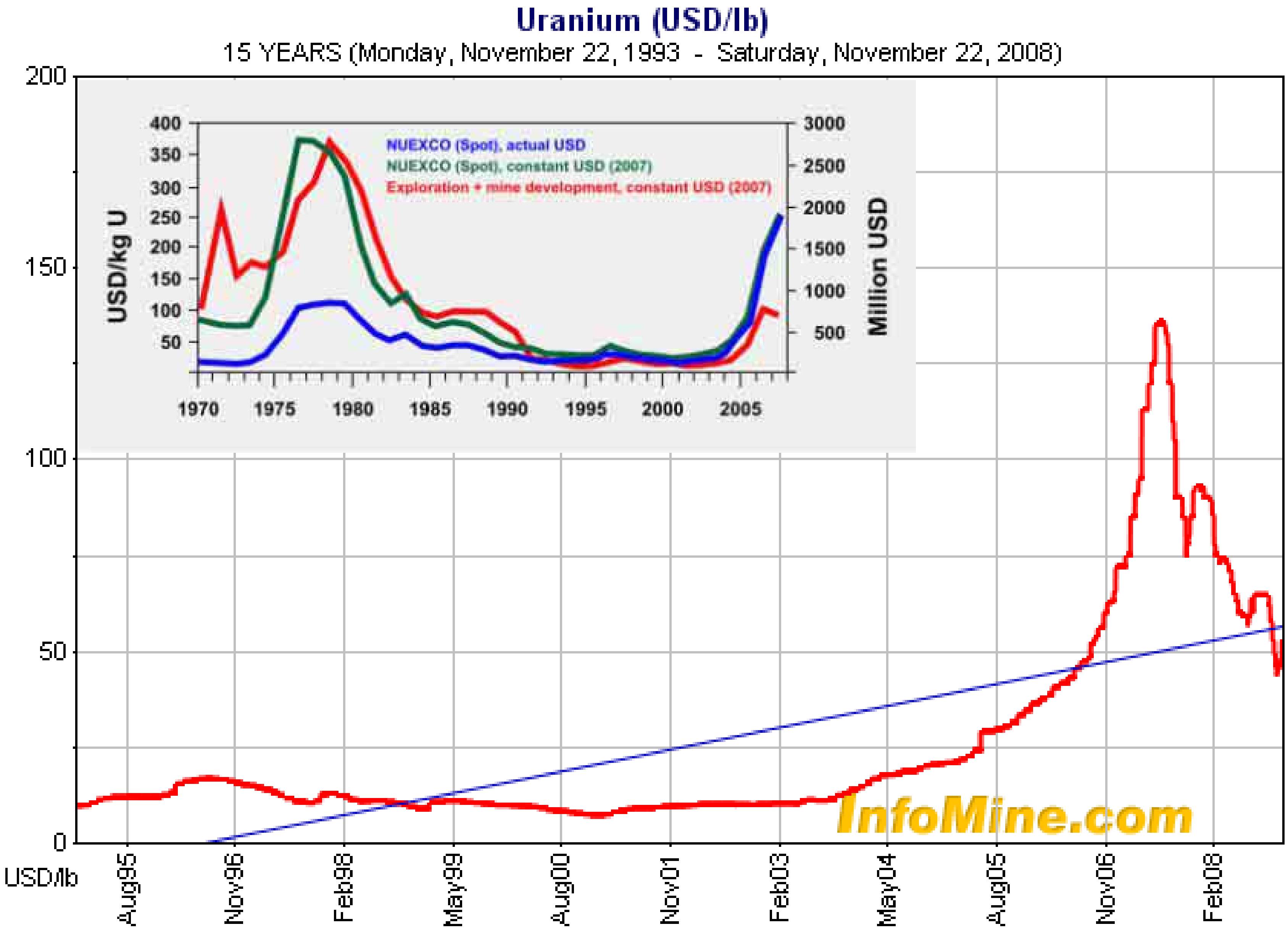
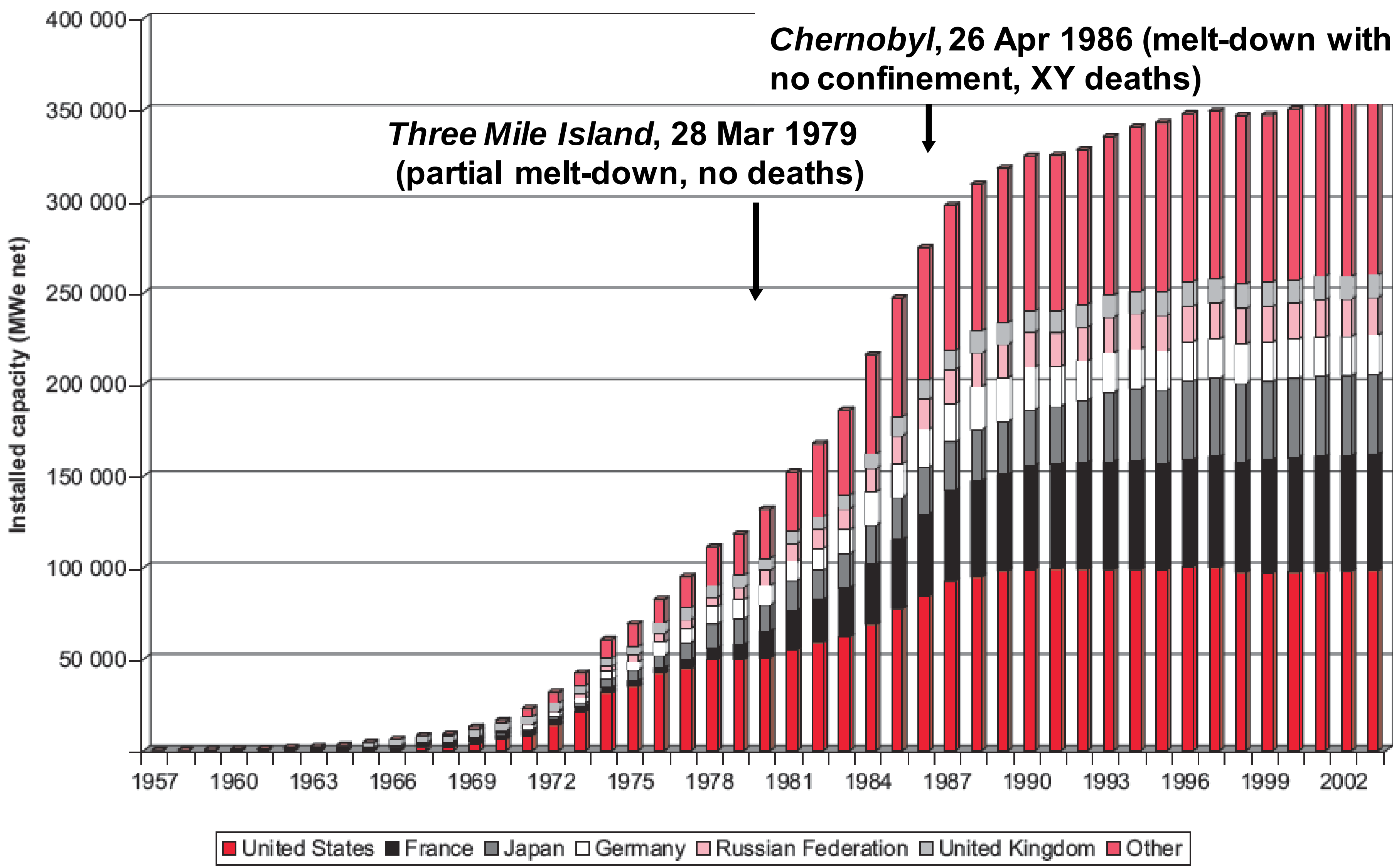
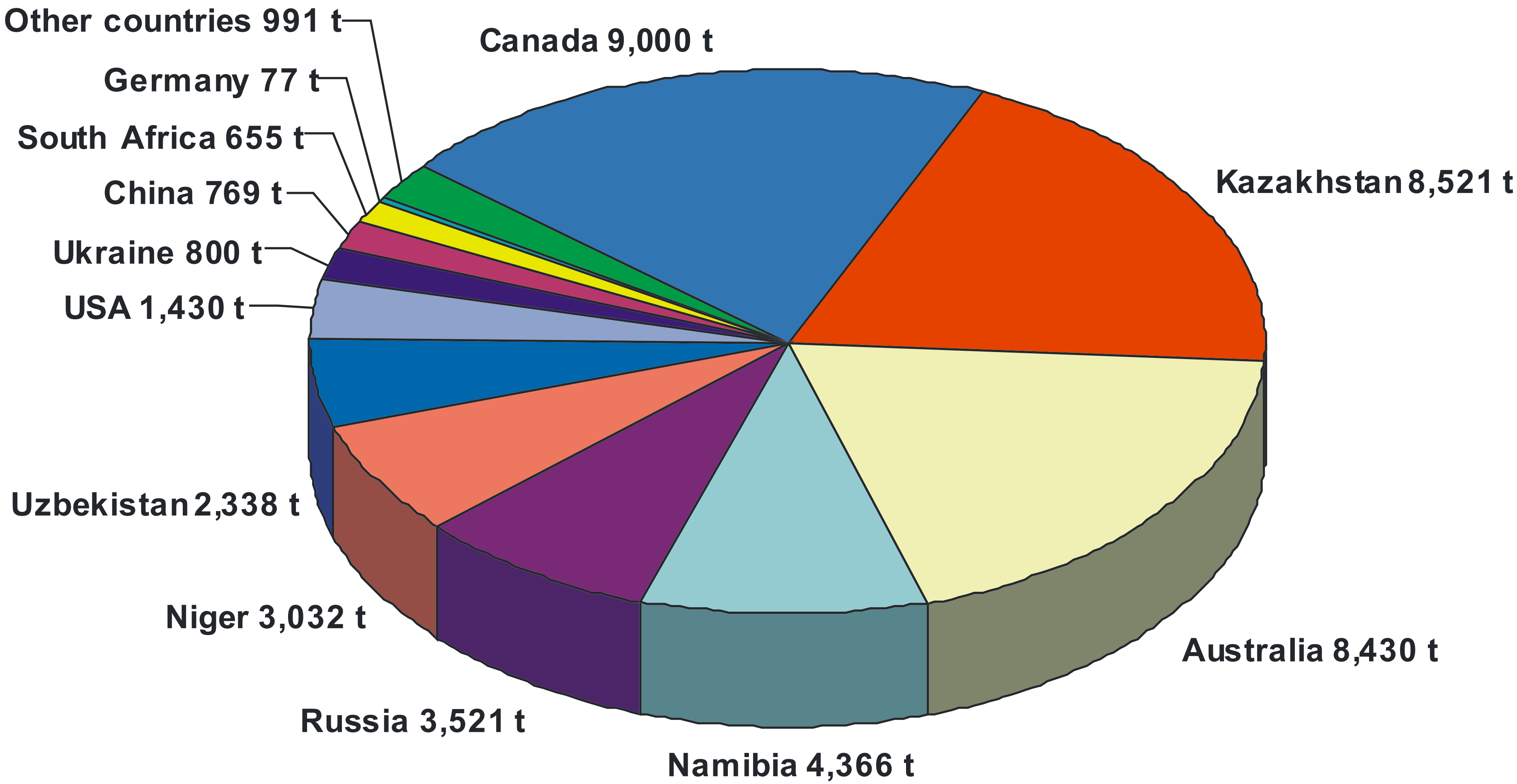


Uranium (USD/lb)
15 YEARS (Monday, November 22, 1993 - Saturday, November 22, 2008)
200
150
100
50
0
USD/lb
Aug95
Nov96
Feb98
May99
Aug00
Nov01
Feb03
May04
Aug05
Nov06
Feb08
InfoMine.com
USD/kg U
400
350
300
250
200
150
100
50
1970
1975
1980
1985
1990
1995
2000
2005
3000
2500
2000
1500
1000
500
Million USD
NUEXCO (Spot), actual USD
NUEXCO (Spot), constant USD (2007)
Exploration + mine development, constant USD (2007)

Figure 2.2. Nuclear generating capacities (1957-2003)



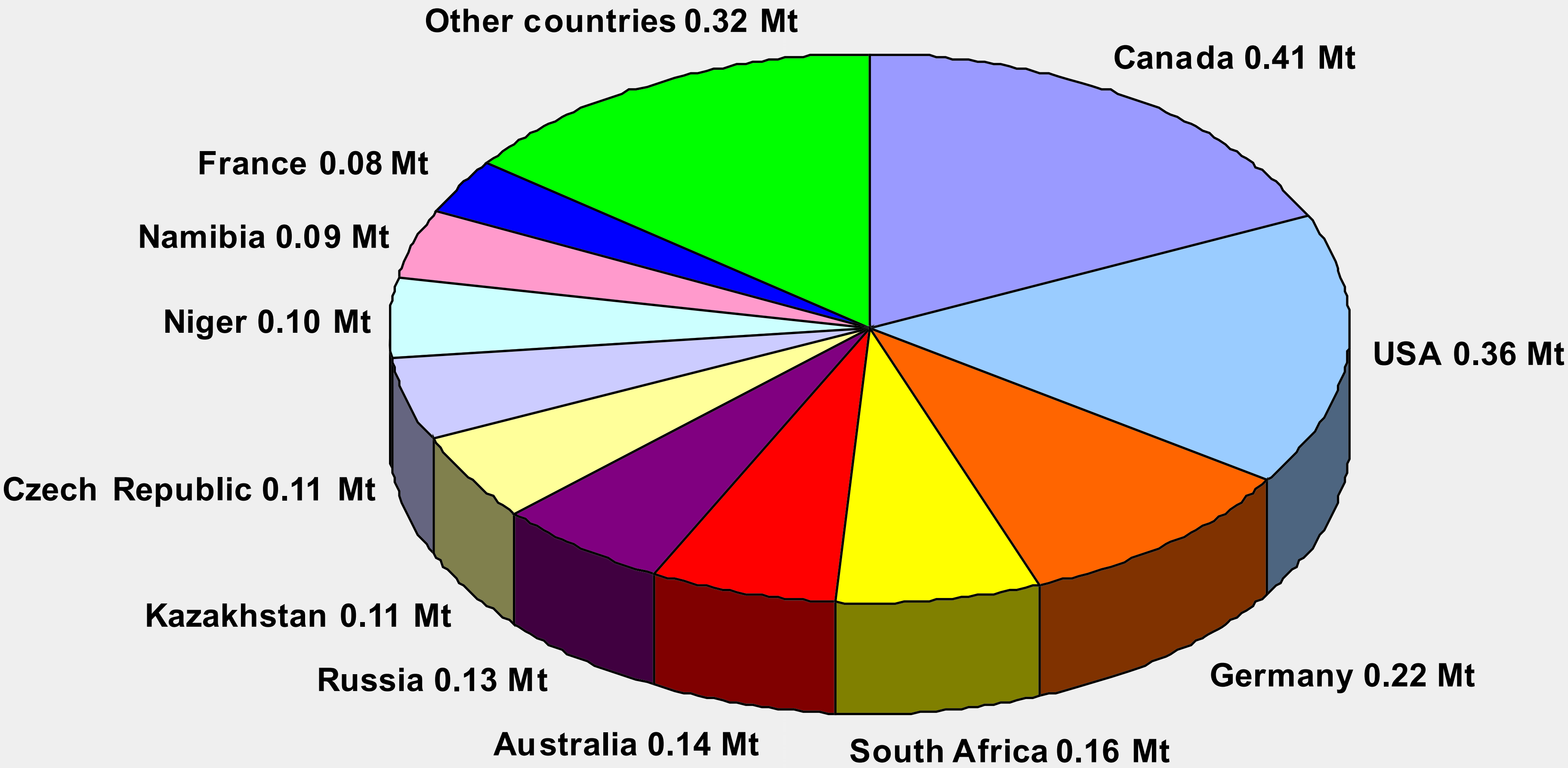
URANIUM WORLD MINE PRODUCTION 2008 (43,930 t)*



Import Germany: 3,800 t/a

*** equivalent to about 5 billion USD in July 09**

HISTORICAL URANIUM PRODUCTION UP TO 2006 (2.2 Mt)



Identified uranium resources by deposit type (2005)

Geological type of deposit	Reasonably Assured Resources						Inferred Resources*					
	<USD 40/kgU		<USD 80/kgU		<USD 130/kgU		<USD 40/kgU		<USD 80/kgU		<USD 130/kgU	
	10^3 tU	%	10^3 tU	%	10^3 tU	%	10^3 tU	%	10^3 tU	%	10^3 tU	%
Unconformity-related	433.2	22.2	492.2	18.6	498.5	15.1	151.6	19.0	169.6	14.6	171.3	11.8
Sandstone	552.5	28.4	716.5	27.1	986.6	29.9	172.9	21.6	256.3	22.1	301.6	20.9
Hematite breccia complex	513.3	26.4	513.3	19.4	522.4	15.8	281.9	35.3	286.9	24.7	288.5	20.0
Quartz-pebble conglomerate	85.6	4.4	153.3	5.8	229.3	7.0	50.5	6.3	72.0	6.2	84.8	5.9
Vein	0	0	84.0	3.2	258.8	7.9	14.8	1.9	136.1	11.7	231.8	16.0
Intrusive	63.7	3.3	150.6	5.7	202.9	6.2	60.6	7.6	81.1	7.0	109.6	7.6
Volcanic and caldera-related	49.9	2.6	135.5	5.1	140.3	4.3	1.5	0.2	5.7	0.5	7.1	0.5
Metasomatite	109.3	5.6	157.6	6.0	179.8	5.5	5.6	0.7	22.5	1.9	87.2	6.0
Other **	129.2	6.6	164.7	6.2	186.2	5.6	49.6	6.2	102.8	8.9	125.4	8.7
Unspecified	10.6	0.5	75.6	2.9	91.9	2.8	9.9	1.2	28.1	2.4	38.7	2.7
Total	1 947.3	100.0	2 643.3	100.0	3 296.7	100.0	799.0	100.0	1 161.0	100.0	1 446.2	100.0

* Formerly EAR-I with the name changed for the 2005 edition of the Red Book.

** Includes surficial, collapse breccia pipe, metamorphic, limestone and uranium coal deposits. Rock types with elevated uranium contents such as pegmatite, granites and black shale are not included.

Red Book (2006)

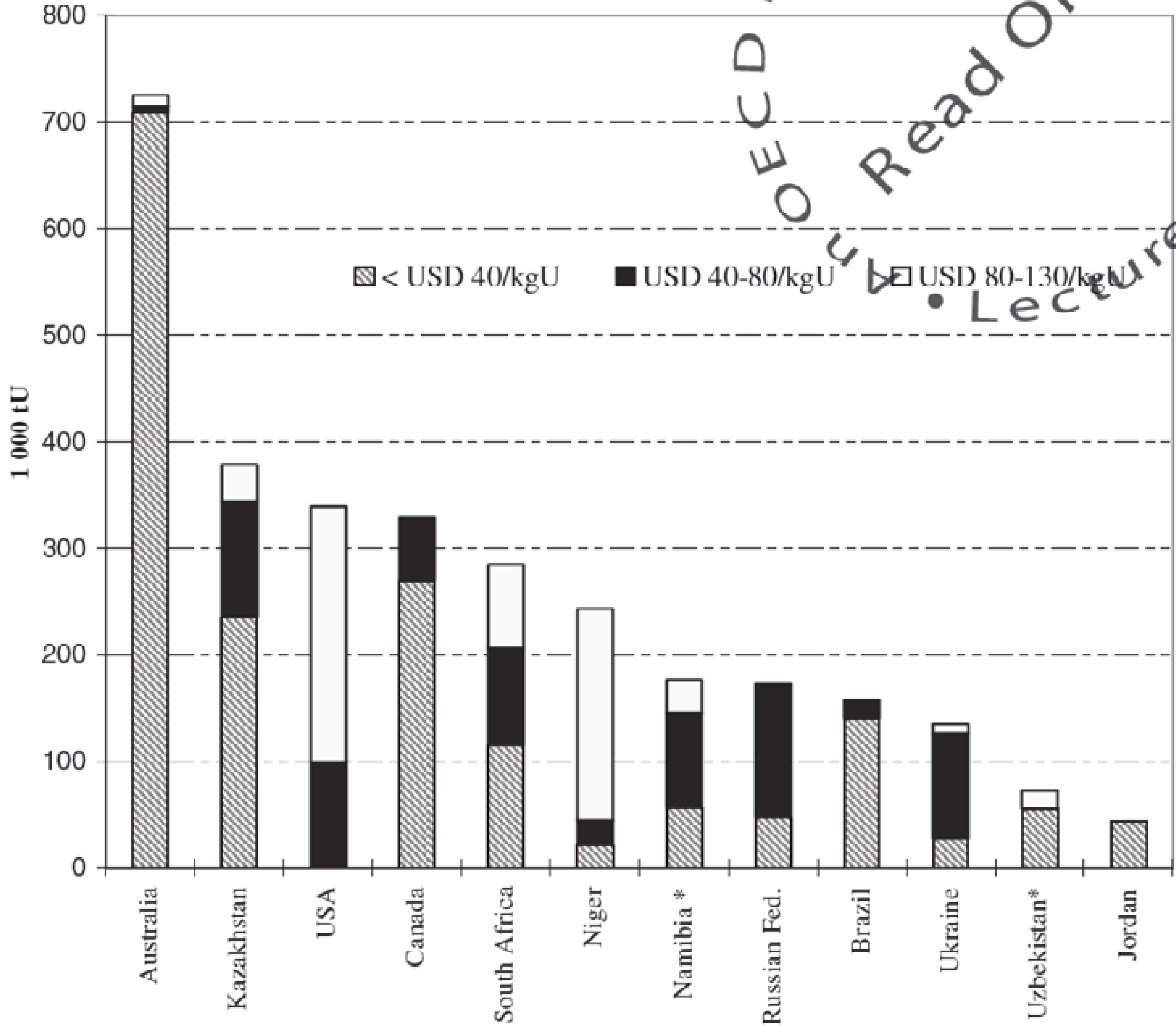
Table 8. **Reasonably Assured Resources (RAR) by deposit type**
(tonnes U)

	<USD 40/kgU	<USD 80/kgU	<USD 130/kgU
Unconformity-related	424 100	485 200	491 600
Sandstone	347 800	537 300	999 500
Hematite breccia complex	492 300	492 300	499 400
Quartz-pebble conglomerate	88 100	126 400	163 600
Vein	0	89 600	156 800
Intrusive	47 400	131 400	183 700
Volcanic and caldera-related	50 400	155 700	157 800
Metasomatite	121 200	291 300	304 900
Other *	162 300	221 000	284 300
Unspecified	32 800	67 800	96 700
Total	**1 766 400**	**2 598 000**	**3 338 300**

* Includes Surficial, Collapse breccia pipe, Phosphorite and other types of deposits, as well as rock types with elevated uranium content. Pegmatite and black shale are not included.

Red Book (2008)

Figure 2. **Distribution of Reasonably Assured Resources (RAR) among countries with major resources**



* Secretariat estimate.

