRODUCING COUNTRIES 2014

- 1. Kazakhstan - Mine production: 23,127 tonnes
- Kazakhstan has been the world's leading producer of uranium since 2009, when it produced almost 28 percent of the global total.
- 2. Canada- Mine production: 9,134 tonnes
- 3. Australia- Mine production: 5,001 tonnes
- 4. Niger- Mine production: 4,057 tonnes
- 5. Namibia- Mine production: 3,255 tonnes
- 6. Russia- Mine production: 2,990 tonnes
- 7. Uzbekistan- Mine production: 2,400 tonnes
- 8. United States- Mine production: 1,919 tonnes
- 9. China- Mine production: 1,500 tonnes
- 10. Ukraine- Mine production: 926 tonnes

CONSUMPTION OF URANIUM FUEL OF CHINA

- China will construct 6~ 8 nuclear power plants per year starting 2016;
- The power capacity of 2020 is 3 times of 2014, China is expected to have at least 110 nuclear power plant in 2030 which is more than USA ;
- 50% U fuel is imported.

U RESERVE OF CHINA

- China was considered as the U- deficiency country, but it changes when Da Ying U- mine (大营铀矿） was found in 2012, it is upgraded to the largest U mine in China, and the 14th largest in the world, it is a world class U mine.

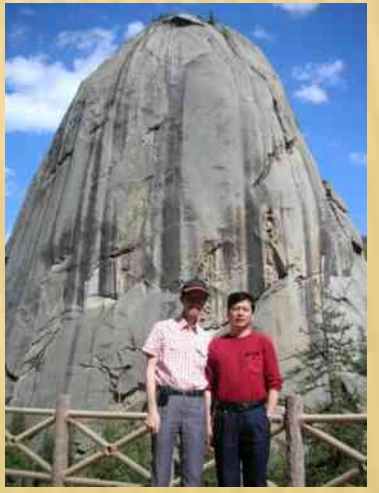
  Ordos basin- low grade U is always associated with coal.

WHERE IS THE U- DEPOSIT?







THE CHARACTERISTICS OF DEPOSITS

- Minerals exist in groups (成群出现);
- Focus in belts (成带集中)

Whenever you find an elephant in the forest, it should not be the only one !

THE FIRST GEOLOGICAL TEAM OF CHINA FOR URANIUM-NO. 309 TEAM JIN YIN ZHAI，HUNAN

URANIUM CAPITAL OF CHINA- XIANGSHAN

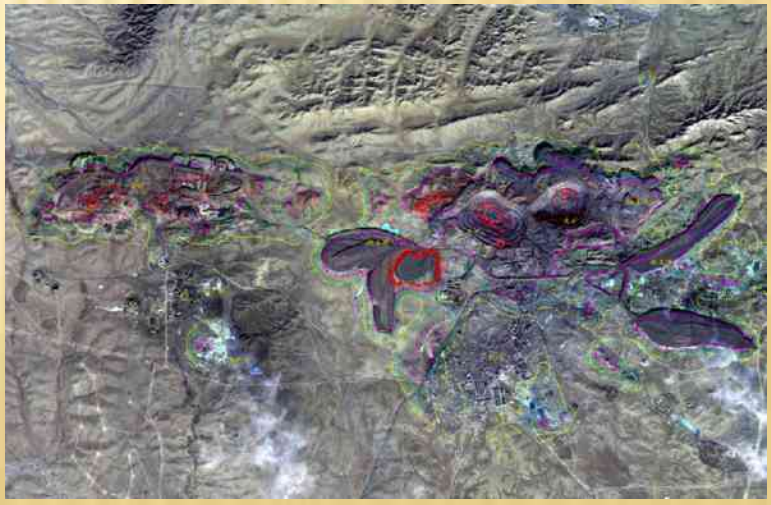
- It was discovered by Team 261(P.O. Box 78);
- The team has found 29 U mines in China。

SO, LET US FLY~~~~~~~

USE OF AIRBORNE GAMMA -RAY SPECTROMETRY FOR ENVIRONMENTAL ASSESSMENT OF THE MINE RICH IN RADIOACTIVE MINERALS, CHINA

WU Qifan∗1, FENG Youcai1,2, ZHAO Shunping1,3, LIU Guifang1,4, XIONG Shengqing5, TSANG Hin-yuen6

The airborne measuring system consisted of a spectrometer (NaI (Tl) detector and 256-channel analyzer (GR-820)) , radar altimeter and barometer, the GPS. Spectra were measured at a range of heights –1.8, 2.1, 2.4, 2.7 and 3.0 km above the water. Data were recorded for ten minutes accumulation time at each height.



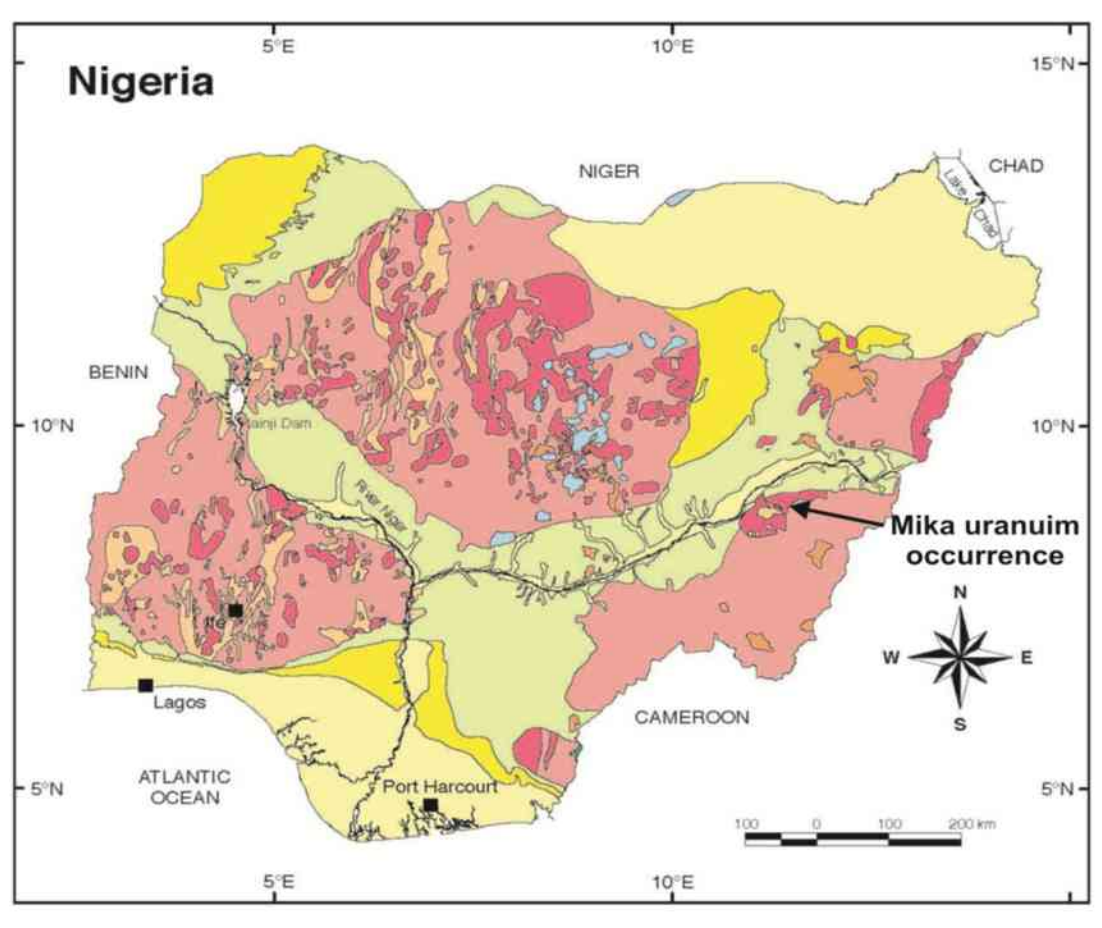
OTHER PROSPECTING METHODS

- Observation of outcrops
- Chemical analysis of samples
- Testing of radon
- Study of regional geology and environment
- Fungshui prospecting (By George Tsang)
- Including plant anomalous

NIGERIA


Niger
Chad
Niamey
Lake Chad
Niger R.
Sokoto
Kaura Namoda
Nguru
Hadejia
Kano
Damaturu
Maiduguri
Potiskum
Bama
Rijau
Zaria
Benin
Kontagora
Kaduna
Bauchi
Gombe
Wawa
Jos
Ouémé R.
Minna
Yankari Game Reserve
Benue R.
Kishi
Bida
Abuja
Yola
Bénoué R.
Nigeria
Ilorin
Beli
Makurdi
Lokoja
Ibadan
Abeokuta
Niger R.
Ondo
Ikeja
Porto-Novo
Lagos
Benin City
Enugu
Ikom
Warri
Owerri
Cameroon
Port Harcourt
Calabar
Sanaga R.
Niger Delta
Malabo
Yaoundé
Gulf of Guinea
Equatorial Guinea
0 200 km
0 150 mi
©1992 MAGELLAN Geographix℠ Santa Barbara, CA (800)929-4MAP

GEOLOGICAL MAP OF NIGERIA



CENOZOIC

	Alluvials, sands, gravels, clays, mangrove swamps, pebbles	Quaternary
	Sands, clays, shales, sandstones, lignites, grits	Neogene (- Paleogene)
	Volcanics (basalts, trachytes, rhyolites)	Cenozoic, undifferentiated

MESOZOIC

	Sands, clays, coals, shales, sandstones, mudstones, limestones, siltstones, ironstones, grits	Mostly Cretaceous
	Basic and intermediate intrusions	
	Granites, syenites, gabbros, rhyolites	Jurassic

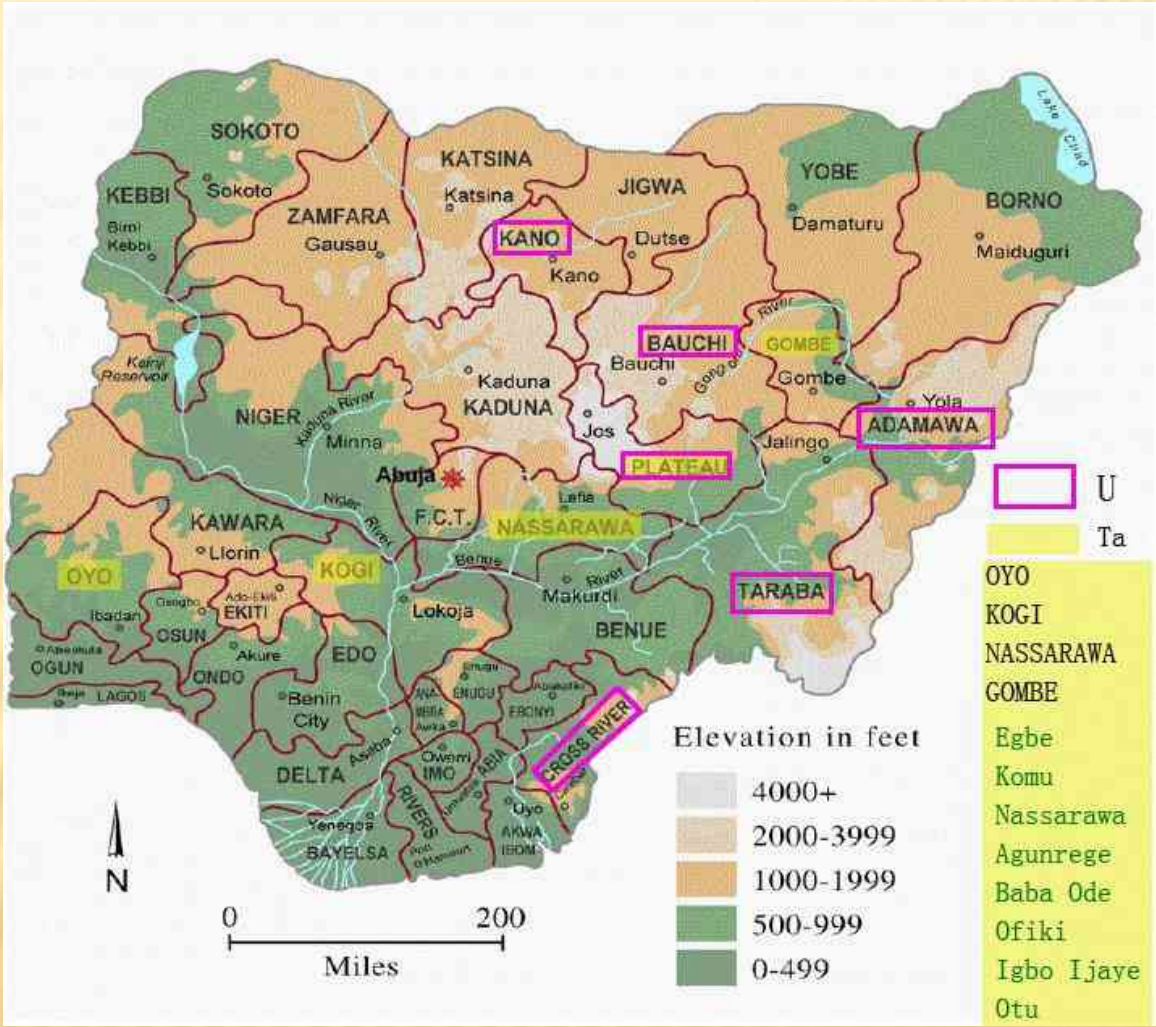
PALEOZOIC - PROTEROZOIC

	Metasediments, schists, quartzites	(Ordovician?) - Neoproterozoic
	Older granites, undifferentiated	
	Basement complex, undifferentiated	