Table 7.1. Leading uranium producer countries based on cumulative production (1945-2003)

Country	tU	Percentage of world total
USSR[1]	377 613	17.1
Canada	374 548	17.0
United States	356 485	16.2
Germany[2]	219 239	9.9
South Africa	157 618	7.1
Others (total)	719 229	32.7
World total	2 204 732	100.0

1. Only includes production until 1991.
2. Includes production of German Democratic Republic (1946-1989) and Federal Republic of Germany (1961-2003).

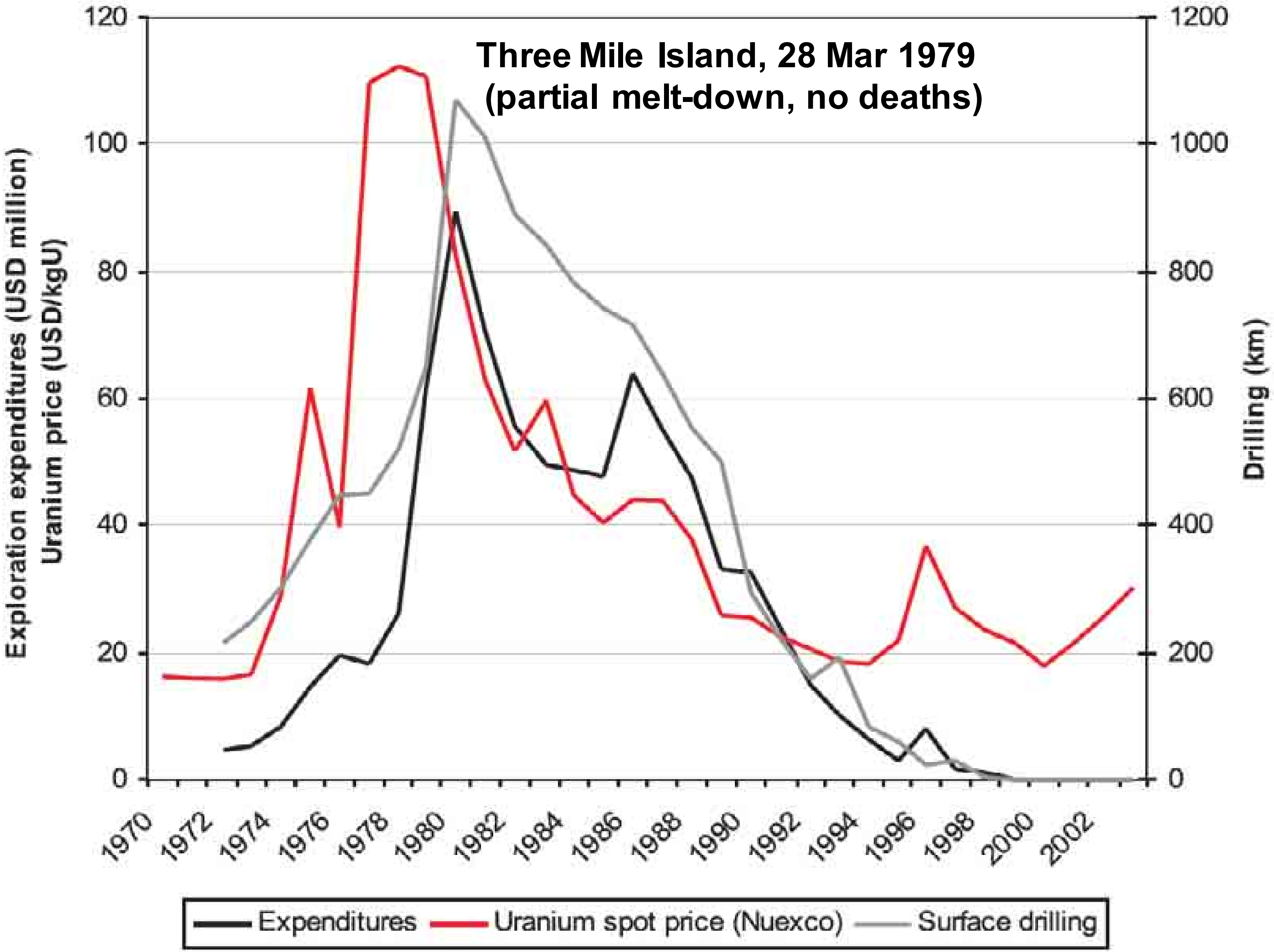
Table 6.1. Countries with largest Known Conventional Resources recoverable at <USD 130/kgU (2003)[1]

Country	tU	Percentage of world total
Australia	1 058 000	23.1
Kazakhstan	847 620	18.5
Canada	438 544	9.6
South Africa	395 670	8.6
United States[2]	345 000	7.5
Others (total)	1 503 166	32.7
World total	4 588 000	100.0

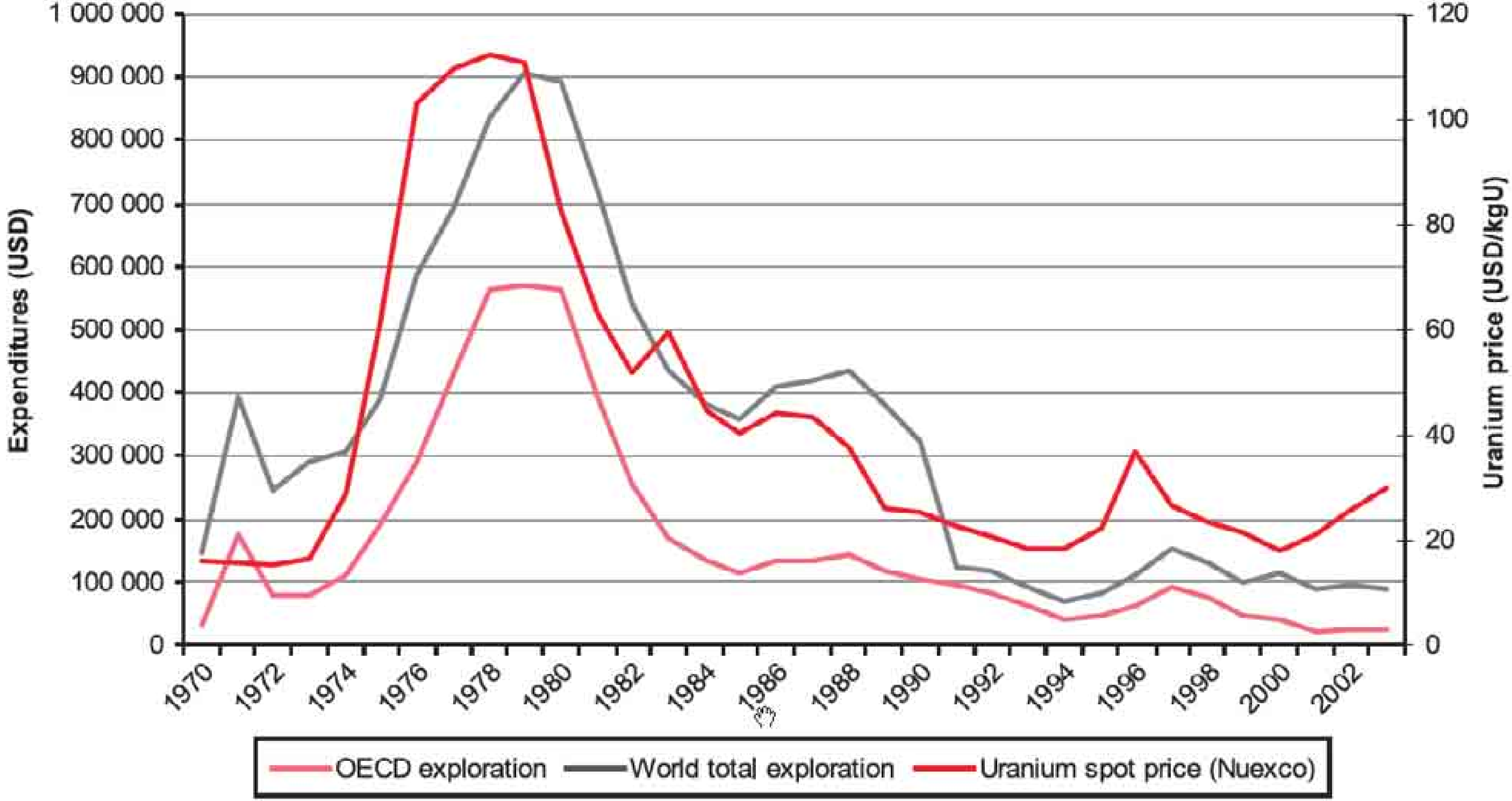
1. Includes RAR and EAR-I resources at <USD 130/kgU.
2. The United States does not report resources in the EAR-I category.

Red Book (2006)

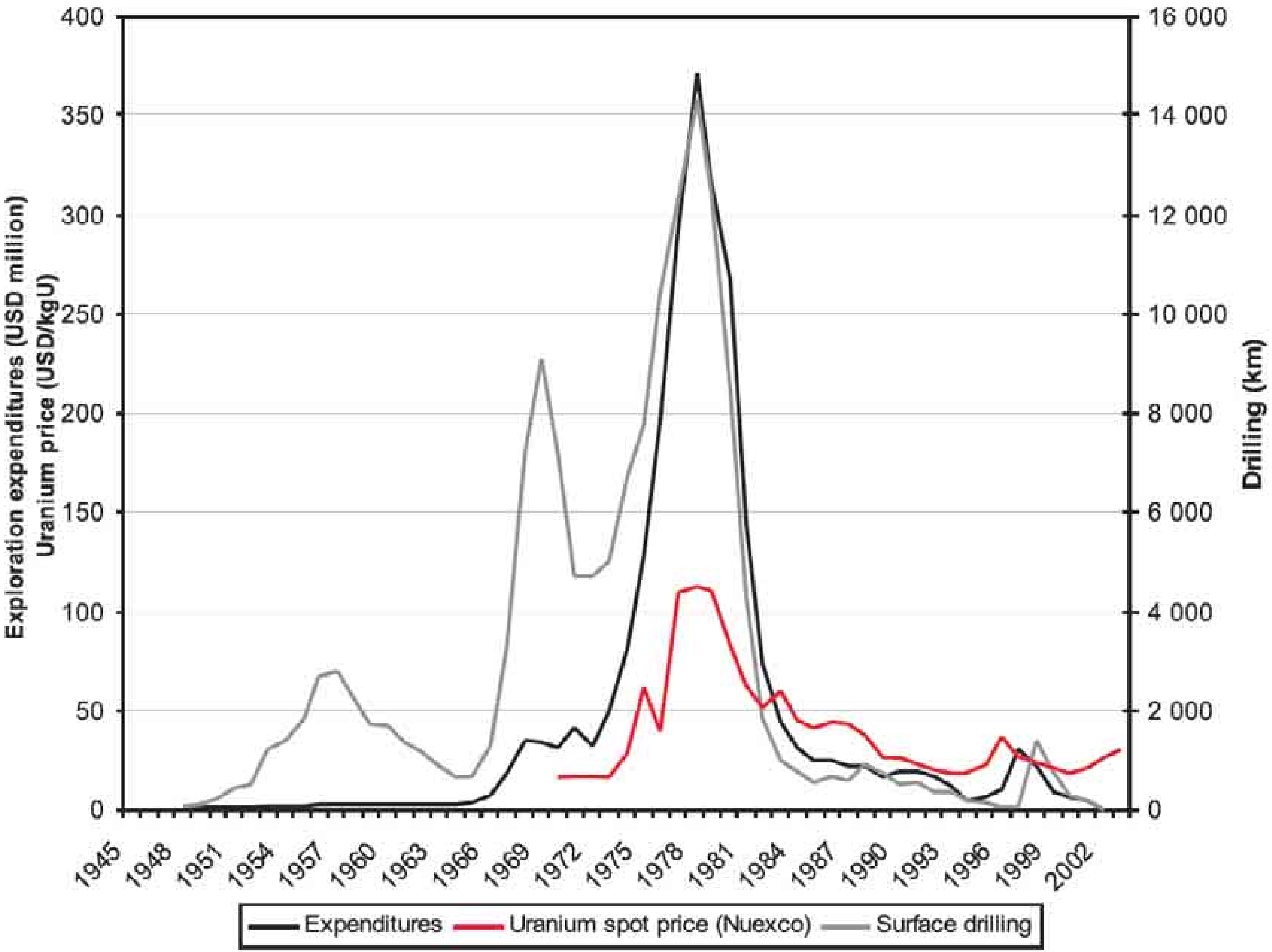
Uranium exploration expenditure and drilling in France



Uranium exploration expenditure and drilling in Canada

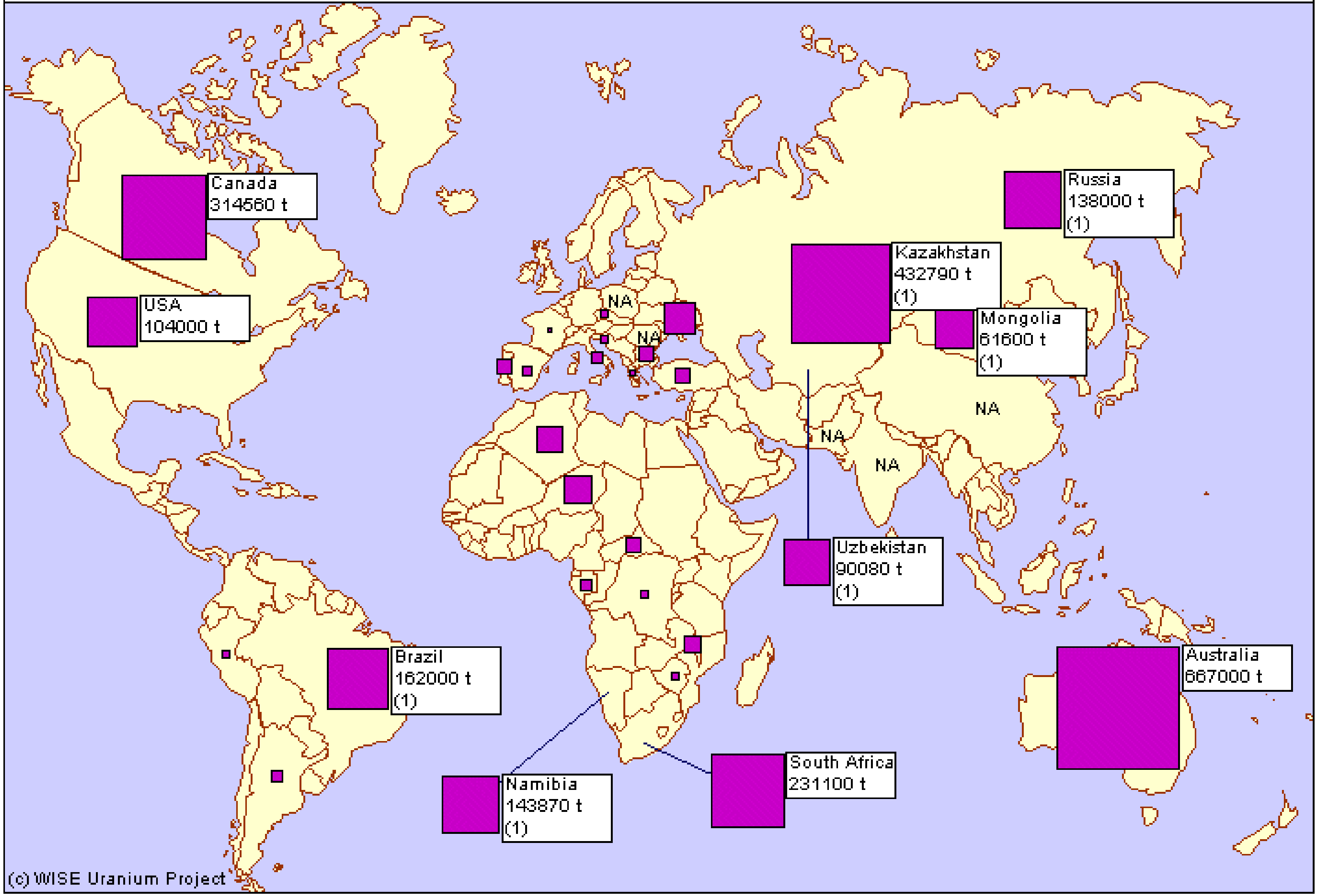


Uranium exploration expenditure and drilling in USA



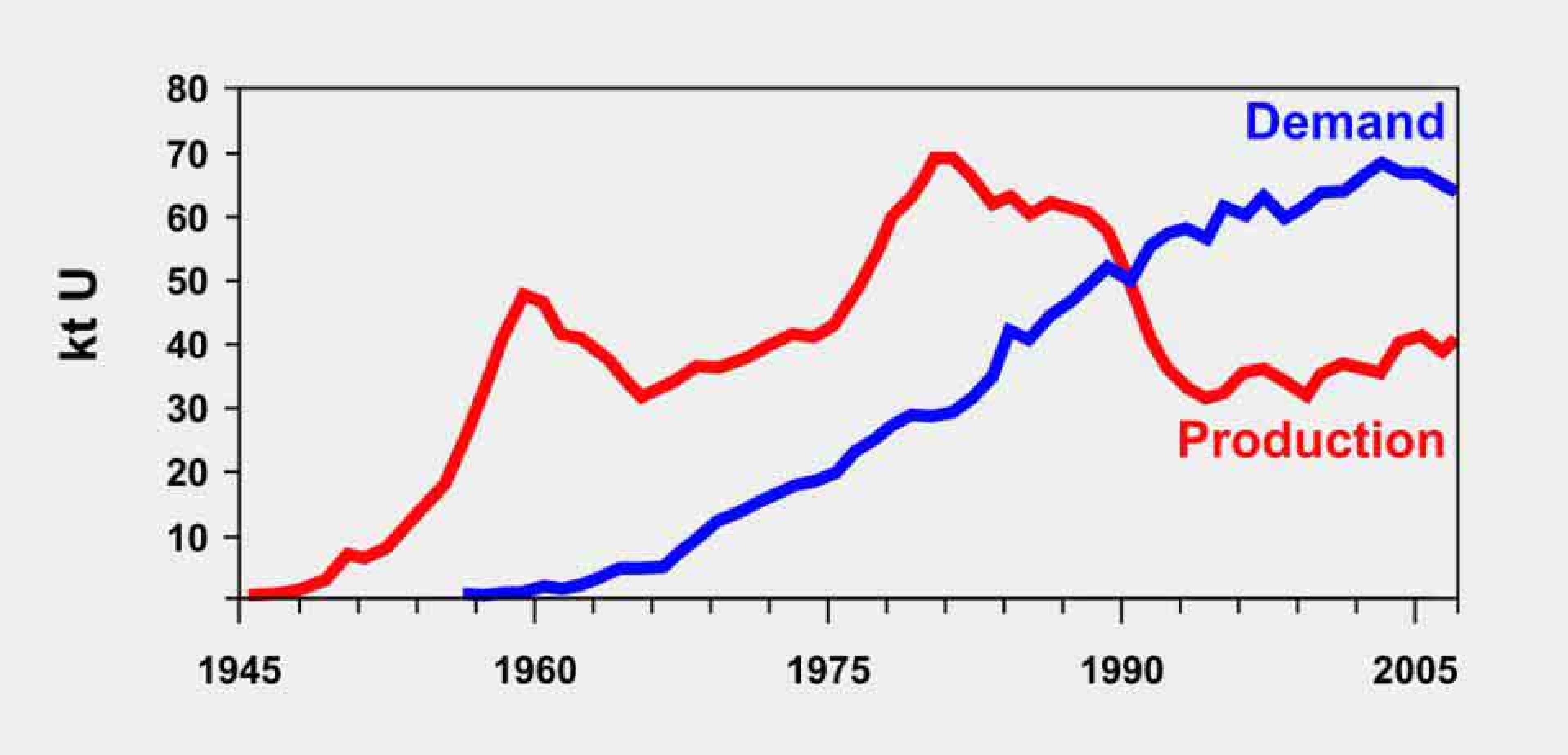
World Uranium Resources (RAR)

[t U] Reasonably Assured Resources as of 1/1/2001, Cost range US$80/kg U or less (OECD 2002)



(1) In situ resources

t = metric tonne · NA = Data not available



There is a gap in between uranium production and demand since about 1990 filled by recycled uranium and conversion of military stockpiles

Joachimsthal/Jachymov (Czech Republic)

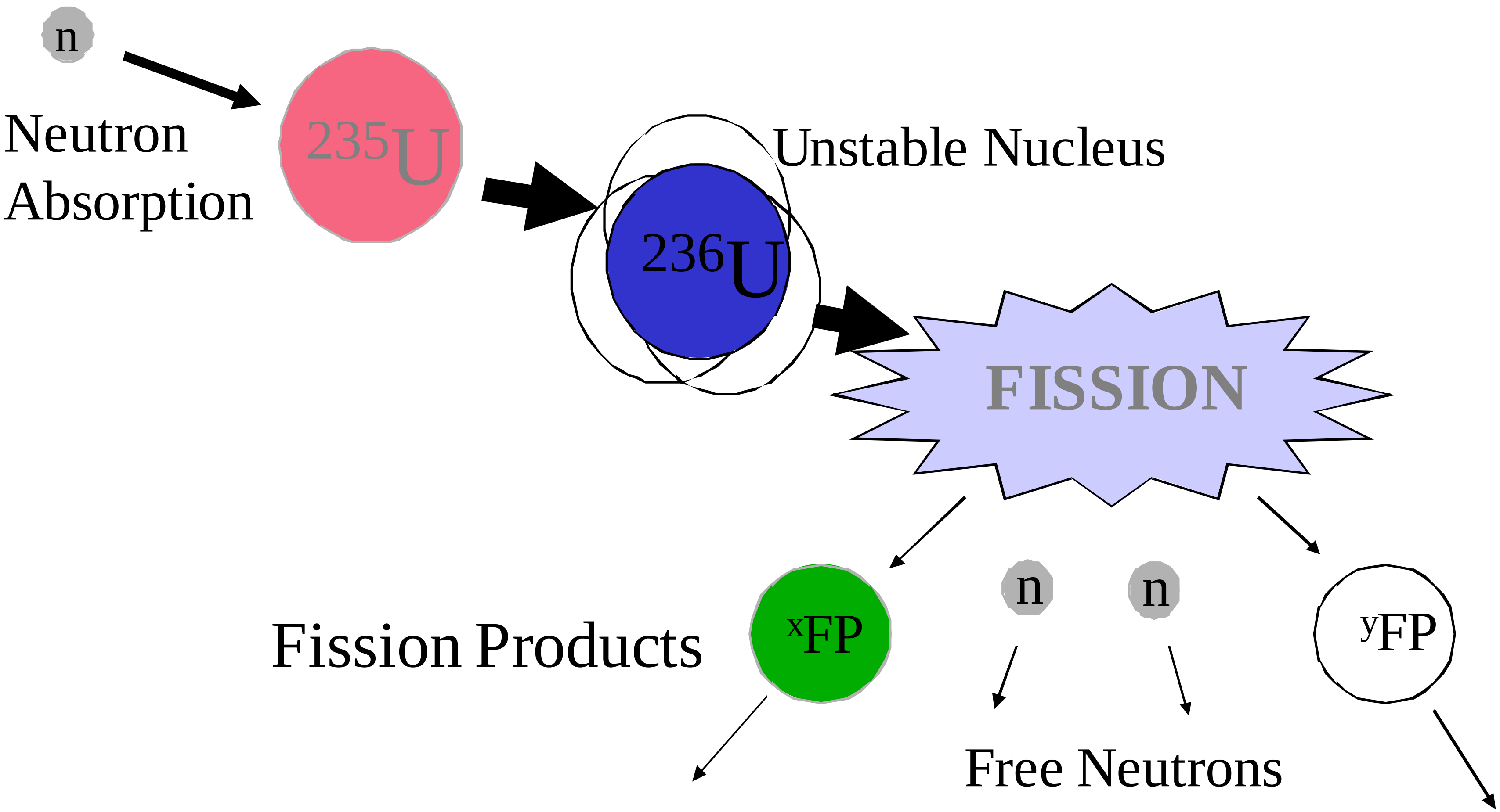
Marie Curie
Nobel-Preis für Physik 1903
Nobel-Preis für Chemie 1911