NIGERIA URANIUM MINES

- Some Uranium occurrences have been located in Cross River, Bauchi, Adamawa, Taraba, Plateau and Kano States. Small bodies of granite containing Pyroclore which contains 3.3% Uranium oxide, 3.3% Thorium oxide and 41.1% Niobium and Tantalum oxides were found by the Atomic Energy Division of the Geological Survey of Great Britain in the Liruei Hills in Kano State and in the Kigo Hills near Dorowa on the Jos Plateau in 1947. Recent studies are indicating that Uranium deposits may occur at depths in those areas of occurrences, particularly in Taraba State.

MAP SHOWING OCCURRENCE OF TA & U



NIGERIA URANIUM EXPLORATION TEAM

PROJECT AREA

THE SITE

WORKING

TRIBAL CHIEF

U-TA-NB MINE

ZR WAREHOUSE

THORIUM 232

- China has the second biggest resource of thorium, next to India.
- Thorium can be converted to U233 which is a fuel and weapon;
- 77% of thorium oxide in China is found in Baiyun Obo (2009);
- Advantages of using thorium over uranium- less radioactive pollution (50%), higher energy, more resource.

MAIN PIT OF URANIUM DEPOSIT

URANIUM MINERALS

Primary uranium minerals	
Name	**Chemical Formula**
uraninite or pitchblende	UO_2
coffinite	$U(SiO_4)_{1-x}(OH)_{4x}$
brannerite	UTi_2O_6
davidite	$(REE)(Y,U)(Ti,Fe^{3+})_{20}O_{38}$
thucholite	Uranium-bearing pyrobitumen

Secondary uranium minerals	
Name	**Chemical Formula**
autunite	$Ca(UO_2)_2(PO_4)_2$ x 8-12 H_2O
carnotite	$K_2(UO_2)_2(VO_4)_2$ x 1–3 H_2O
gummite	gum like amorphous mixture of various uranium minerals
saleeite	$Mg(UO_2)_2(PO_4)_2$ x 10 H_2O
torbernite	$Cu(UO_2)_2(PO_4)_2$ x 12 H_2O
tyuyamunite	$Ca(UO_2)_2(VO_4)_2$ x 5-8 H_2O
uranocircite	$Ba(UO_2)_2(PO_4)_2$ x 8-10 H_2O
uranophane	$Ca(UO_2)_2(HSiO_4)_2$ x 5 H_2O
zeunerite	$Cu(UO_2)_2(AsO_4)_2$ x 8-10 H_2O

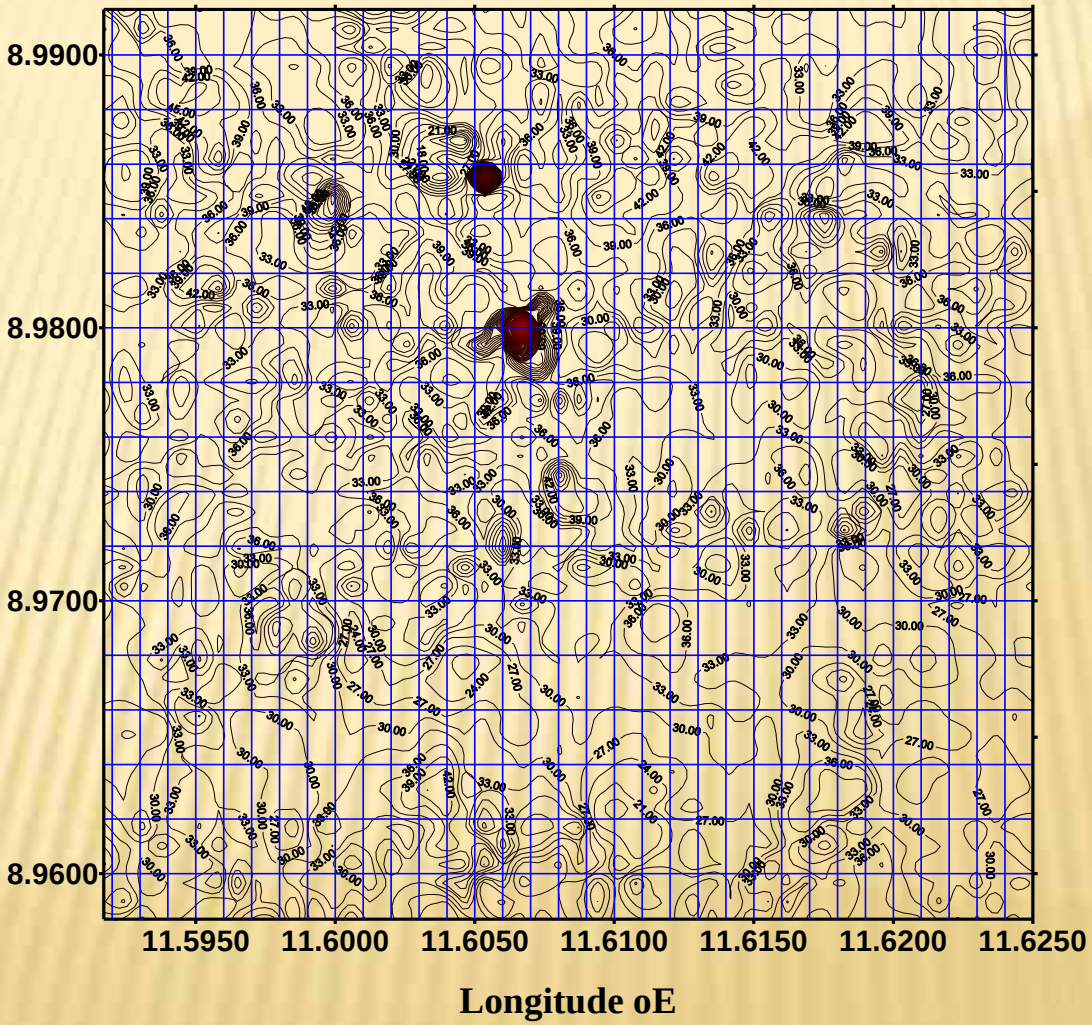
URANIUM ORES- MAINLY URANINITE/ PITCHBLENDE

AUTUNITE ON FRACTURE WALL

AFFECTION OF U ORE TO HUMAN

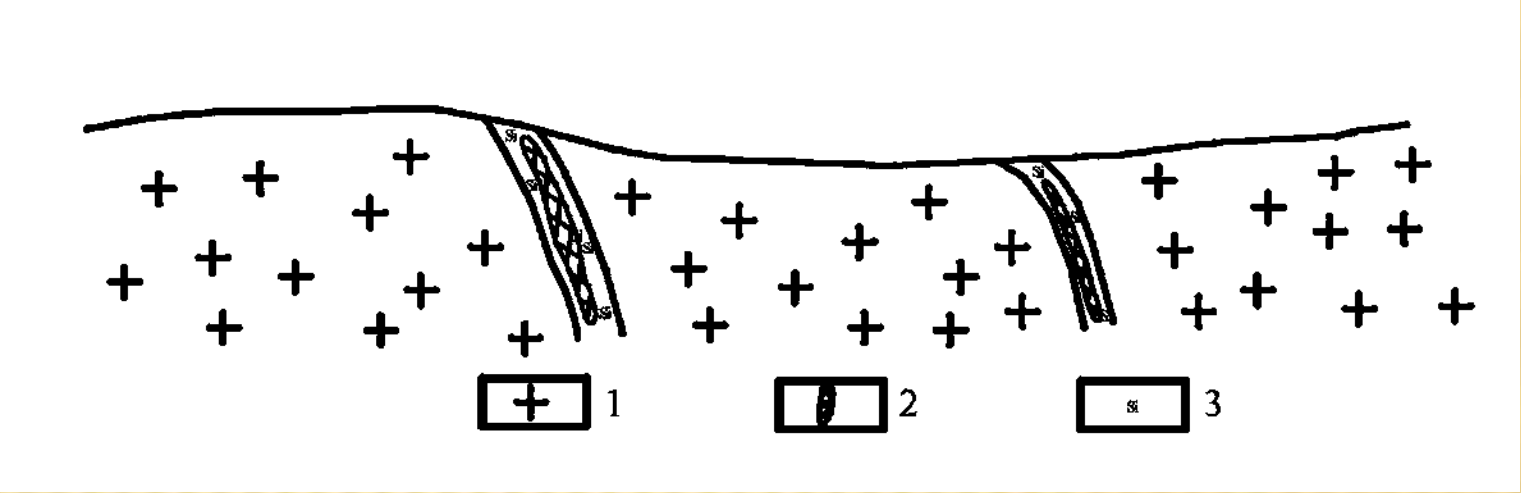
铀同位素	丰度	半衰期	衰变类型	衰变能
U-233	人造	1.592×10^5 年	α	4.908MeV
U-234	0.0054%	2.455×10^5 年	α	4.858MeV
U-235	0.7204%	7.04×10^8 年	α	4.679MeV
U-236	人造	2.342×10^7 年	α	4.573MeV
U-237	人造	6.75 天	β^-	0.519MeV
U-238	99.2742%	4.468×10^9 年	α	4.270MeV
U-239	人造	23.45 分钟	β^-	1.262MeV

RADIOMETRIC MAP



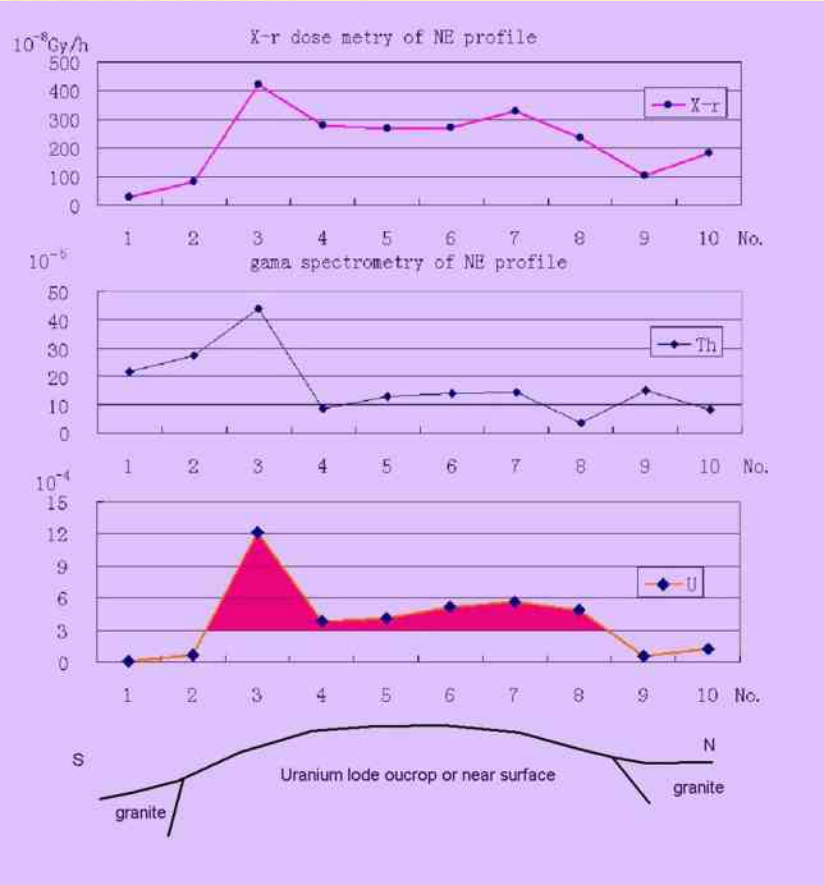
SITE OBSERVATION

Two veins are found in the site which is located in a W-E direction hill, the height of the hill is about 15～20m, plantation is stripped, length of W- E is 150 meters, N- S is 20～30m, the country rock is composed of felsic granite with fractured rock body.



sketch map of geology around uranium veins
1—granite,2—uranium vein,3—silicified vein