Lise Meitner
Otto Hahn
Nobel-Preis für Chemie 1955

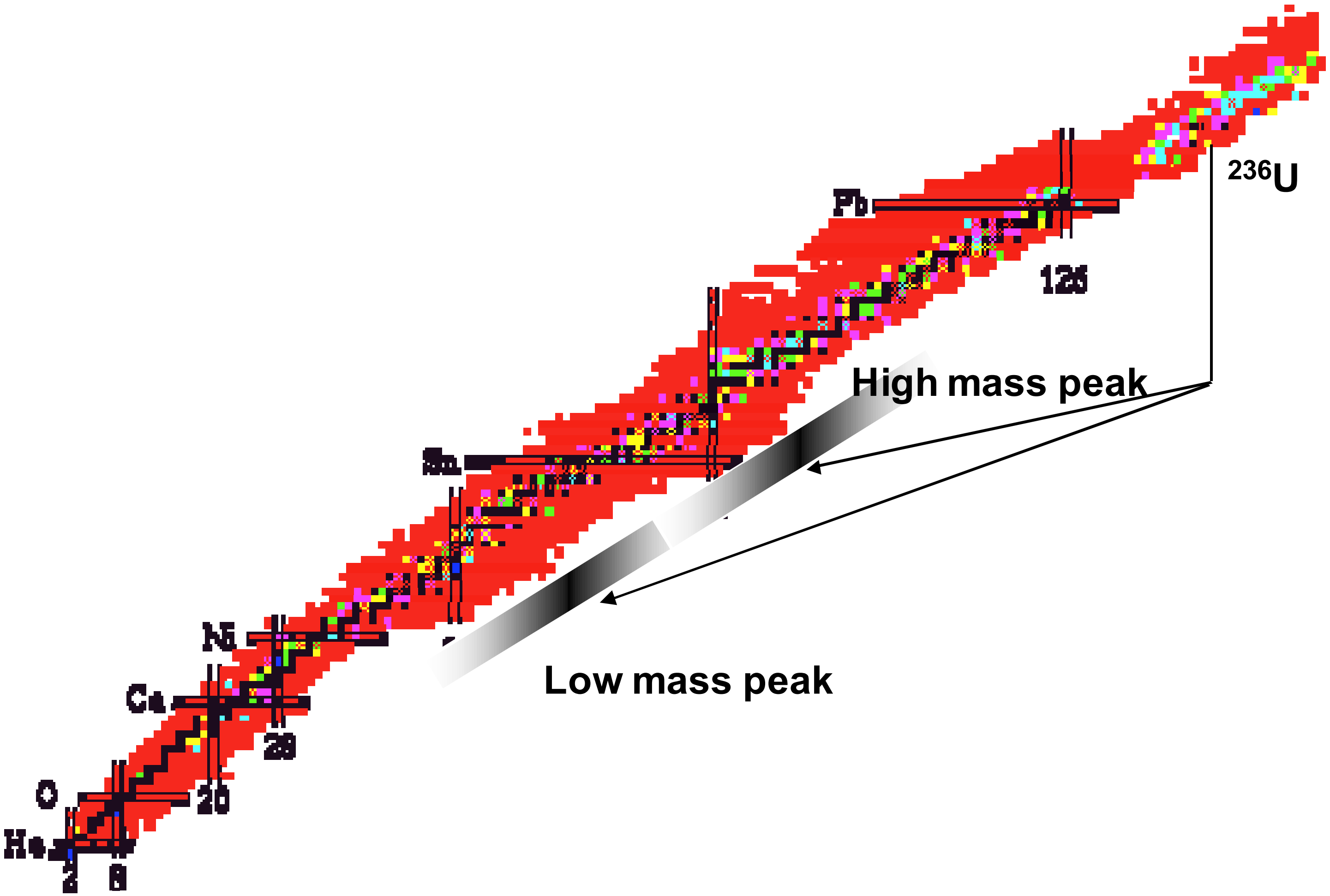
dem die Wissenschaftler
Otto Hahn, und Fritz Straßmann
1938 entdeckten.
Otto Hahn, and Fritz Straßmann

^{235}U Fission

$$^{235}U + {}^{1}n \Rightarrow {}^{x}FP + {}^{y}FP + (2\ \ or\ \ 3)^{1}n$$



Fission product mass ranges



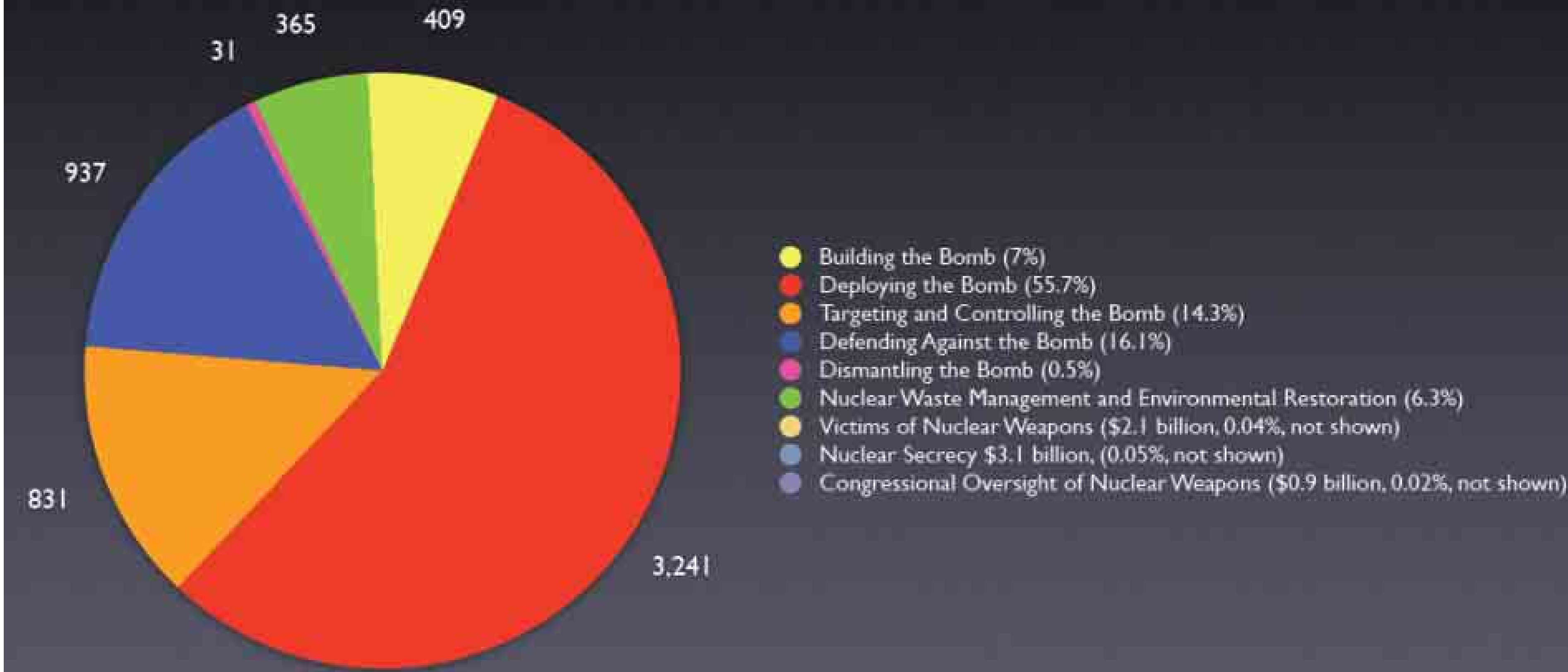
Little Boy: Gun-style uranium bomb, exploded over Hiroshima, 6 Aug 1945

Hiroshima Atomic Bomb Dome

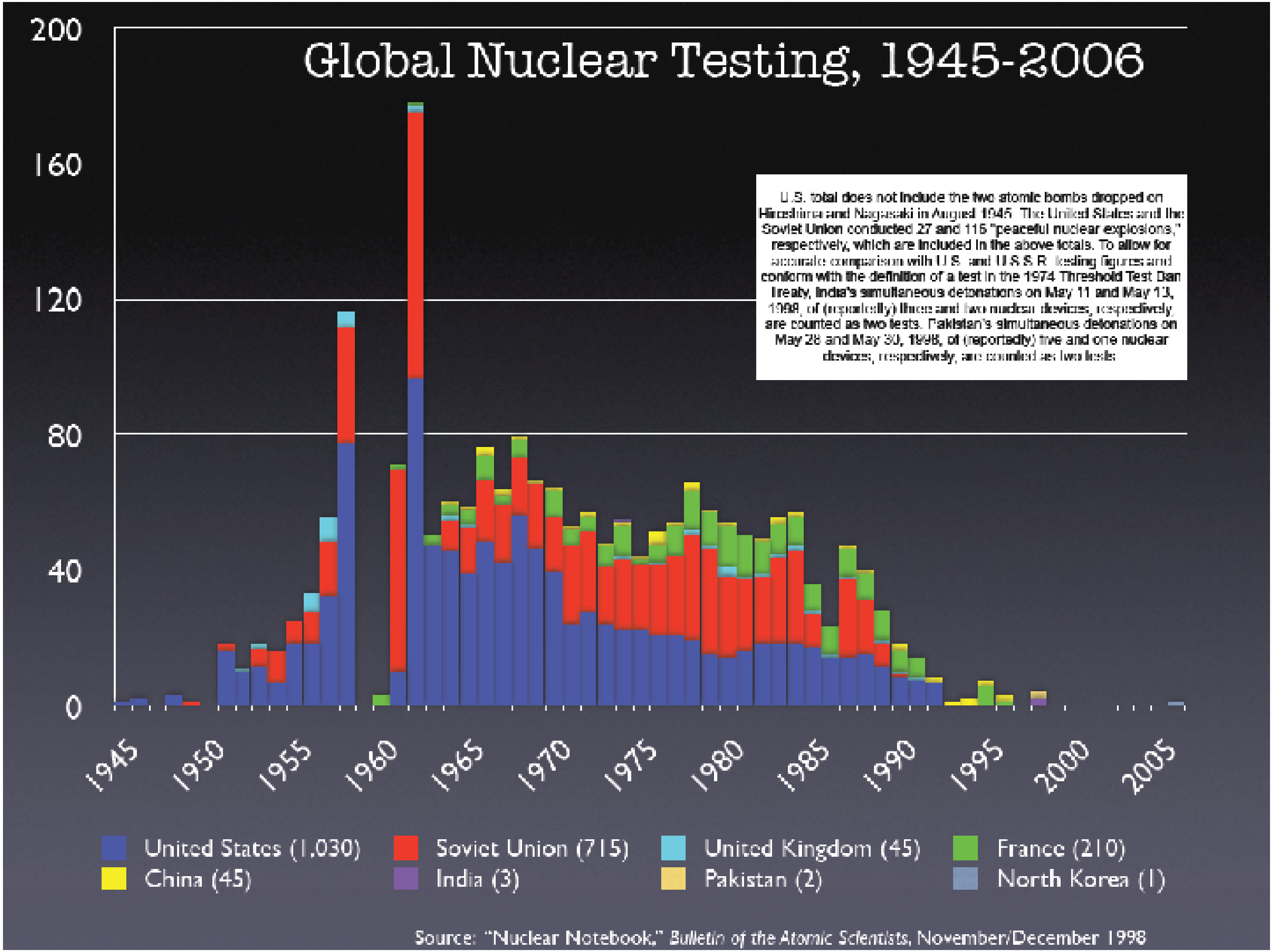
Estimated Minimum Incurred Costs of U.S. Nuclear Weapons Programs, 1946-1996*

in billions of constant 1996 dollars

Total - $5,821.0 billion

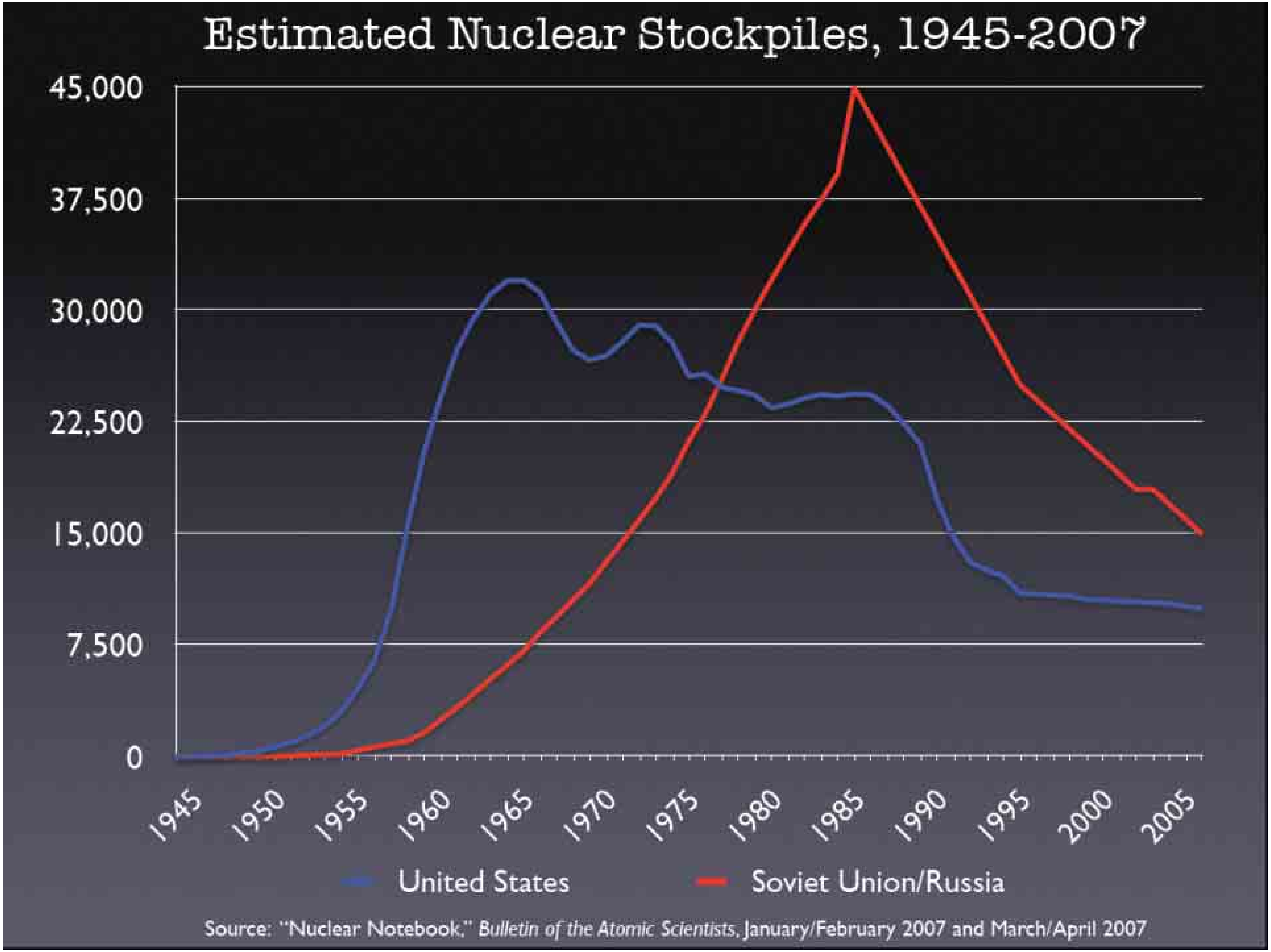


* Includes average projected future-year costs for nuclear weapons dismantlement and fissile materials disposition and environmental remediation and waste management. Total actual and estimated expenditures through 1996 were $5,481.1 billion.



Global Nuclear Testing, 1945-2006
200
160
120
80
40
0
U.S. total does not include the two atomic bombs dropped on Hiroshima and Nagasaki in August 1945. The United States and the Soviet Union conducted 27 and 116 "peaceful nuclear explosions," respectively, which are included in the above totals. To allow for accurate comparison with U.S. and U.S.S.R. testing figures and conform with the definition of a test in the 1974 Threshold Test Ban Treaty, India's simultaneous detonations on May 11 and May 13, 1998, of (reportedly) three and two nuclear devices, respectively, are counted as two tests. Pakistan's simultaneous detonations on May 28 and May 30, 1998, of (reportedly) five and one nuclear devices, respectively, are counted as two tests.
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
United States (1,030)
Soviet Union (715)
United Kingdom (45)
France (210)
China (45)
India (3)
Pakistan (2)
North Korea (1)
Source: "Nuclear Notebook," Bulletin of the Atomic Scientists, November/December 1998

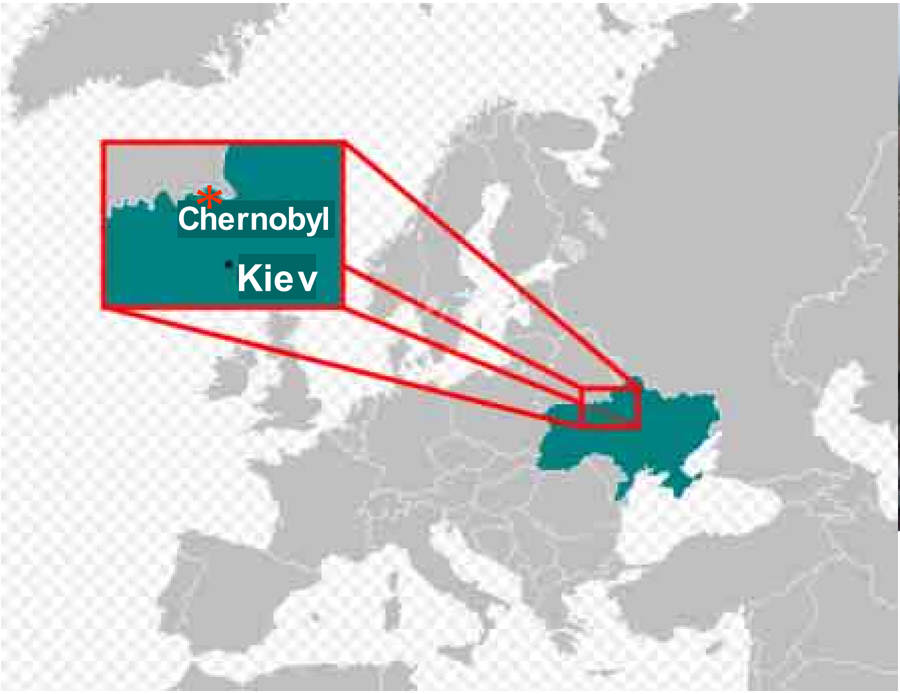
Nevada Test Site



Estimated Nuclear Stockpiles, 1945-2007
45,000
37,500
30,000
22,500
15,000
7,500
0
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
United States
Soviet Union/Russia
Source: "Nuclear Notebook," Bulletin of the Atomic Scientists, January/February 2007 and March/April 2007

Aue (U): Wismut Museum

Power Reactor and Nuclear Fuel Development Corporation (PNC)
Ningyo Toge, Japan


Chernobyl
Kiev


Chernobyl today


The „Sarcophagus“


Reactor
building

Chernobyl, Ukraine:

Reactor (graphite) burning

Lava of reactor fuel in steam safety valve below the reactor

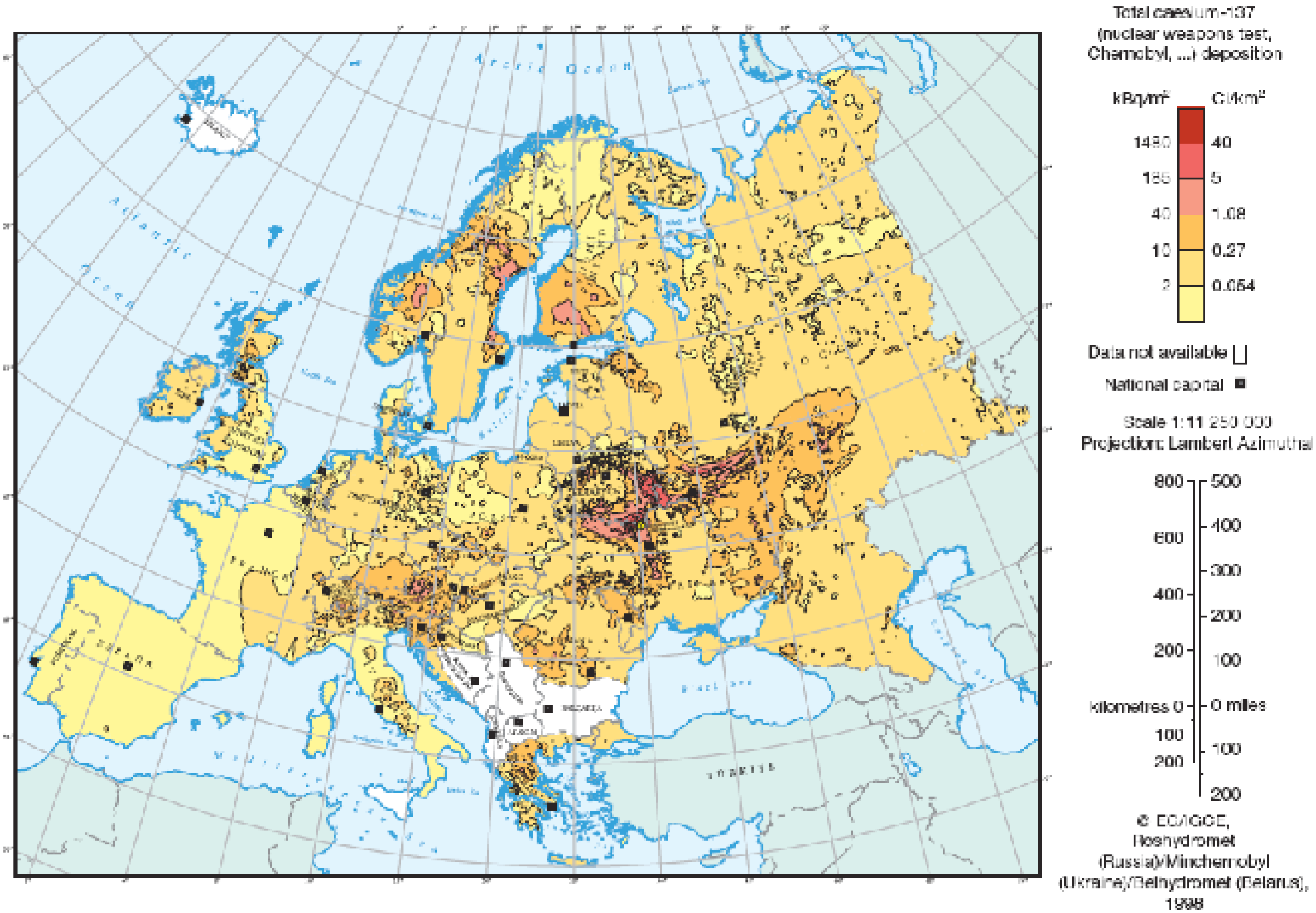


FIG. 3.5. Surface ground deposition of ^{137}Cs throughout Europe as a result of the Chernobyl accident [3.13].

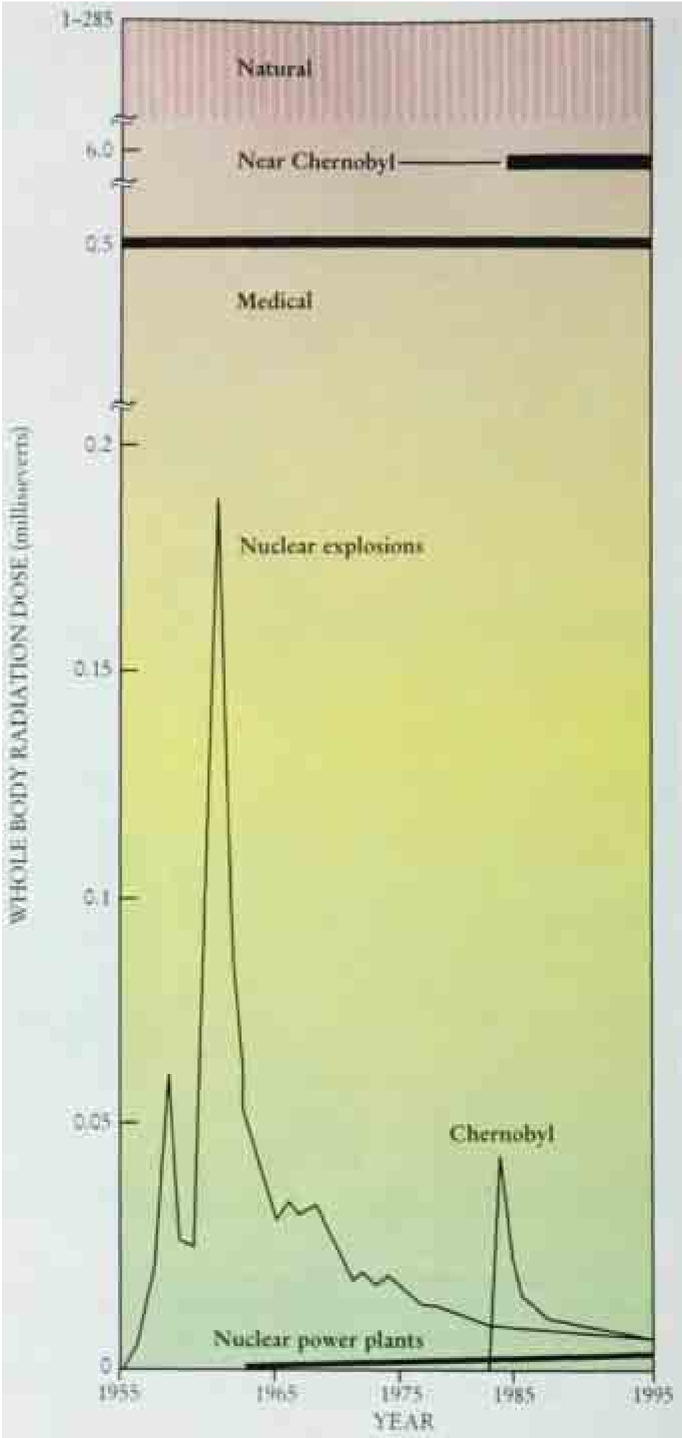
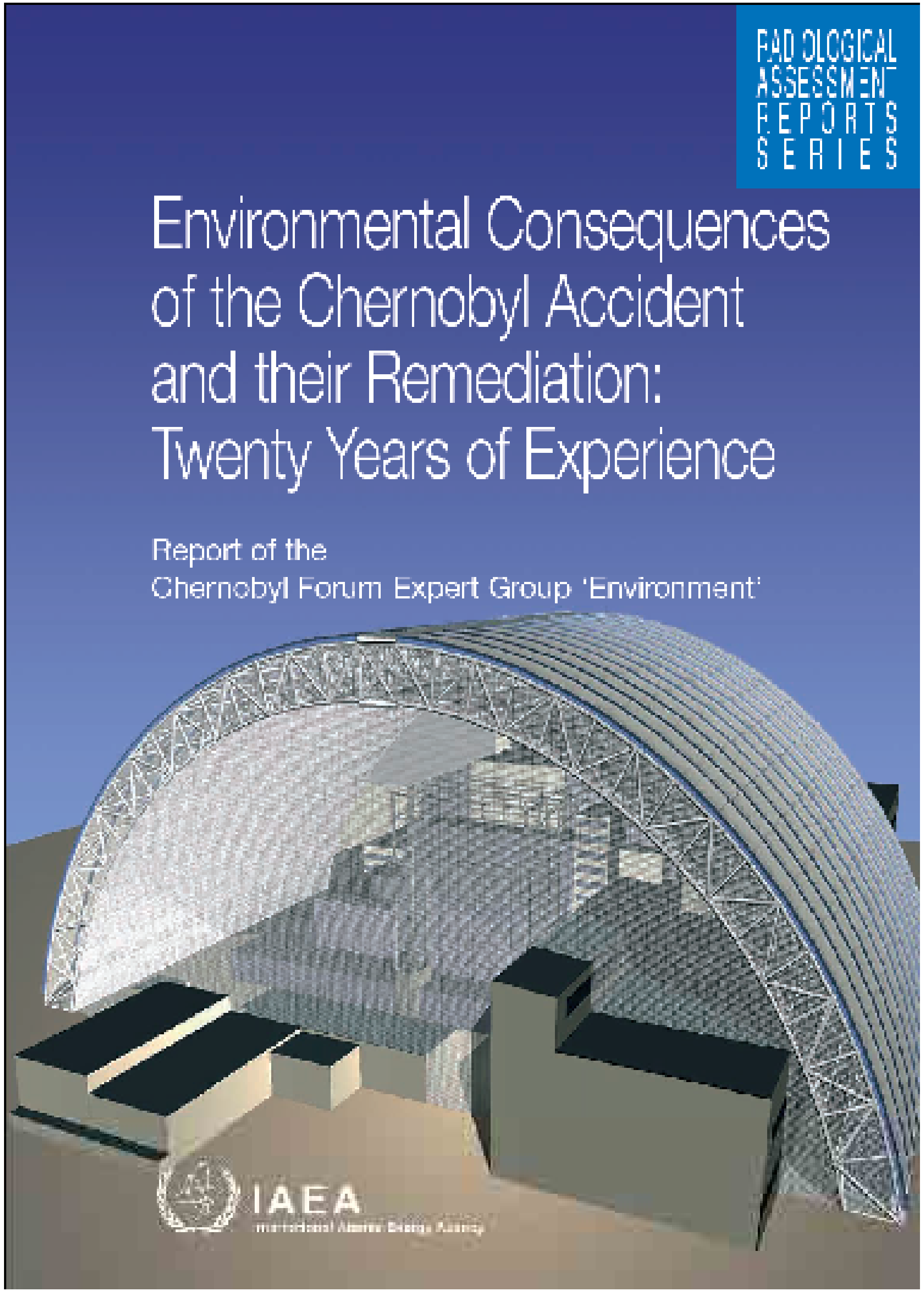


FIGURE 2. AVERAGE INDIVIDUAL GLOBAL RADIATION DOSE in the 1990s from nuclear explosions, the Chernobyl accident, and commercial nuclear power plants combined was about 0.4% of the average natural dose of 2.2 mSv per year. In areas of Belarus, Ukraine, and Russia that were highly contaminated by Chernobyl fallout, the average individual dose was actually much lower than that in the regions with high natural radiation. The greatest man-made contribution to radiation dose has been irradiation from x-ray diagnostics in medicine, which accounts for about 20% of the average natural radiation dose. Natural exposure is assumed to be stable. The temporal trends in medical and local Chernobyl exposures are not presented. (Based on data from UNSCEAR.)

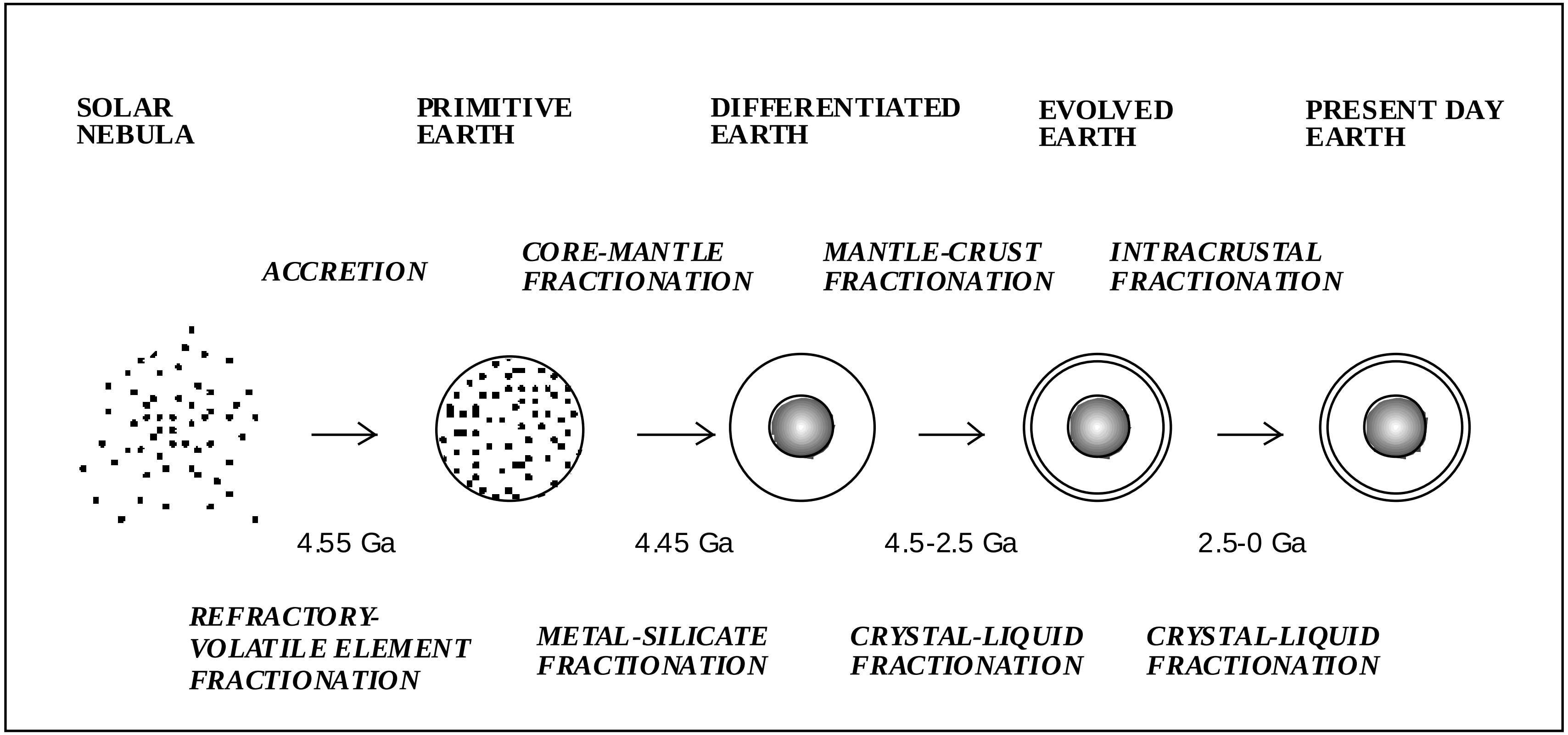
The Chernobyl explosion put 400 times more radio-Active material into the Earth's atmosphere than the Atomic bomb dropped on Hiroshima.
Atomic weapons tests conducted in the 1950s and 1960s all together are estimated to have put some 100 to 1,000 times more radioactive material into the atmosphere than the Chernobyl accident.

Jaworowski (1999) Physics Today 52 (9): 24-29

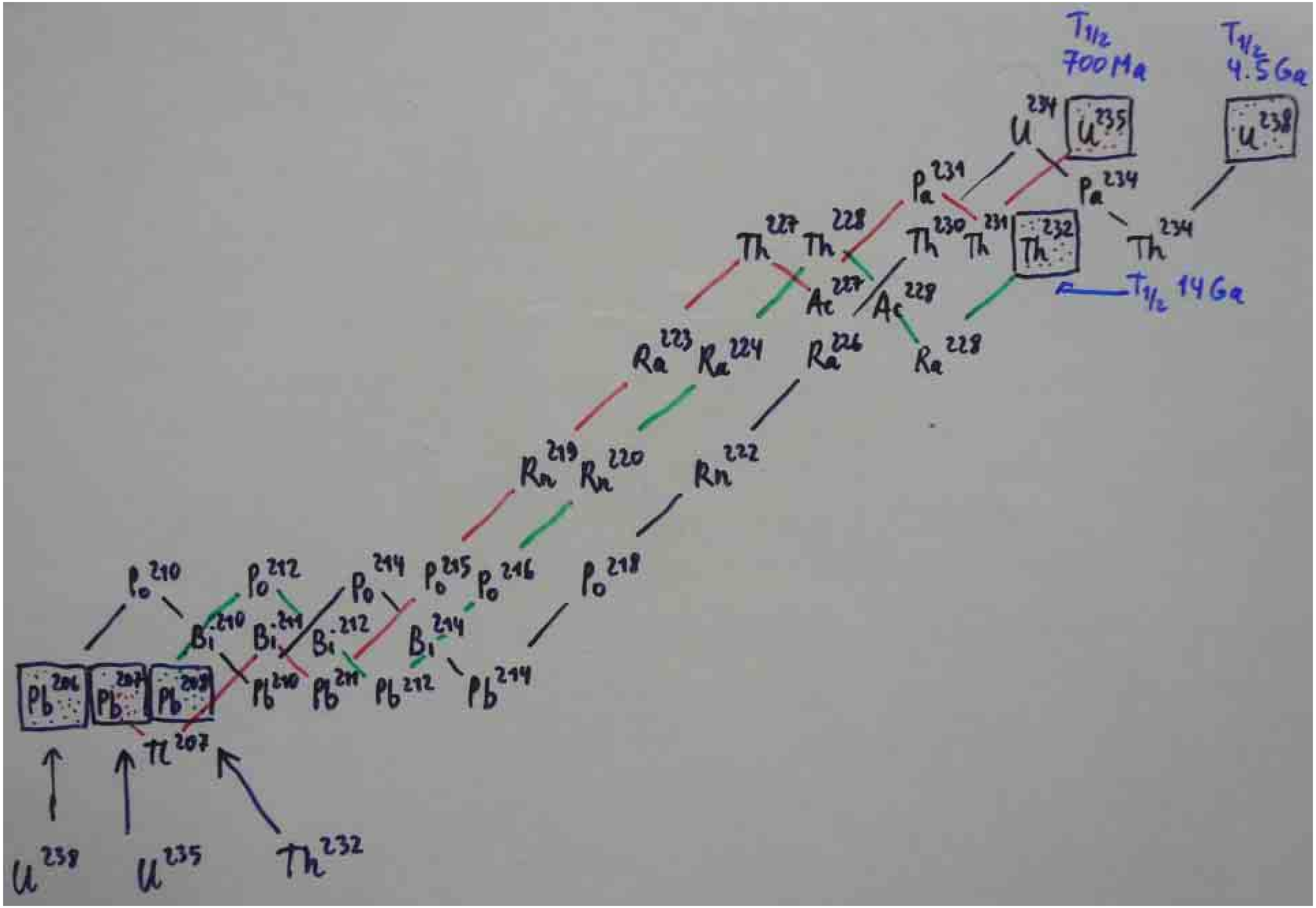


Chernobyl

The „New Safe Confinement“ (NSC) to be constructed until 2012 at ~1.6 billion USD Span: 270 m; Height: 100 m; Length: 150 m)



	C1 CHONDRITES	BULK EARTH	PRIMITIVE MANTLE	BULK CRUST	LOWER CRUST	UPPER CRUST
24 Cr	2660 ppm	4120 ppm	2625 ppm	120 ppm	215 ppm	35 ppm
29 Cu	126 ppm	31 ppm	30 ppm	26 ppm	26 ppm	25 ppm
42 Mo	0.928 ppm	2.35 ppm	0.05 ppm	0.65 ppm	0.45 ppm	1.5 ppm
50 Sn	1.72 ppm	0.39 ppm	0.13 ppm	1.5 ppm	1.1 ppm	2.5 ppm
73 Ta	0.014 ppm	0.023 ppm	0.037 ppm	0.7 ppm	0.6 ppm	0.96 ppm
74 W	0.093 ppm	0.18 ppm	0.029 ppm	0.69 ppm	0.5 ppm	2.0 ppm
78 Pt	0.99 ppm	1.67 ppm	0.007 ppm	0.0018 ppm	0.0019 ppm	0.0015 ppm
79 Au	0.140 ppm	0.26 ppm	0.001 ppm	0.003 ppm	0.0014 ppm	0.0018 ppm
82 Pb	2.5 ppm	0.115 ppm	0.15 ppm	12.5 ppm	4.3 ppm	20 ppm
92 U	0.008 ppm	0.014 ppm	0.02 ppm	1.4 ppm	0.28 ppm	2.8 ppm
Rb/Sr	0.295	0.032	0.028	0.17	0.03	0.32



U-Th decay series

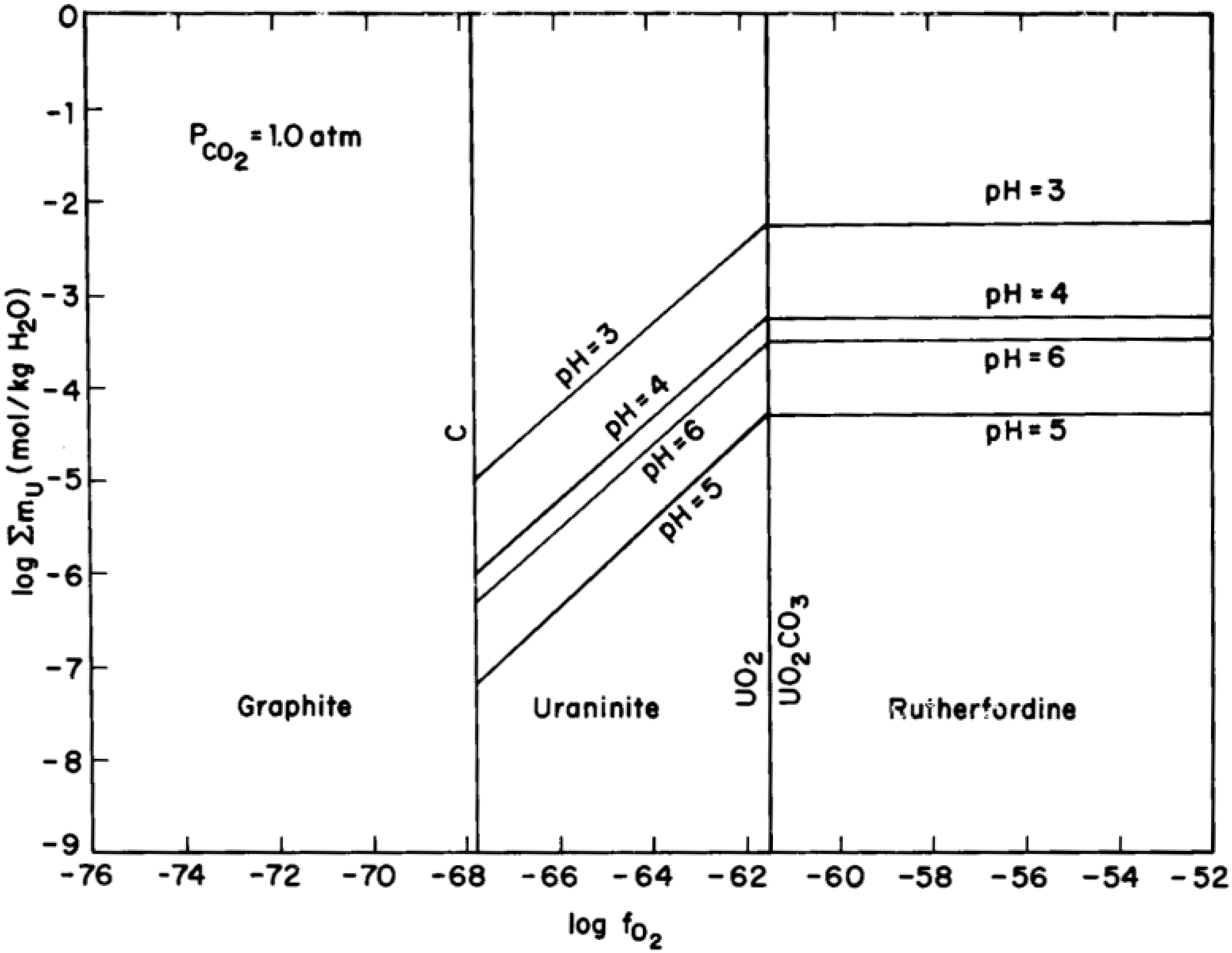
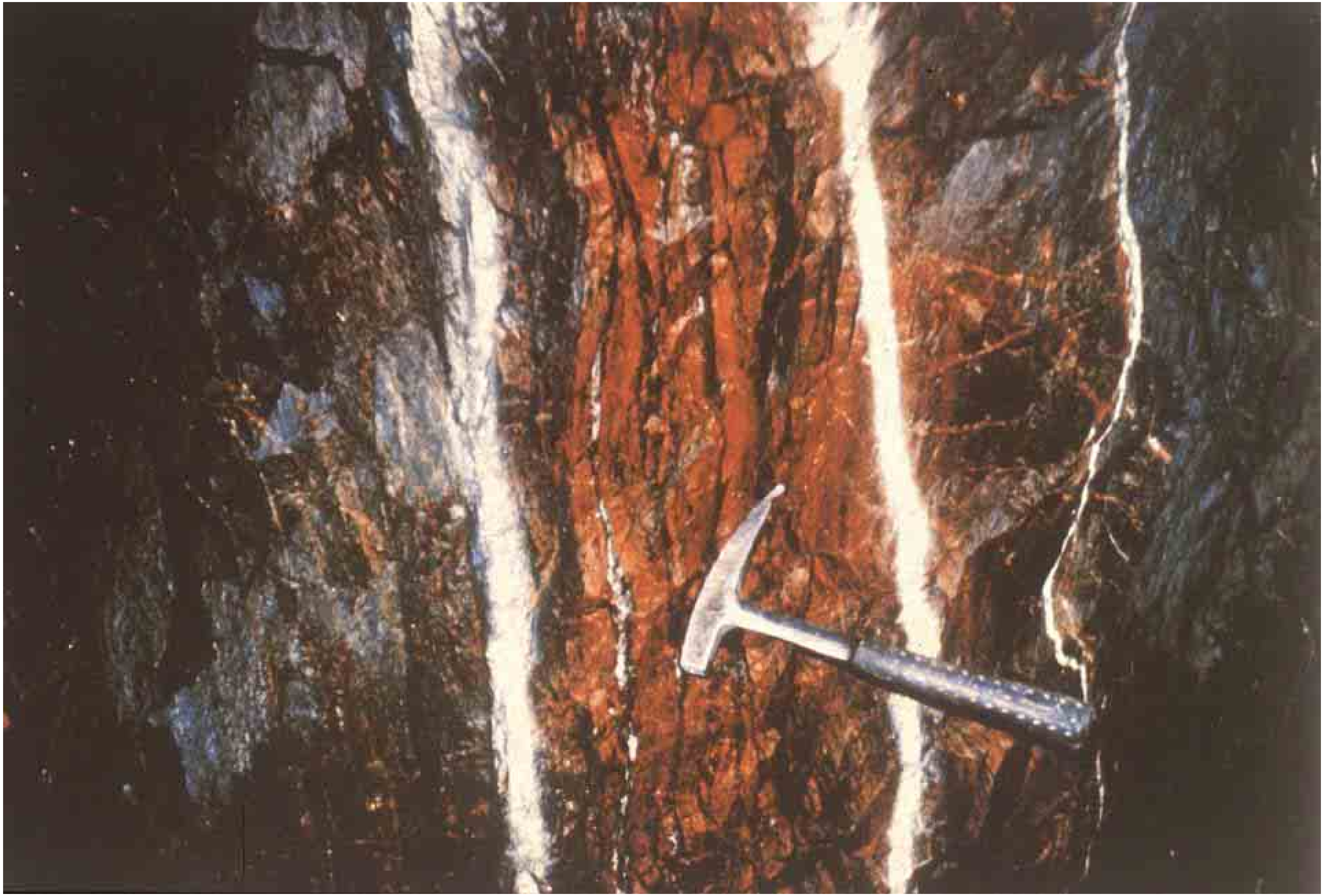


Fig. 4-7. Concentration of uranium as a function of f_{O_2} in solutions saturated with respect to uraninite and/or rutherfordine at 25° C, a CO_2 pressure of 1 atm, and an ionic strength of about 0.02.