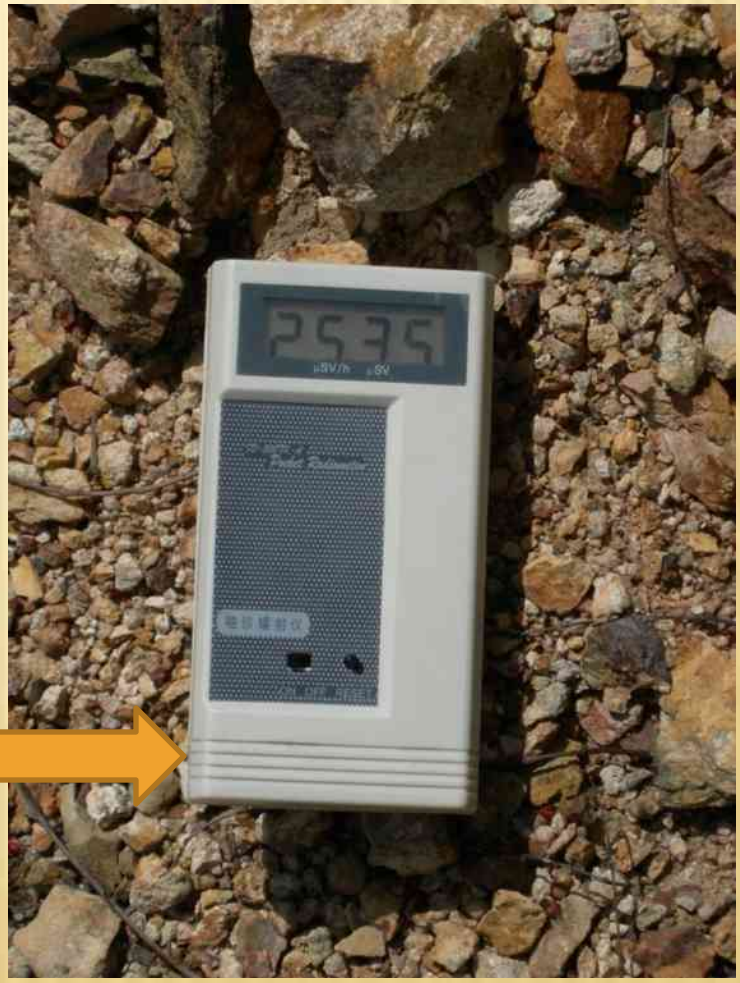
RADIOACTIVE SURVEY



SE-N profiles for radioactive survey

W-E profiles for radioactive survey

CHECKING OUTCROP WITH DOSIMETER



Can we use this to conduct the U exploration ?

SILICIFIED RADIOACTIVE VEIN

GEOLOGICAL ACTIVITIES IN THE AREA

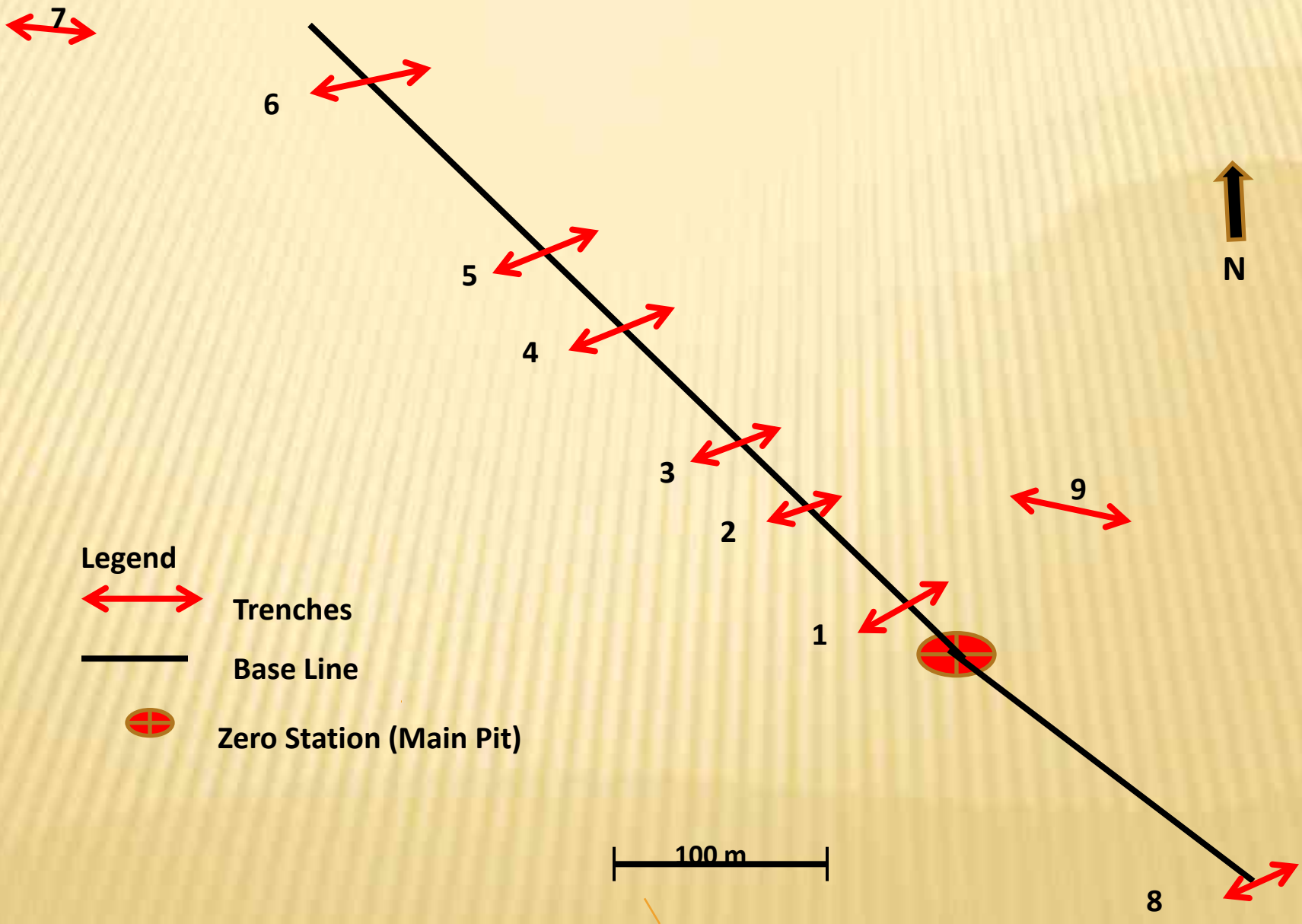
Exposure of granite with vein that is showing displacement

The granite (right of pen) and micro-granite (under and to left of pen) contact

THE EXCAVATION PITS

TRENCHES

WASTE DUMPS


7
6
5
4
3
2
1
9
8
N
Legend
Trenches
Base Line
Zero Station (Main Pit)
100 m

DATA COLLECTED FROM THE SITE

Y	X	X-r	U(ppm*100)	Th(ppm*100)	K(%*100)
8.98000000	11.60638889	107.75	20073	1160	494
8.98027778	11.60666667	91.65	12417	2030	360
8.98027778	11.60666667	34.75	1894	2438	402
8.98055556	11.60666667	31.75	1697	2417	475
8.98000000	11.60694444	331.35	38114	2835	725
8.98000000	11.60722222	119.35	14373	1808	530
8.98000000	11.60722222	82	3696	2687	637
8.98000000	11.60750000	33.6	1380	3422	534