Rich et al (1977) Hydrothermal uranium deposits. Elsevier.



Fay Mine, Beaverlodge District, Canada: UO_2-vein zone + hematite alteration
Rich/Holland/Petersen (1977: 1)

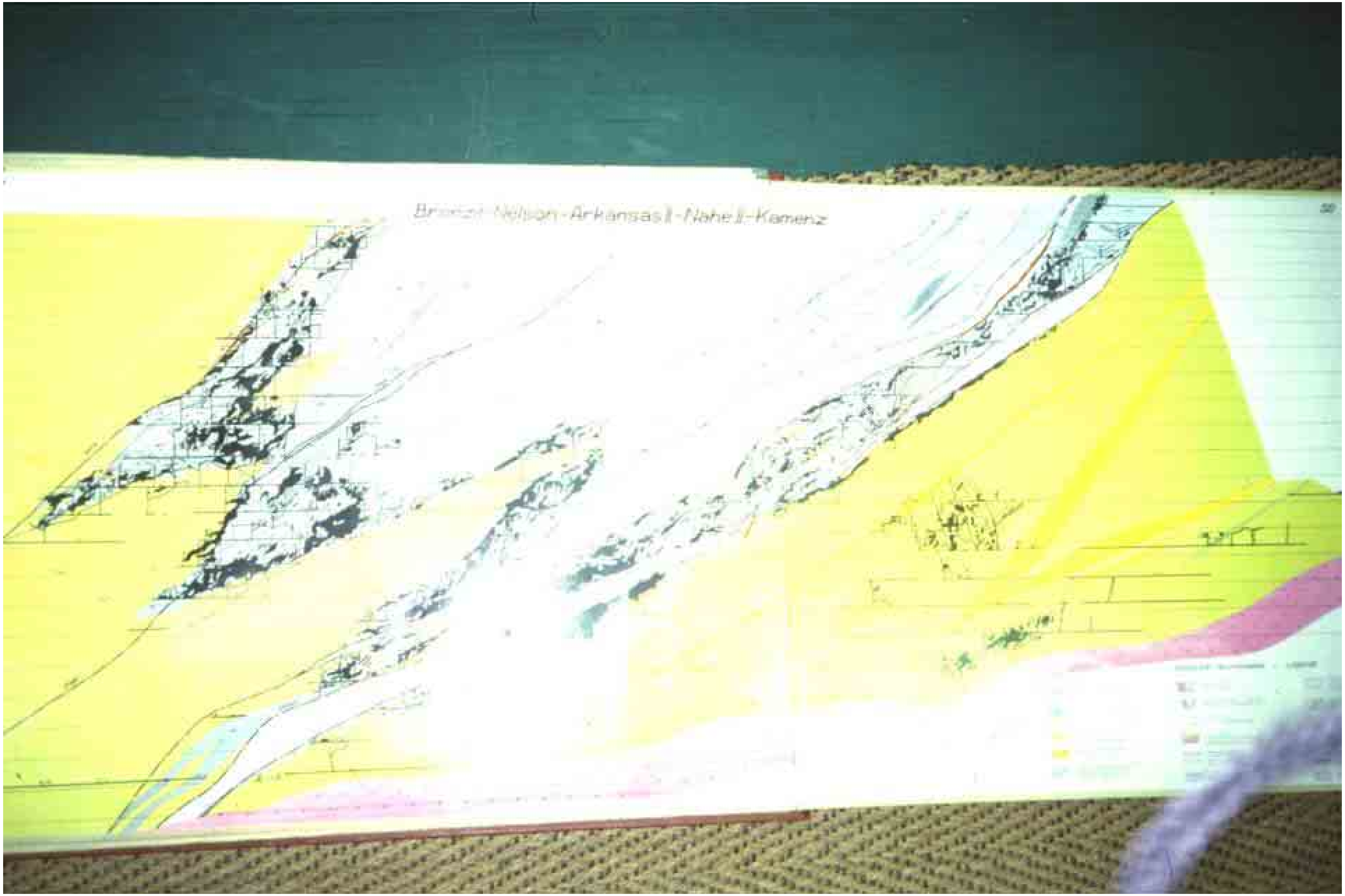
Aue (Erzgebirge): Shear-zone controlled hematite alteration

Aue (Erzgebirge): Shear-zone controlled hematite alteration

Oberschlema-Aue, Erzgebirge: BiCoNi + U, As: black, Ag: grey

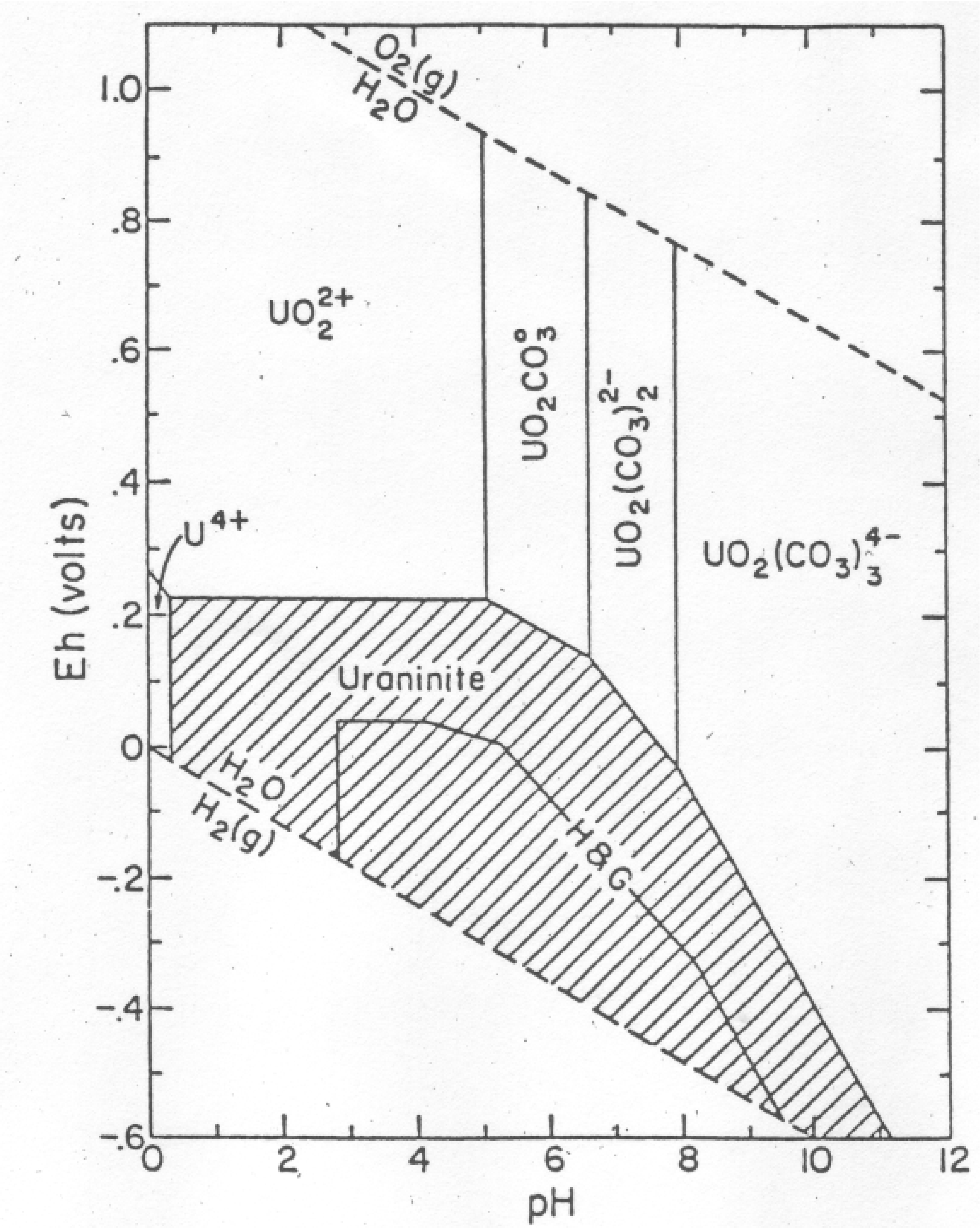
Hematite → Pitchblende → Pyrite

Bertholène, Massif Central, France



Aue: Longitudinal section: Ore shoots in black schist
Total production: 73,000 t U; Grade: 0.4 % U

Rozna, Czech Republic: Bituminous uraninite ore



Eh-pH plot for the $U\text{-}CO_2\text{-}H_2O$ system at 25°C for p_{CO2} 100 b

UO_2 solution boundaries are drawn at 10^{-6} M (0.24 ppm U)

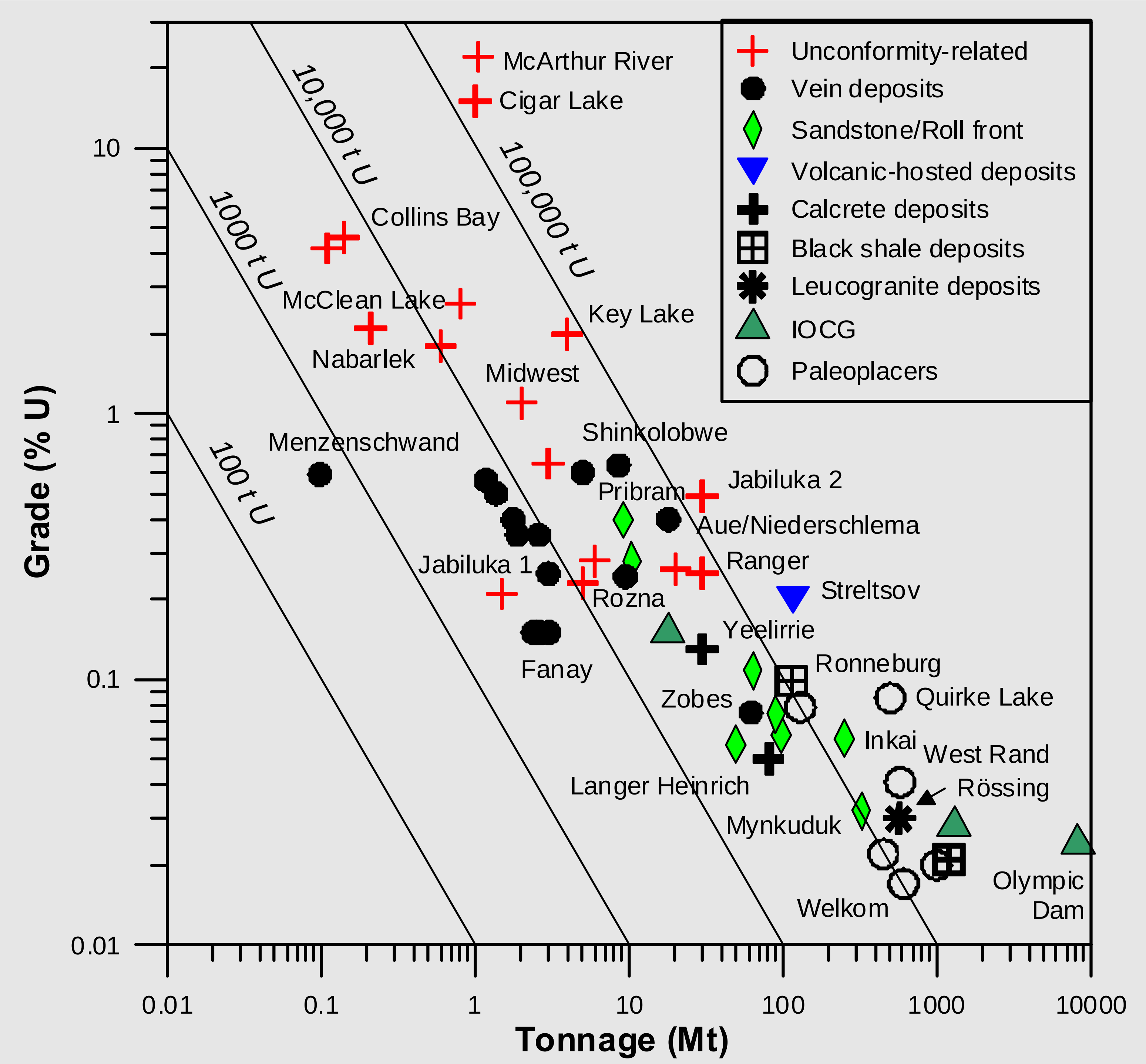
General background:

$U^{6+}_{(aqueous)} + 2e^{-} = U^{4+}_{(solid)}$

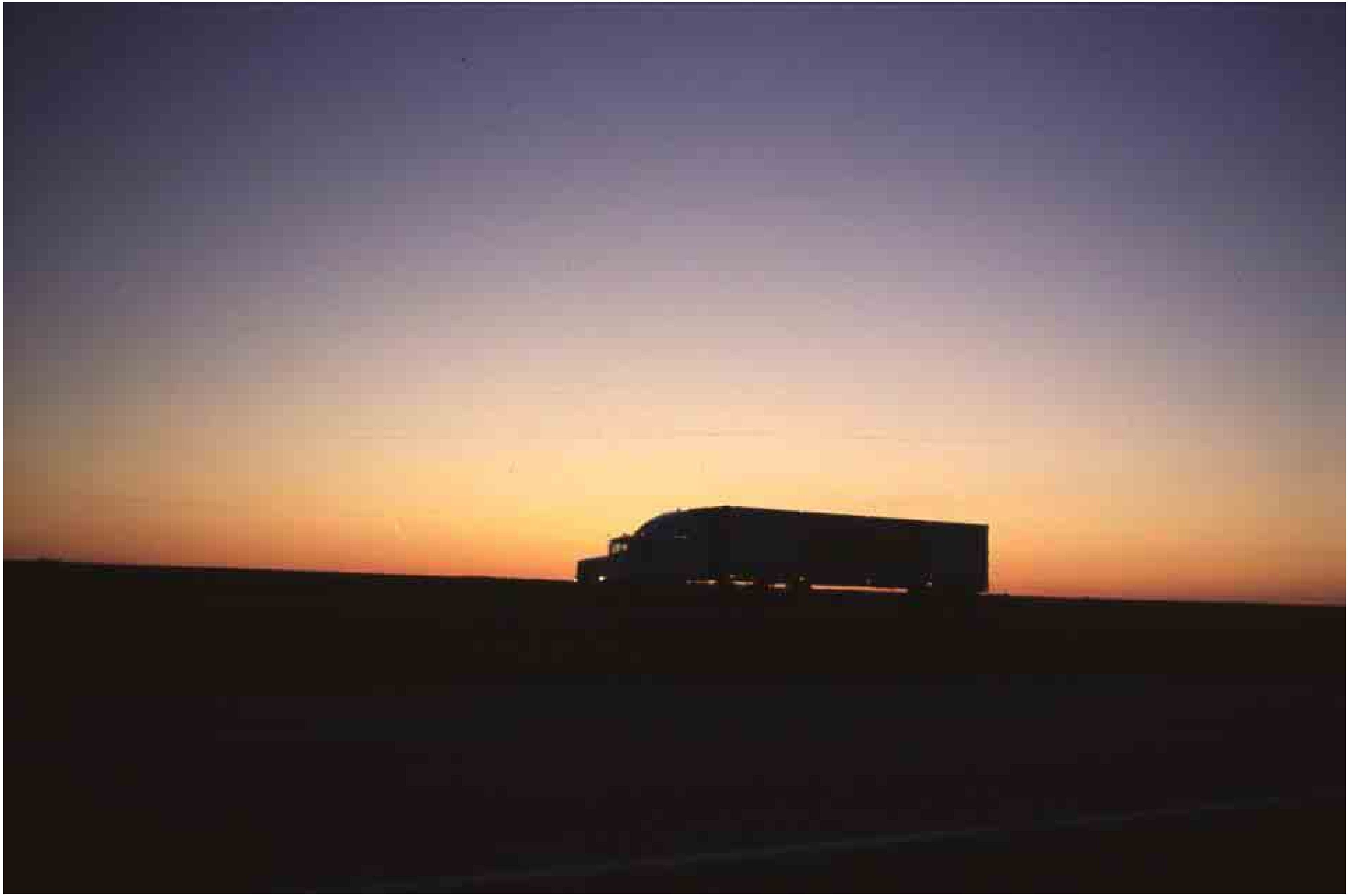
Example:

$UO_2(CO_3)_2^{2-} + 2H^{+} = UO_2 + ½O_2 + 2CO_2 + H_2O$

Nash et al (1981)
EG Anniv Vol: 68



Unconformity-related
Vein deposits
Sandstone/Roll front
Volcanic-hosted deposits
Calcrete deposits
Black shale deposits
Leucogranite deposits
IOCG
Paleoplacers
10,000 t U
100,000 t U
1000 t U
100 t U
McArthur River
Cigar Lake
Collins Bay
McClean Lake
Nabarlek
Key Lake
Midwest
Menzenschwand
Shinkolobwe
Jabiluka 2
Pribram
Aue/Niederschlema
Ranger
Jabiluka 1
Rozna
Streltsov
Yeelirrie
Fanay
Ronneburg
Zobes
Quirke Lake
Inkai
West Rand
Langer Heinrich
Rössing
Mynkuduk
Olympic Dam
Welkom
Grade (% U)
Tonnage (Mt)
10
1
0.1
0.01
0.01
0.1
1
10
100
1000
10000



Saskatchewan, Canada

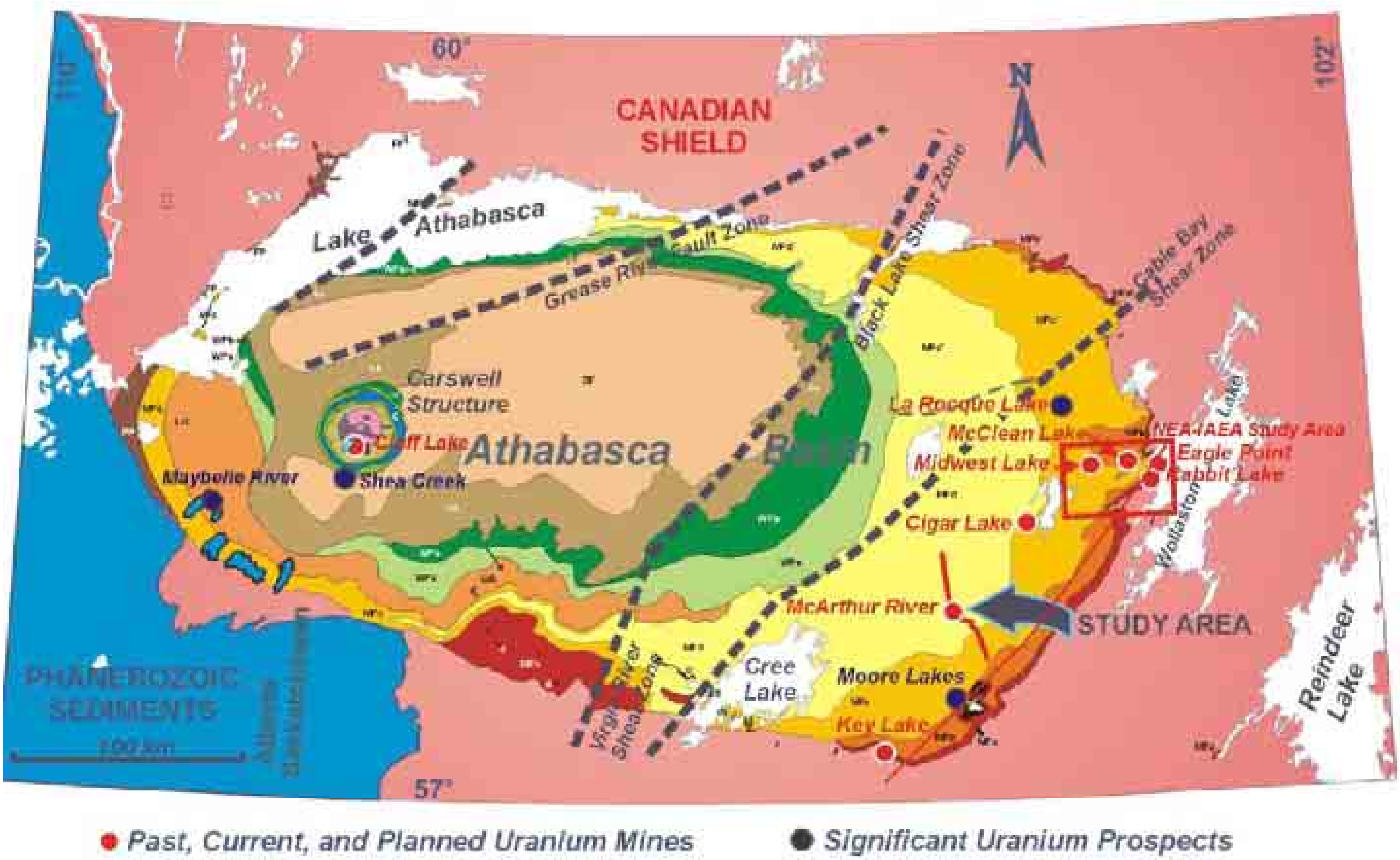
Southern Saskatchewan, Canada: Les Prairies