ASSAY REPORT

测试结果汇总																
序号	检测单位统一编号	送样单位样品编号	测试结果(μg/g)													
			Li	Be	Sc	V	Cr	Co	Ni	Cu	Zn	Ga	As	Se	Rb	Sr	Y
1	15287	1	11.0	7.58	5.07	20.9	4.76	1.82	5.12	11.8	300	15.8	5.37	0.265	123	146	13.8
2	15288	2	9.86	1.90	3.50	16.3	4.80	0.986	2.22	7.47	32.2	21.0	7.08	0.193	175	152	14.4
3	15289	3	9.24	1.56	3.08	17.0	3.53	0.816	0.015	7.08	28.2	21.5	2.23	0.214	217	176	12.1
4	15290	4	336	8.85	366	29.9	33.1	1.31	3.09	9.65	264	32.3	23.4	48.7	351	29.5	3154
			Zr	Nb	Mo	Cd	In	Sn	Sb	Cs	Ba	La	Ce	Pr	Nd	Sm	Eu
1	15287	1	560	13.7	21.8	0.344	0.036	3.87	0.932	2.26	1193	42.0	76.7	8.49	29.0	5.45	0.886
2	15288	2	611	25.1	8.71	0.178	0.042	5.66	0.486	1.97	1197	43.8	74.8	8.86	31.8	5.89	1.18
3	15289	3	578	21.2	30.5	0.143	0.036	4.62	0.235	3.31	1277	40.0	67.1	7.01	23.1	3.96	0.767
4	15290	4	251046	6751	16.0	21.2	6.99	470	1.68	5.78	161	134	430	76.9	199	79.3	2.78
			Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Re	Tl	Pb	Bi
1	15287	1	4.07	0.622	3.64	0.688	2.11	0.386	3.30	0.475	14.1	0.789	2.02	0.001	0.900	146	0.502
2	15288	2	4.69	0.591	3.32	0.654	2.28	0.539	5.61	0.935	28.0	1.99	1.22	0.002	0.996	46.6	0.165
3	15289	3	2.97	0.403	2.42	0.524	2.12	0.578	6.25	1.06	29.9	1.93	1.20	0.002	1.19	42.5	0.166
4	15290	4	77.5	42.0	482	144	897	302	3498	567	13734	716	60.8	0.461	4.57	888	41.8
			Th	U													
1	15287	1	37.0	2712													
2	15288	2	43.9	178													
3	15289	3	42.7	343													
4	15290	4	22484	3056													
意见与解释			As、Se、Sn、Ge仅供参考														

SHORT CONCLUSION

①U content in the surface is 0.03%--0.12%；

②Uranite is found along the two veins, the distance between the two veins is about 50m, it is expected the veins would combine together in the deeper level as the spectrometers shown, it indicates the prospect is optimistic;

③The grade of mineral is high which means economic;

④Water is sufficient in the surrounding which provides a good condition for beneficiation.

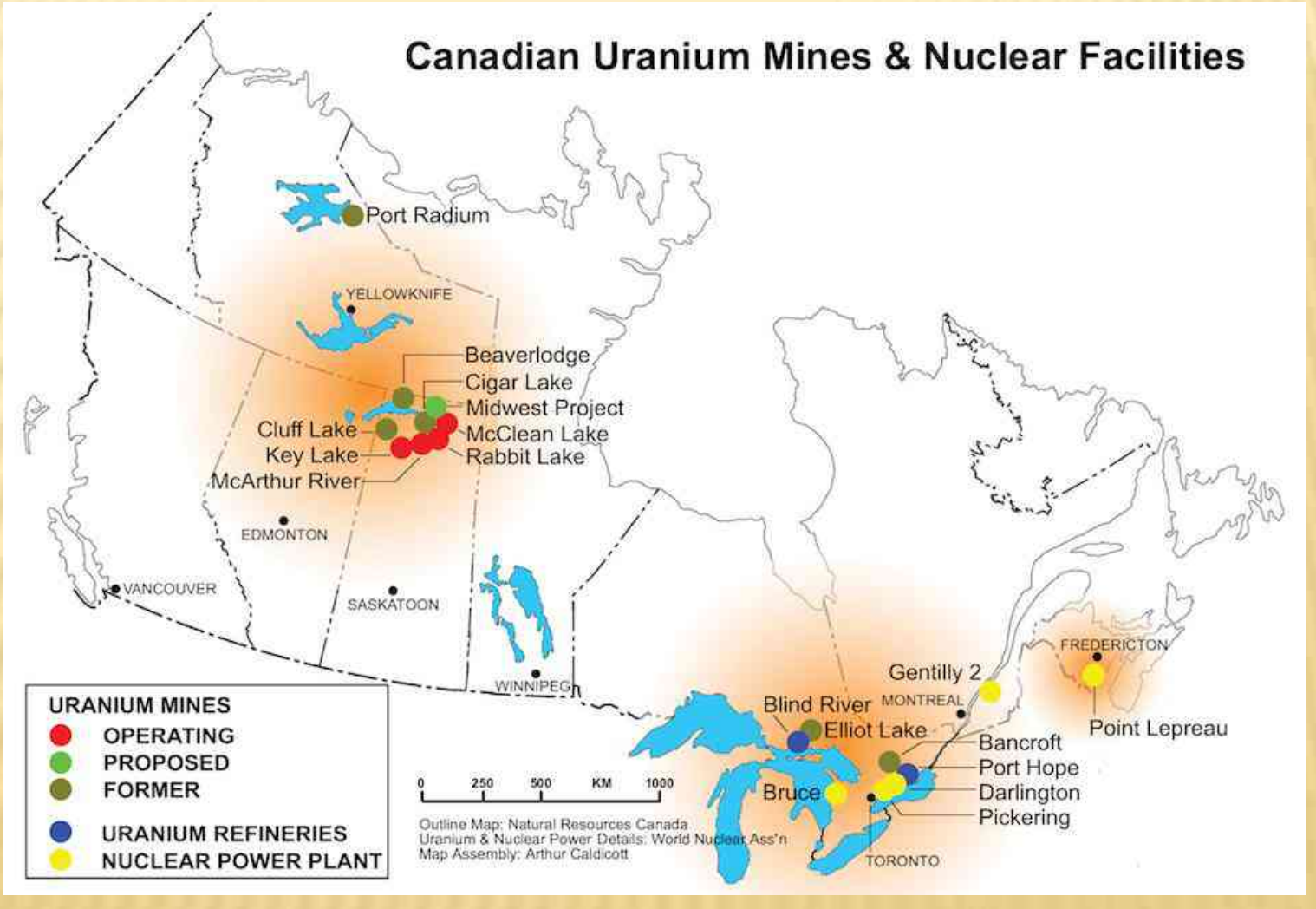
AZELIK, A U MINE OWNED BY CHINESE IN NIGER

- The first overseas U-mine invested by Chinese.
- Azelik is operated by a joint partnership called Somina, with ownership split between the China National Nuclear Corporation (CNNC), which owns 37%, the Niger government, which owns 33%, and a second Chinese investor. A Korean investor holds a 5% stake as well.
- The Chinese proposed to invest USD300 million according to the report of Reuters , but it is said the mine has not produced any U metal up to 2015.