Southern Saskatchewan, Canada: Les Prairies

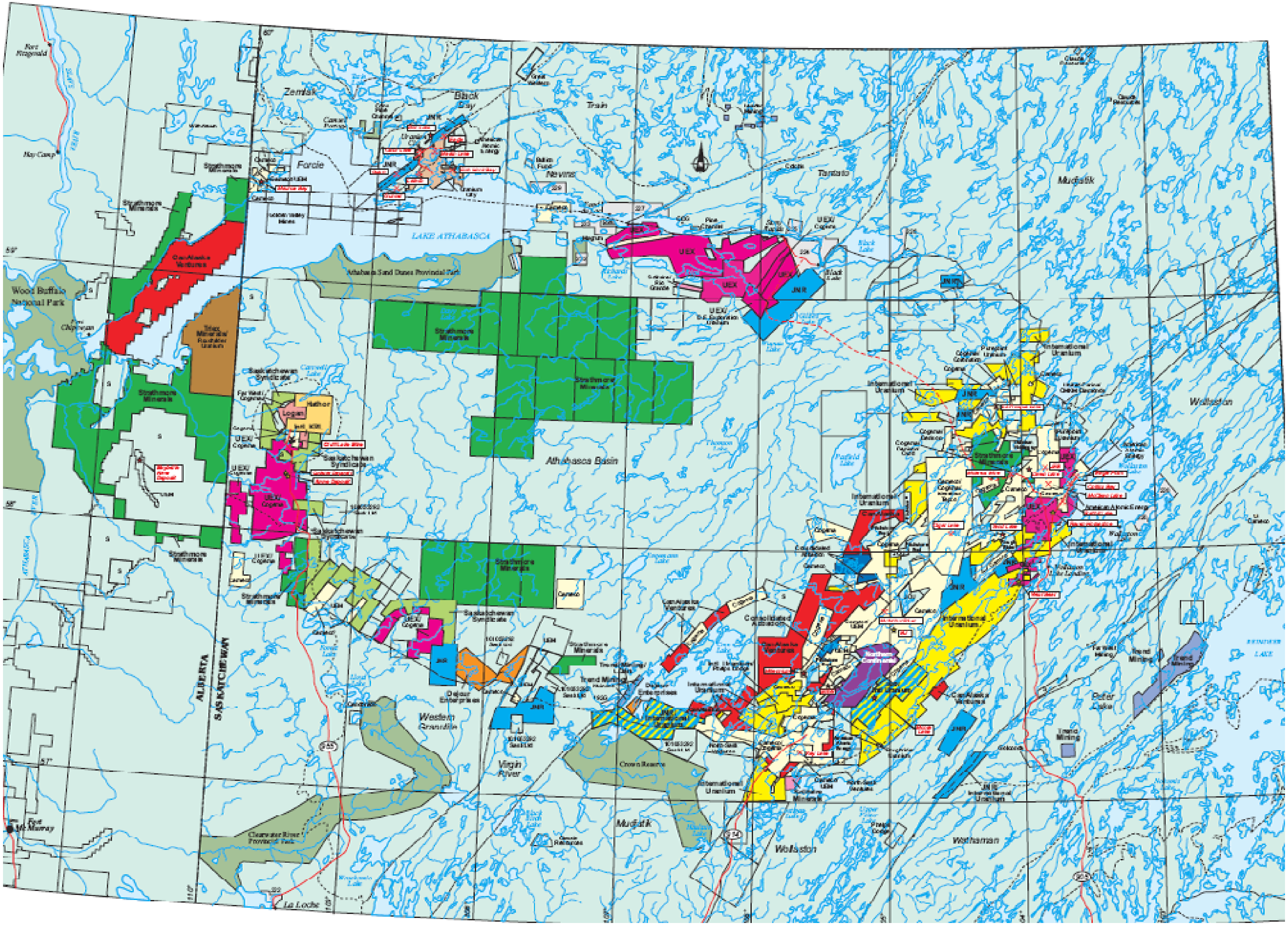
Northern
Saskatchewan,
Canada

Northern
Saskatchewan,
Canada

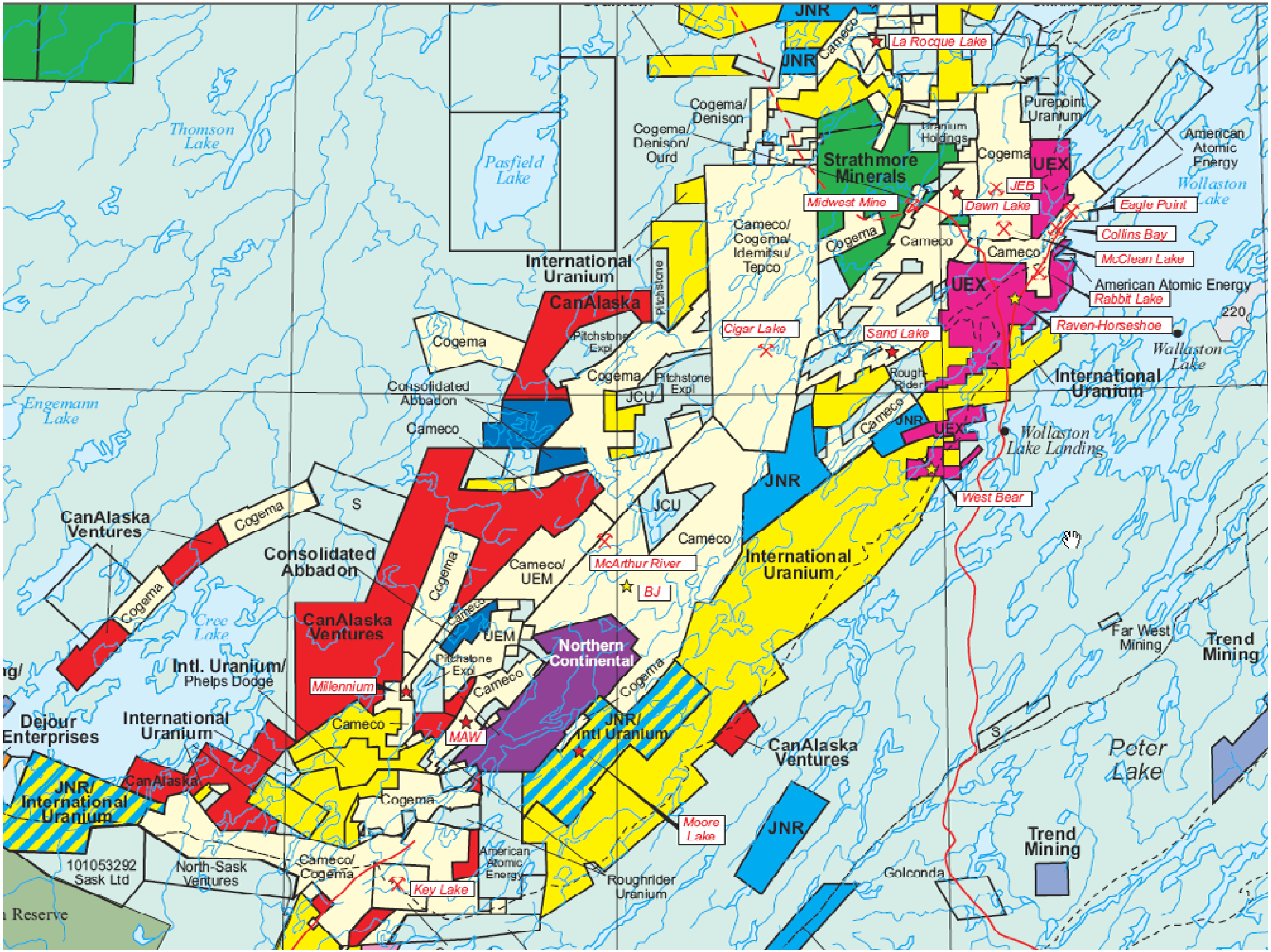
Northern Saskatchewan, Canada



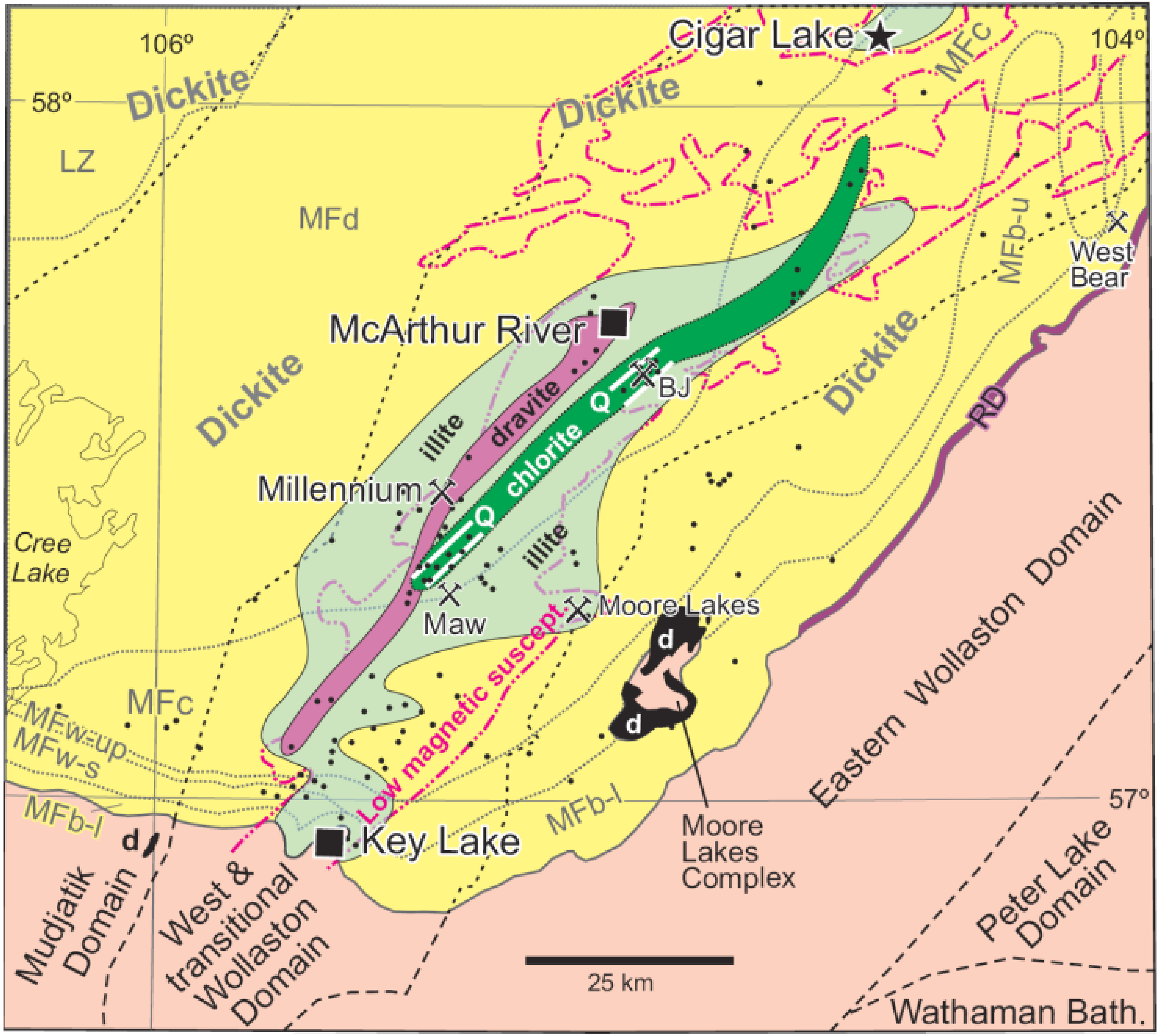
Athabasca Basin, northern Saskatchewan, Canada
Total resource: ~600,000 t U, average grade: ~2% U



Fort Fitzgerald
Hay Camp
Zemlak
Black Bay
Forcie
Nevins
Train
Tantato
Mudjatik
LAKE ATHABASCA
Athabasca Sand Dunes Provincial Park
Wood Buffalo National Park
Fort Chipewyan
CanAlaska Ventures
Strathmore Minerals
Saskatchewan Syndicate
Hathor
Logan
UEX
Cogema
JNR
Athabasca Basin
International Uranium
Wollaston
Trend Mining
Dejour Enterprises
Virgin River
Crown Reserve
Clearwater River Provincial Park
Fort McMurray
La Loche
Wathaman
Peter Lake
ALBERTA
SASKATCHEWAN


JNR
La Rocque Lake
Cameco
Cogema/
Denison
Cogema/
Denison/
Ourd
Purepoint
Uranium
American
Atomic
Energy
Wollaston
Lake
Thomson
Lake
Pasfield
Lake
Strathmore
Minerals
Cogema
UEX
JEB
Midwest Mine
Dawn Lake
Eagle Point
Collins Bay
McClean Lake
Cameco/
Cogema/
Idemitsu/
Tepco
International
Uranium
Pitchstone
CanAlaska
UEX
American Atomic Energy
Rabbit Lake
Raven-Horseshoe
Cigar Lake
Sand Lake
Pitchstone
Expl
Wollaston
Lake
International
Uranium
Rough-
Rider
Consolidated
Abbadon
JCU
Engemann
Lake
Cameco
JNR
UEX
Wollaston
Lake Landing
West Bear
S
CanAlaska
Ventures
Consolidated
Abbadon
Cameco/
UEM
McArthur River
International
Uranium
BJ
Cree
Lake
CanAlaska
Ventures
UEM
Northern
Continental
Far West
Mining
Trend
Mining
Intl. Uranium/
Phelps Dodge
Millennium
Pitchstone
Expl
Dejour
Enterprises
International
Uranium
MAW
JNR/
Intl Uranium
CanAlaska
Ventures
Peter
Lake
JNR/
International
Uranium
CanAlaska
Moore
Lake
JNR
Trend
Mining
101053292
Sask Ltd
North-Sask
Ventures
Cameco/
Cogema
American
Atomic
Energy
Roughrider
Uranium
Golconda
Key Lake
Reserve

SE corner of the Athabasca Basin



Hydrothermal alteration in the Athabasca sandstone near the unconformity to the Archean/Paleoproterozoic basement (light pink color)

Key Lake: Gärtner pit

Key Lake: Deilmann pit
Production of Deilmann + Gärtner pits: 40,000 t U (~1% U)

Key Lake: Deilmann Pit

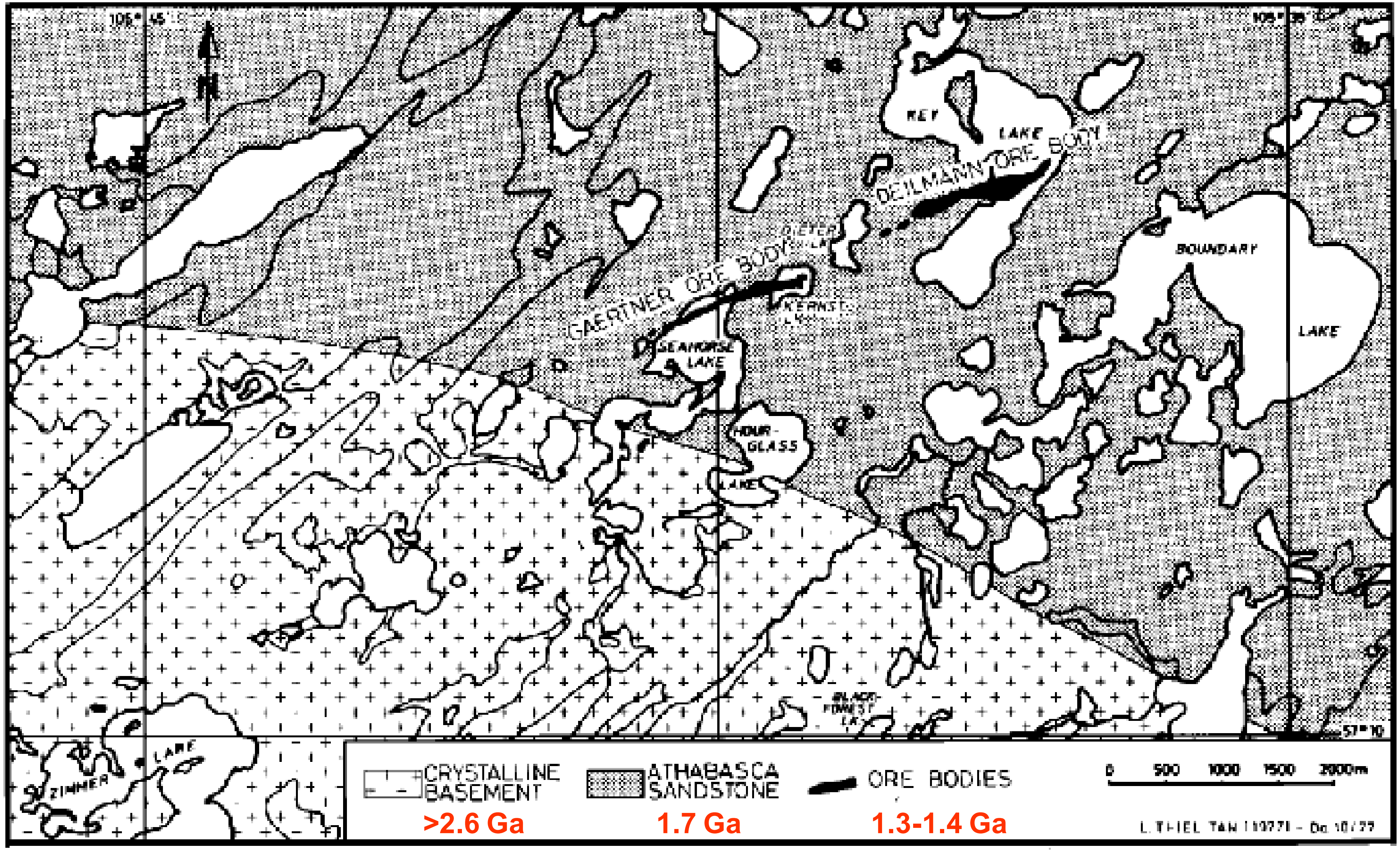
Basal unit of the 1.7 Ga Athabasca sandstone

Basal unit of the 1.7 Ga Athabasca sandstone

Archean basement with graphite-rich rocks

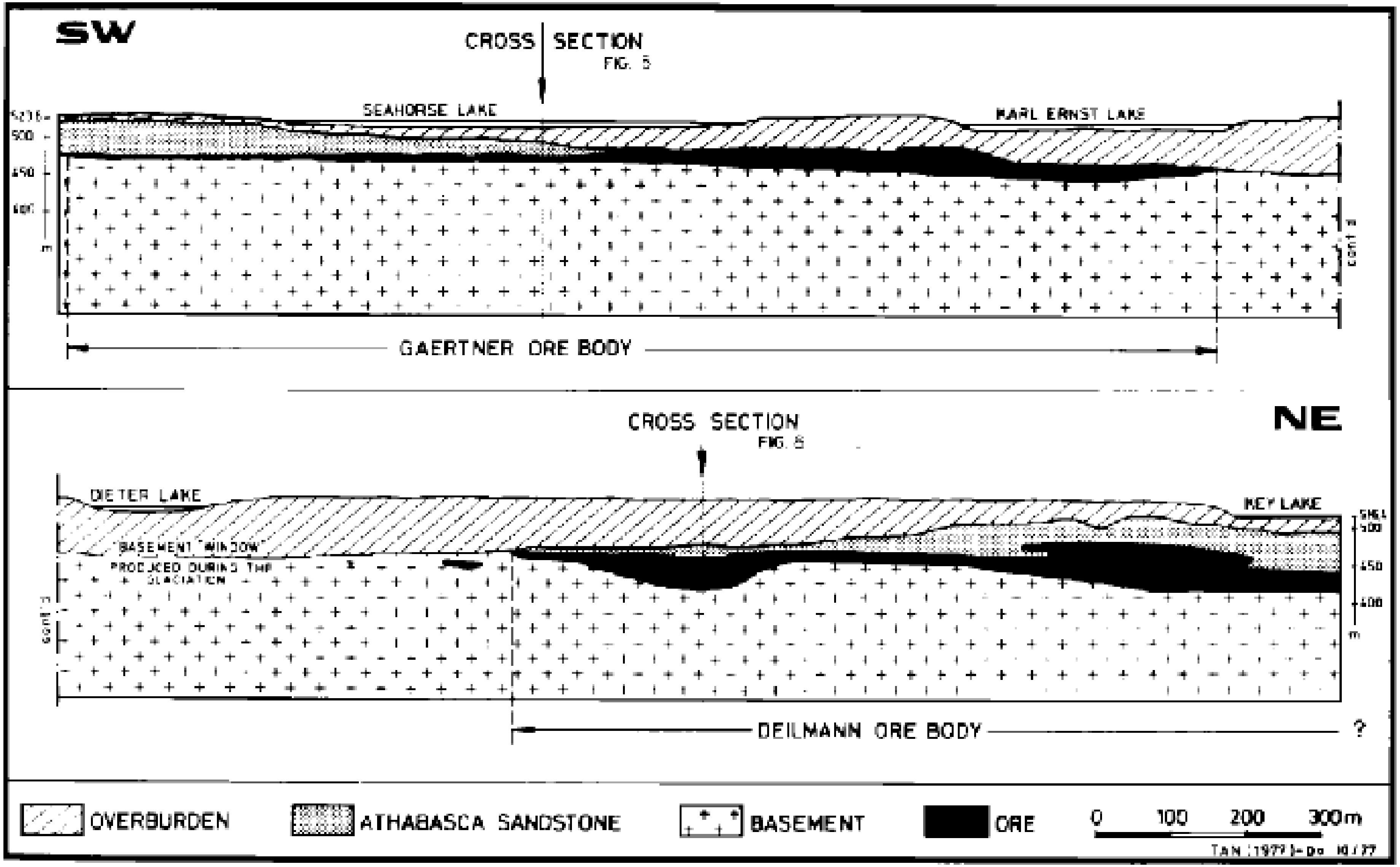
Archean basement with sheared graphite-rich rocks