LOCATION OF THE U MINES IN NIGER

WELCOME TO CANADA

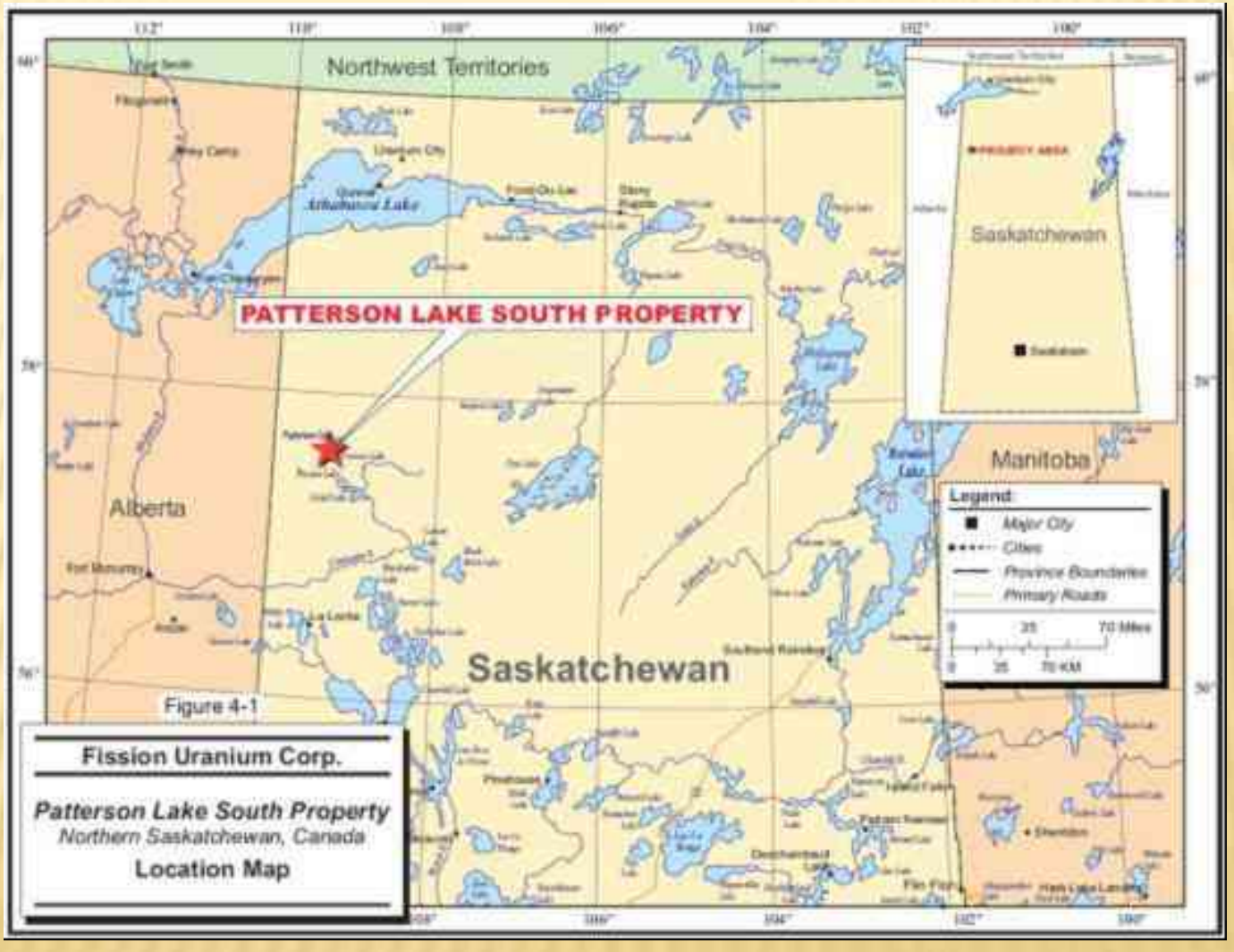
CANADIAN URANIUM MINES



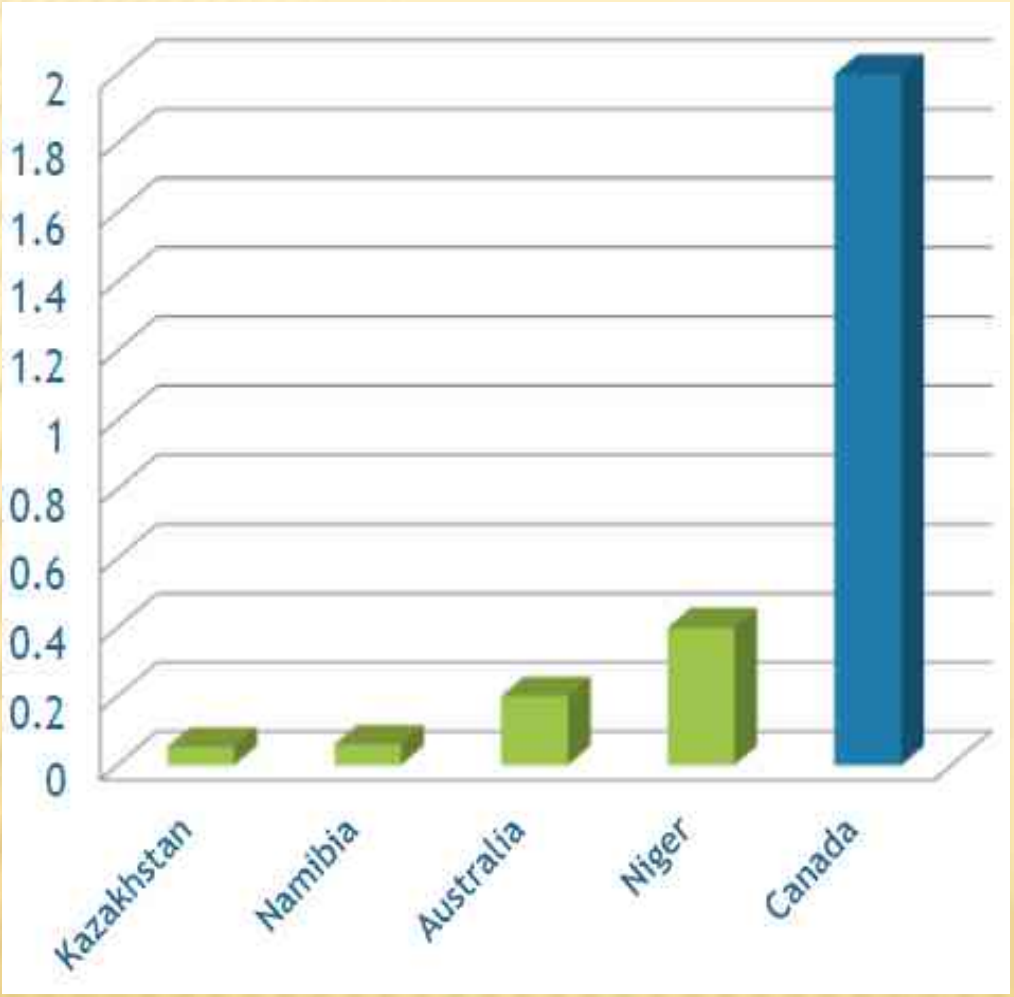
DISCLAIMER

- The speaker has signed a confidential disclosure agreement with the client, some of the content of Canada exploration are deleted, however, the readers can get the complete information from the public document of Hong Kong Stock Exchange News and google search:
- http://www.hkexnews.hk/listedco/listconews/SEHK/2016/0307/LTN20160307433.pdf

LOCATION OF THE CANADIAN SITE



THE HIGHEST GRADE OF URANIUM DEPOSIT



100m Composite Mineralization Includes
38.49% U3O8 Over 10.5m.

STOPOVER- VANCOUVER, KELOWNA, CALGARY

DEPART FOR THE URANIUM SITE

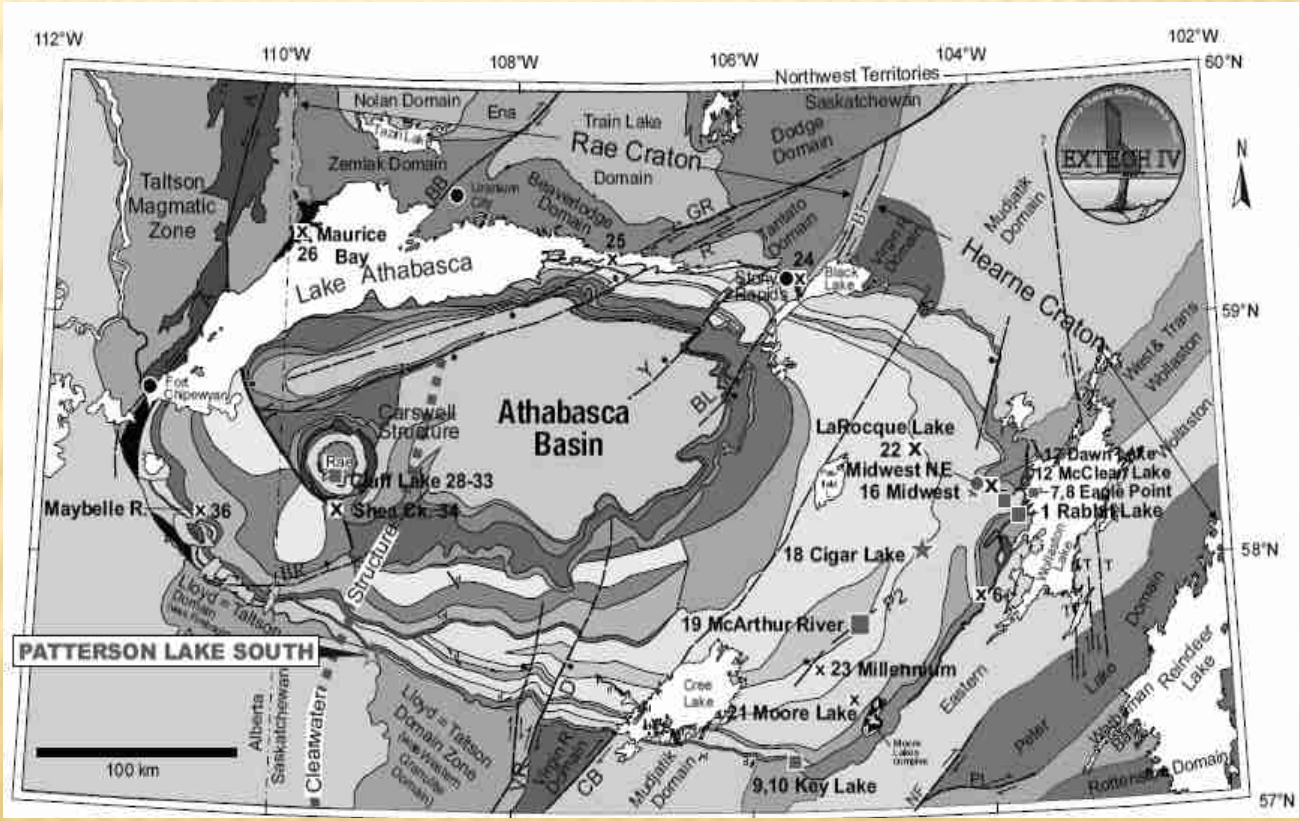
THE BEAUTIFUL LAKES

HIGH DOSE OF THE CORE

SITE OF THE U- VEINS

REGIONAL GEOLOGY- ATHABASCA BASIN

- It is the most significant uranium metallogenic district in Canada, it covers an area of greater than 85000 sq.meters in Northern Saskatchewan and north-eastern Alberta. Age- 1760 ~ 1500 Ma.



ATHABASCA BASIN

- The highest grade uranium deposits are found in the Athabasca Basin in Canada, including the two largest high grade uranium deposits in the world, Cigar Lake with 217 million pounds (99,000 t) U_3O_8 at an average grade of 18% and McArthur River with 324 million pounds (147,000 t) U_3O_8 at an average grade of 17%. Additionally, another high grade discovery is in the development stage at Patterson Lake (Triple R deposit).

YELLOW CAKE- PRODUCT OF THE MINING CO.

Modern yellowcake typically contains 70% to 90% triuranium octoxide (U_3O_8) by weight. Other oxides such as uranium dioxide (UO_2) and uranium trioxide (UO_3) exist.

THANK YOU !