Key Lake: Deilmann Pit



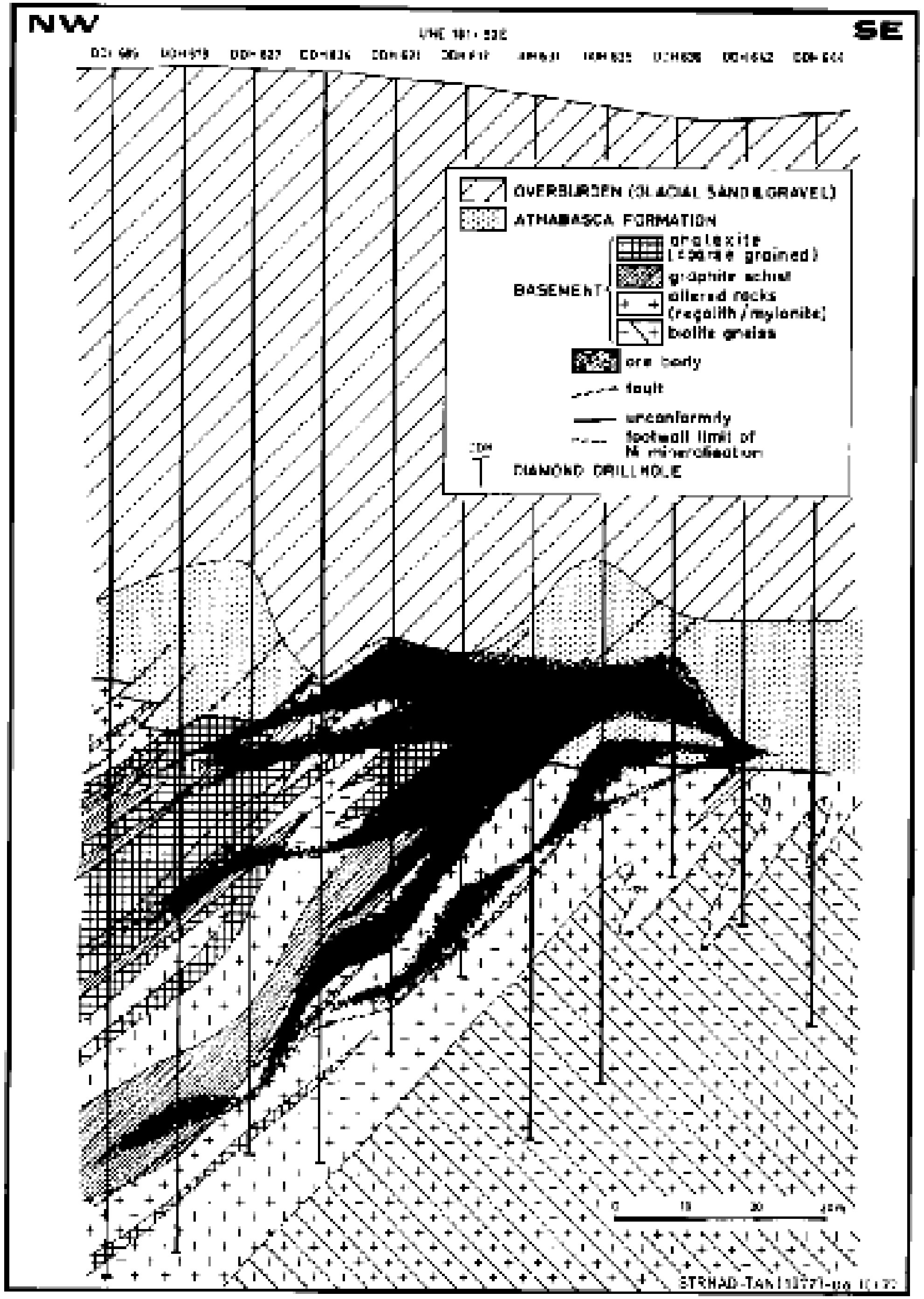
Geology of the Key Lake uranium deposits

Dahlkamp (1978) EG 73: 1430-1449



Longitudinal sections of the Key Lake uranium deposits
~40,000 t U

Dahlkamp (1978) EG 73: 1430-1449

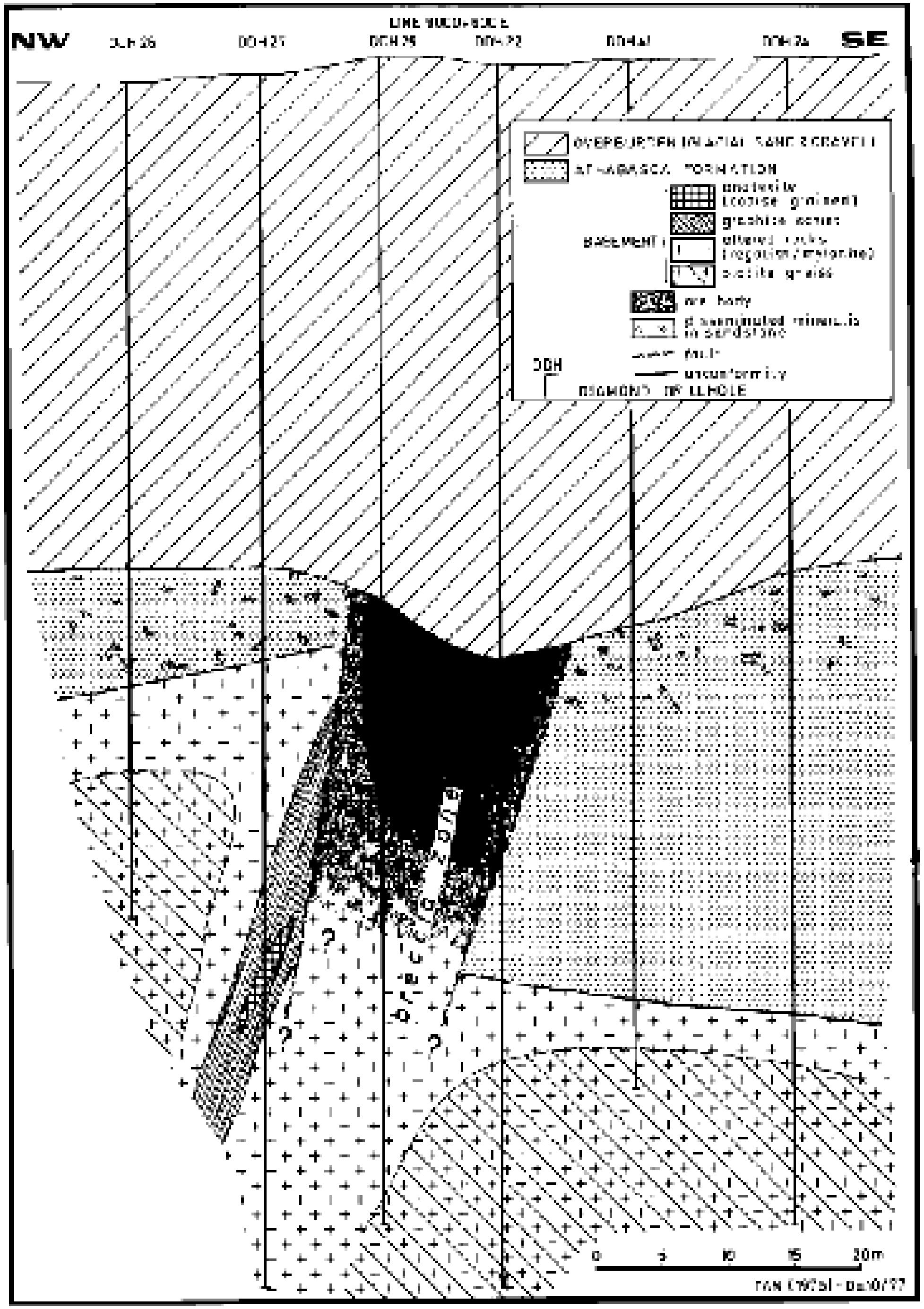


Cross section of the Deilmann orebody, Key Lake

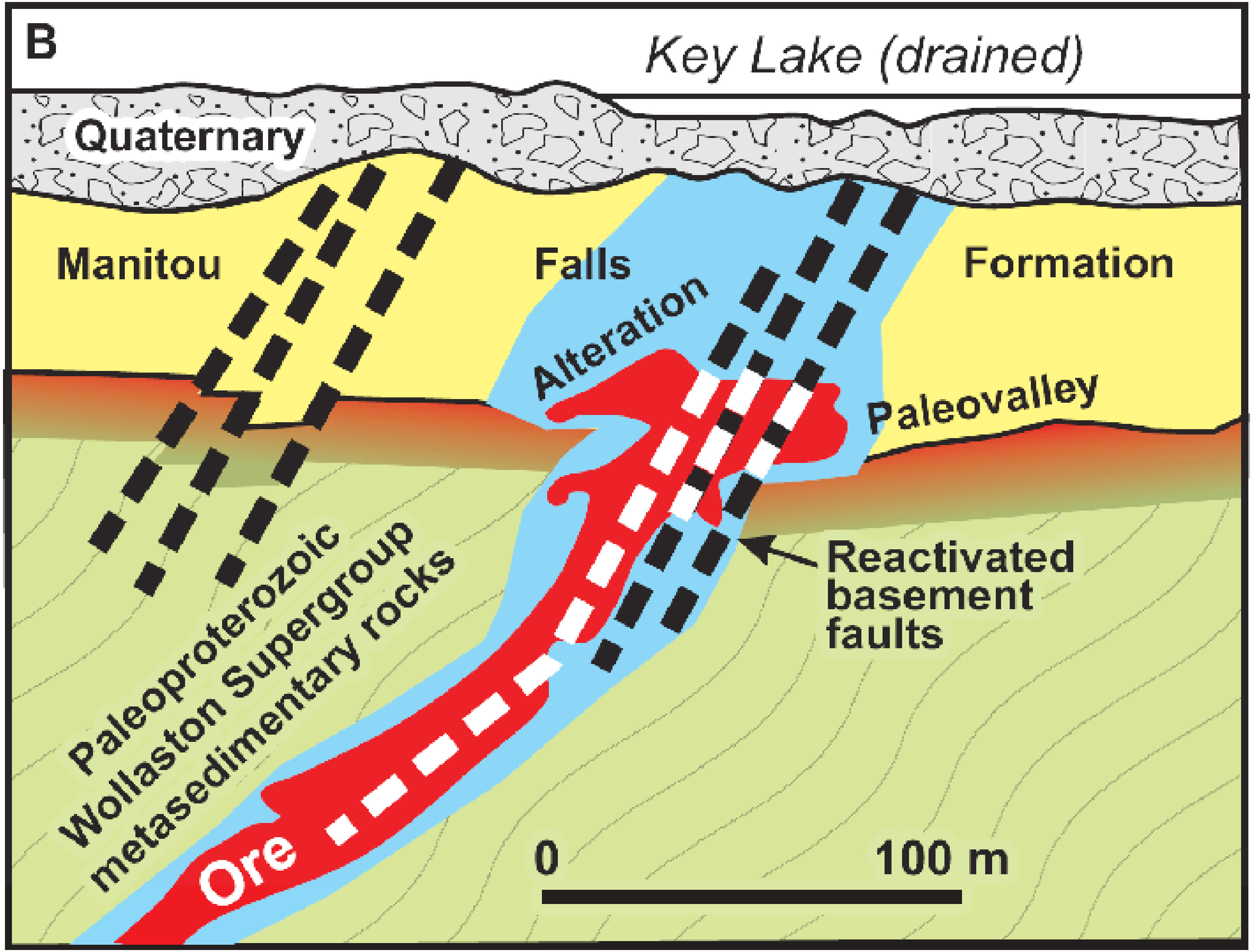
Orebodies with up to 30 % U and 15 % Ni

Dahlkamp (1978) EG 73: 1430-1449

Cross section of the Gärtner orebody, Key Lake



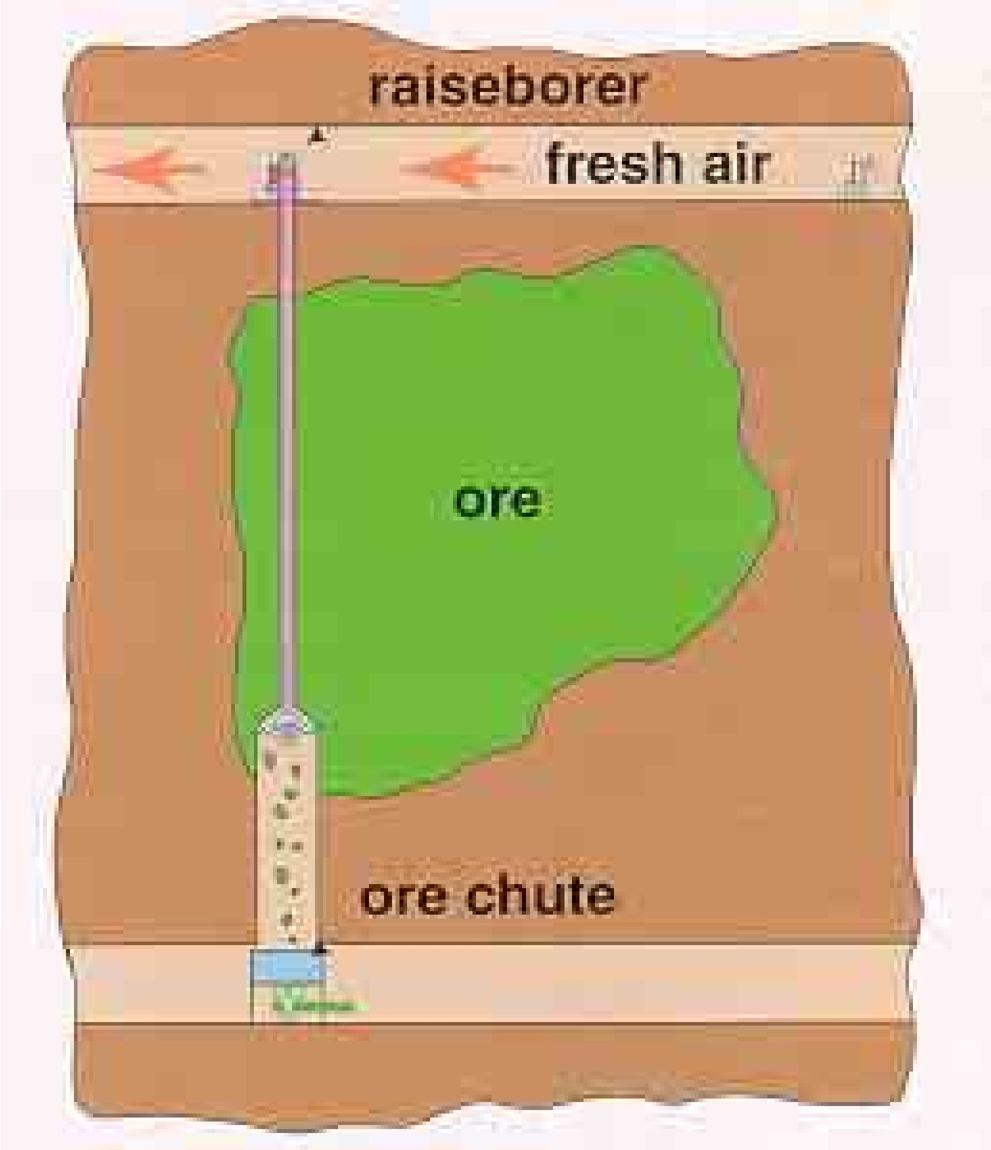
Dahlkamp (1978) EG 73: 1430-1449



B
Key Lake (drained)
Quaternary
Manitou
Falls
Formation
Alteration
Paleovalley
Reactivated basement faults
Paleoproterozoic Wollaston Supergroup metasedimentary rocks
Ore
0
100 m

McArthur River mine, Metal tonnage: 80,000 t U (measured) At 15 % U + 63,000 t U (inferred) at 22%U

McArthur River high-grade drill core



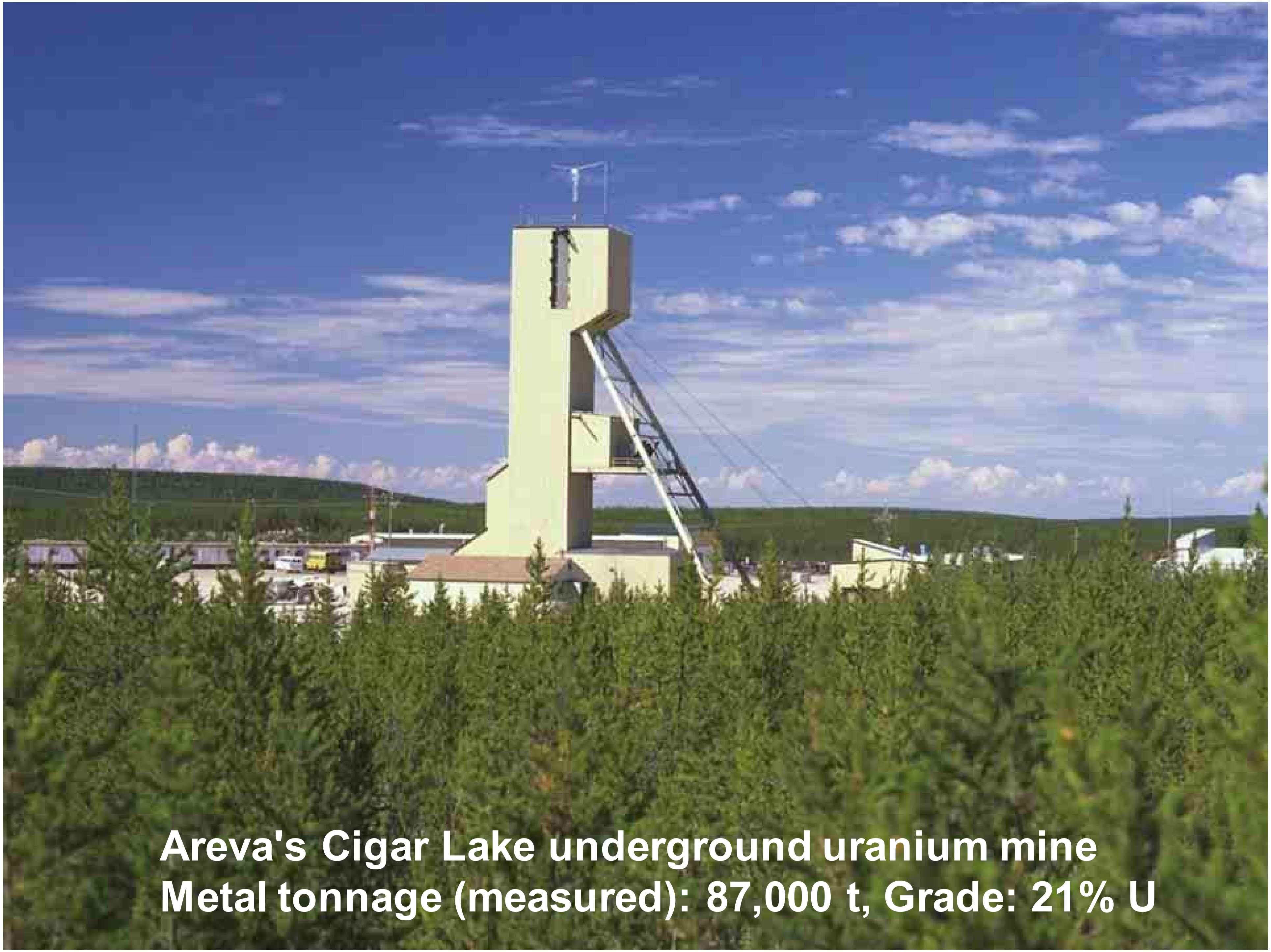
530 m level

640 m level

McArthur River: Raiseboring after ground freezing

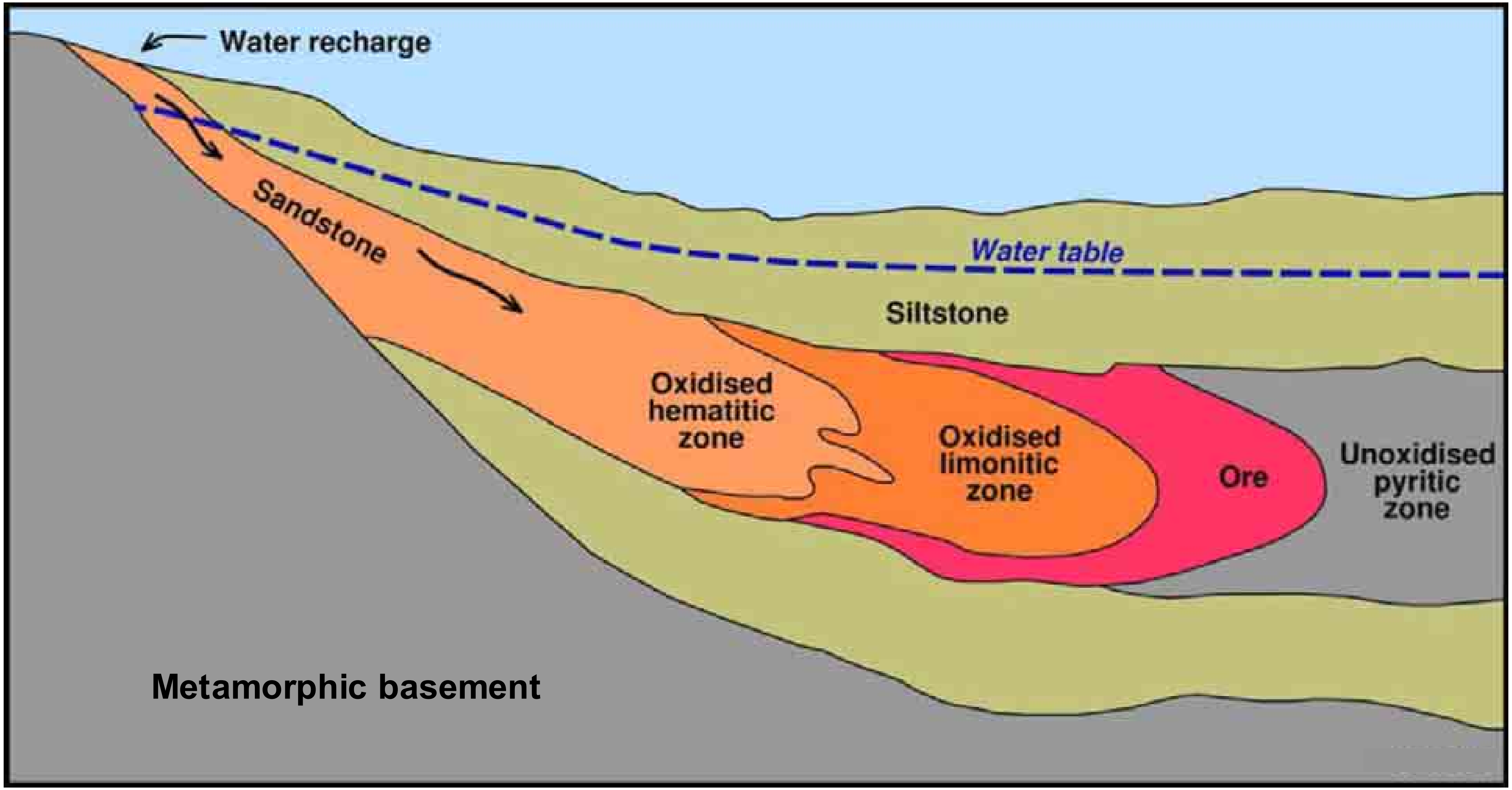
Raisebore drilling
at
McArthur River

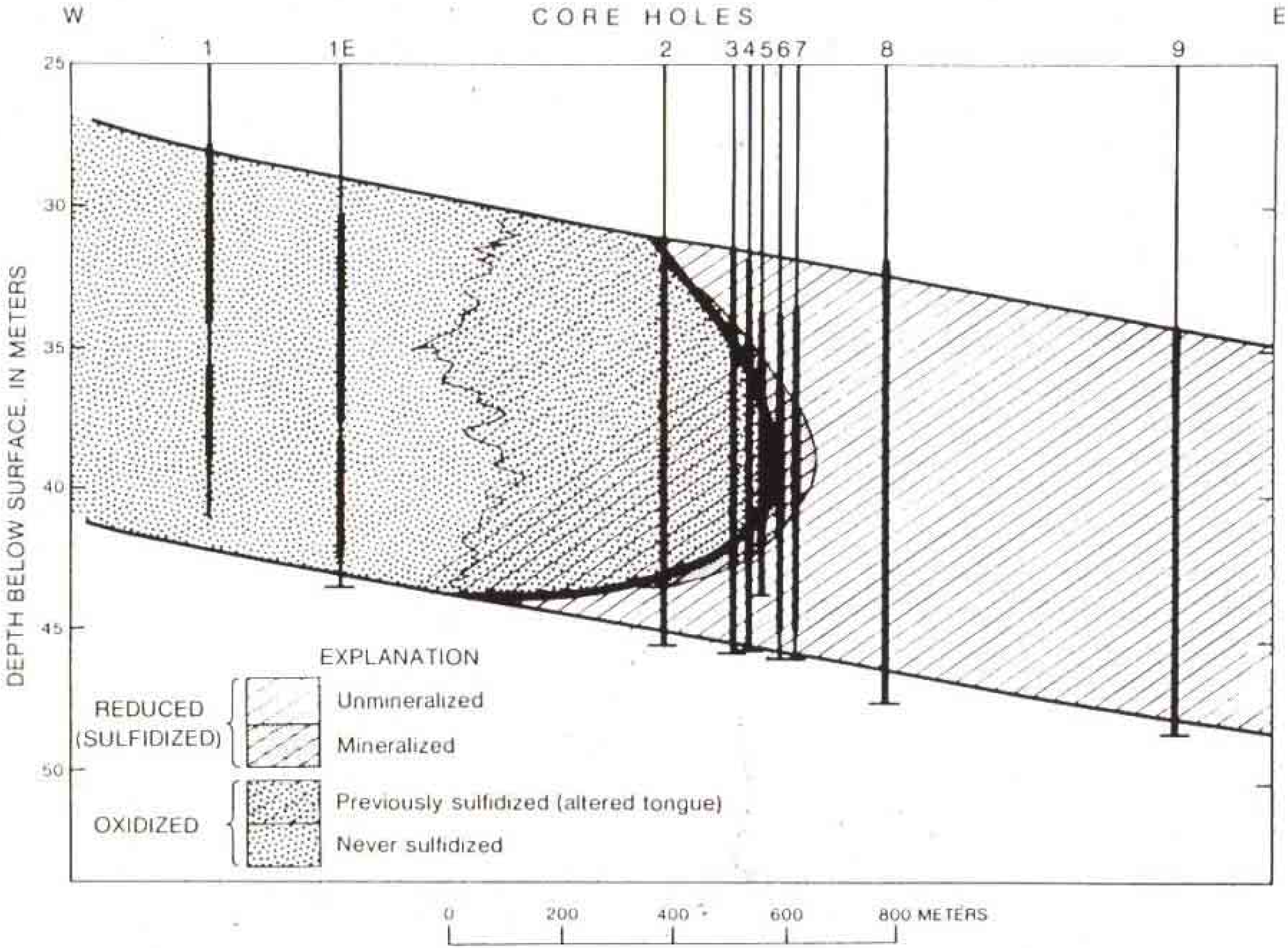

Cigar Lake Uranium Mine
Image © 2008 TerraMetrics
5.00 km
Google
58°02'46.11" N 104°29'46.63" W
Sichthöhe 17.25 km



Areva's Cigar Lake underground uranium mine
Metal tonnage (measured): 87,000 t, Grade: 21% U

Rollfront uranium deposits in sandstone



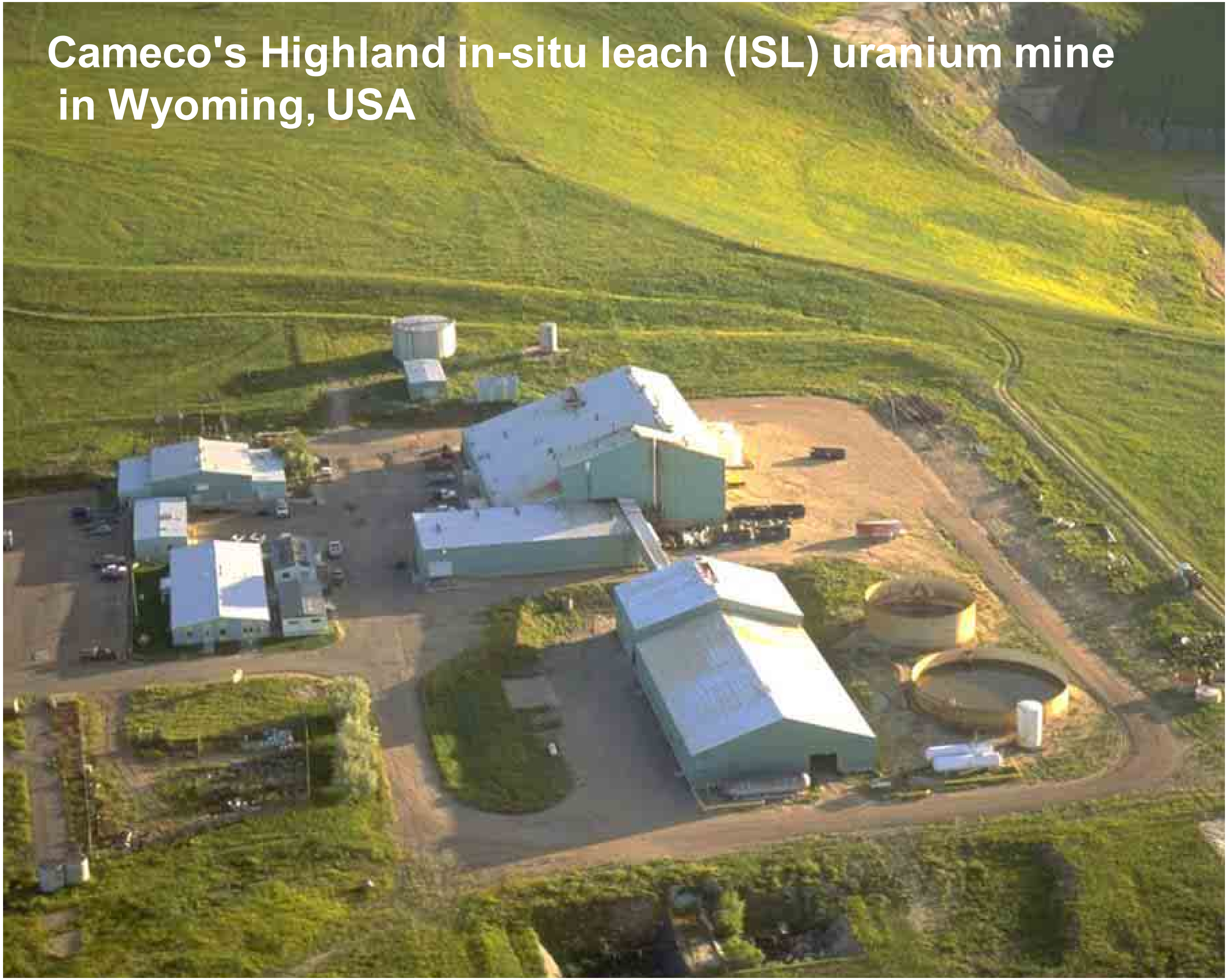


Roll front uranium deposits

Lodève, France

Lodève, France

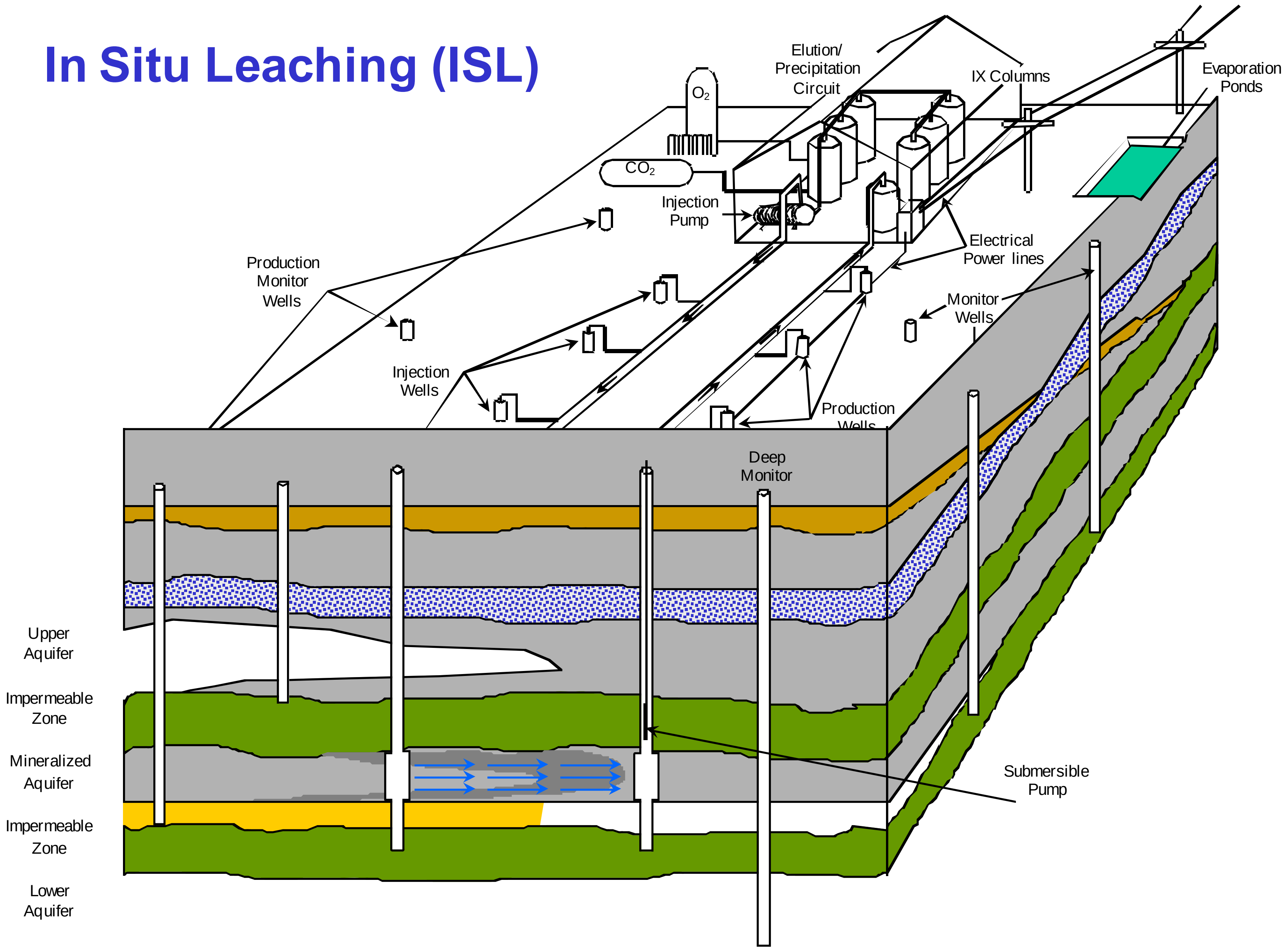
Tyuyamunite (Ca-U-V hydrate) from evapotranspiration.
Wyoming, USA

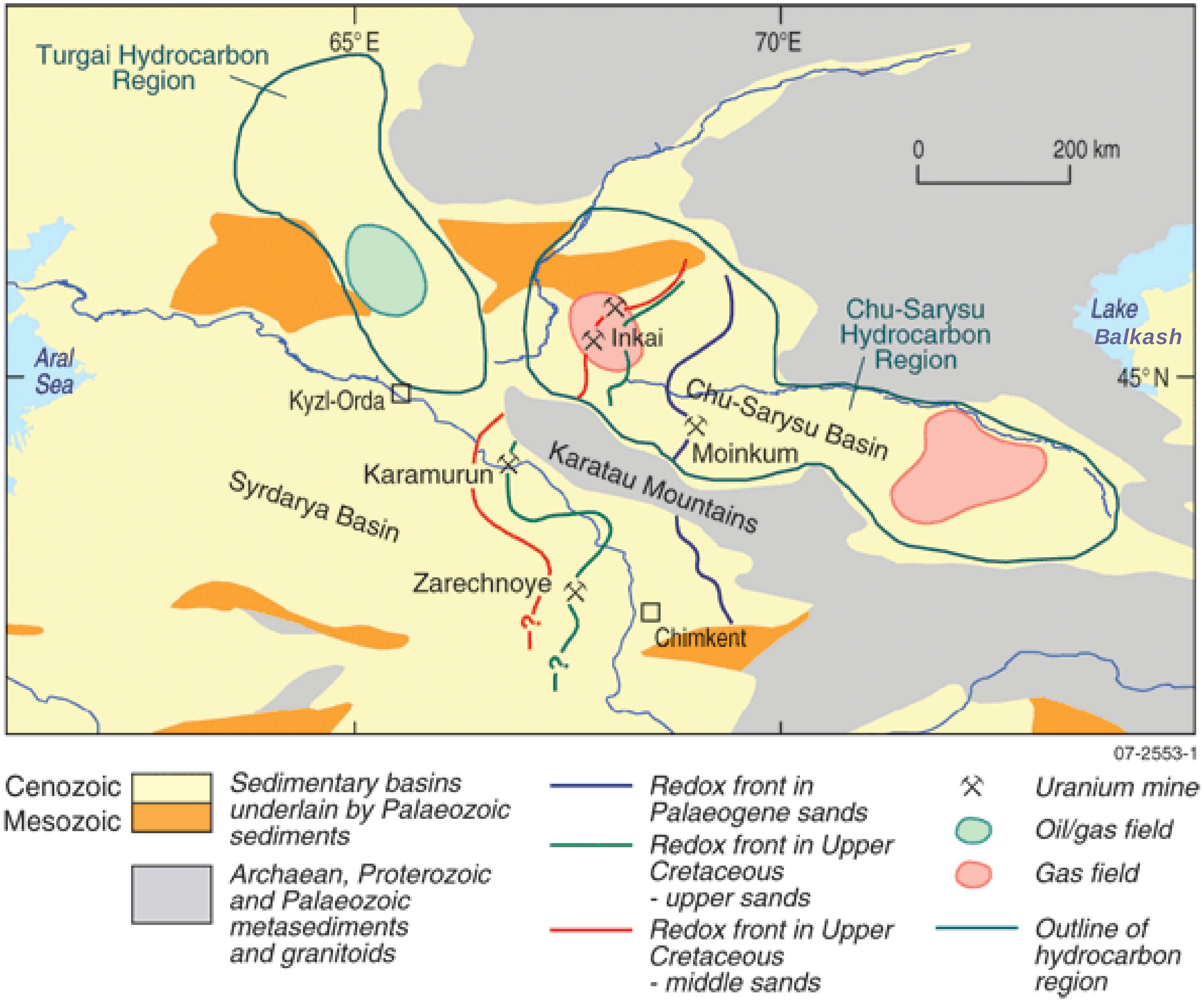

Cameco's Highland in-situ leach (ISL) uranium mine
in Wyoming, USA


Beverley ISL uranium mine
in South Australia (Heathgate Resources)

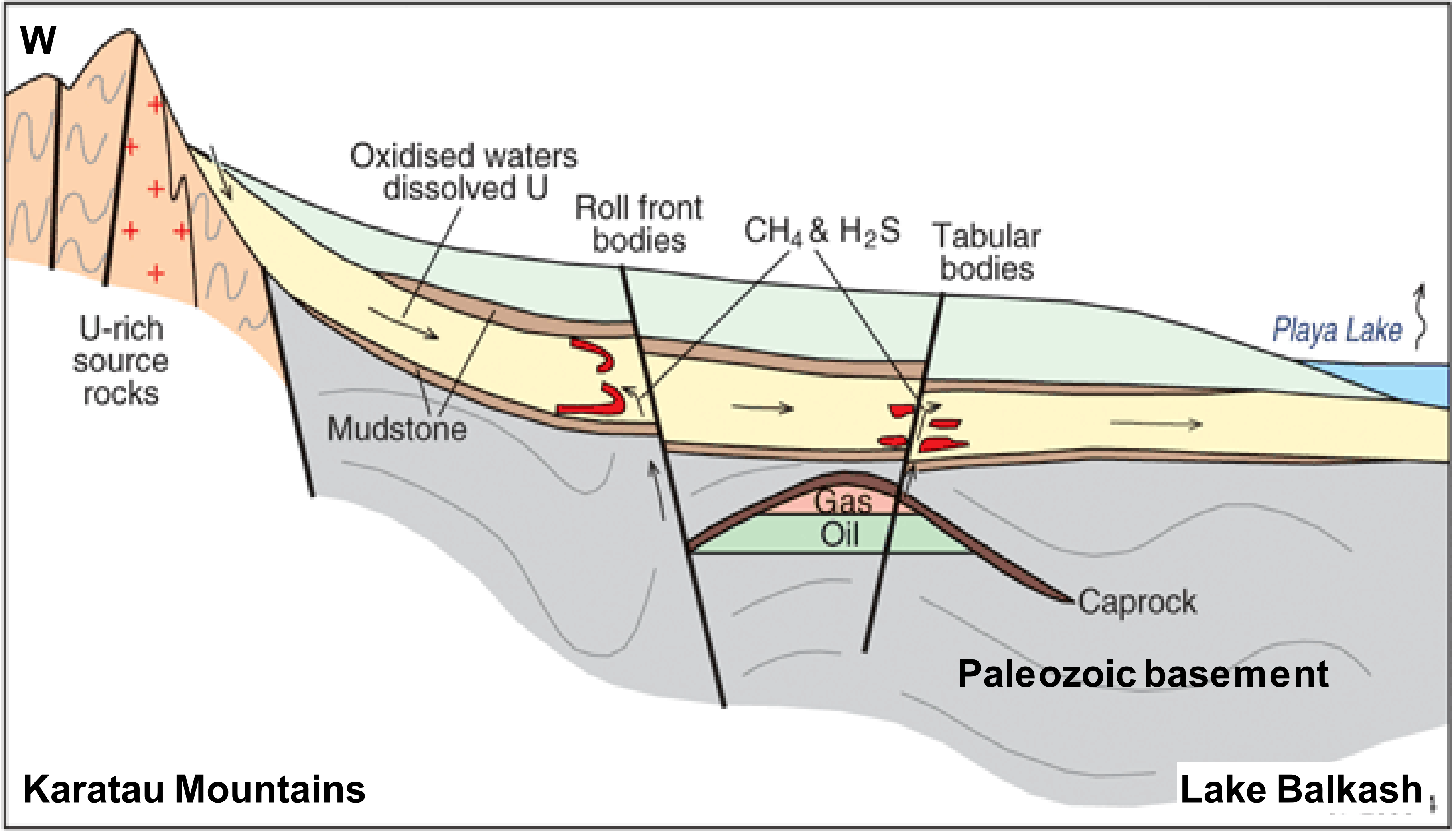
Beverley ISL uranium mine in Australia (Heathgate Resources)

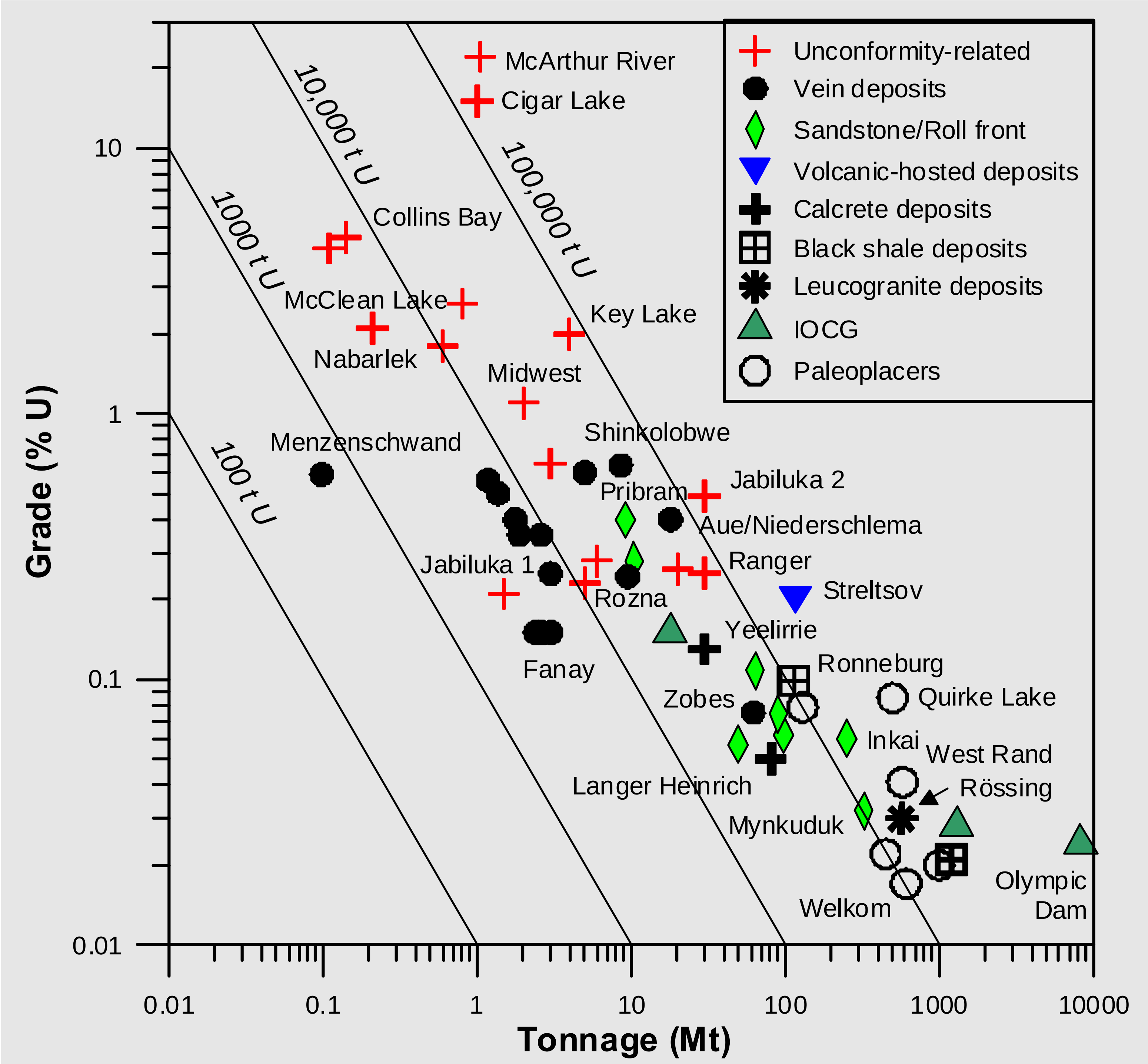
In Situ Leaching (ISL)





Chu-Sarysu and Syrdarya basins in central Kazakhstan: Resource in Late Cretaceous to Paleogene sandstone: 1.1 Gt U


W
U-rich
source
rocks
Oxidised waters
dissolved U
Roll front
bodies
CH4 & H2S
Tabular
bodies
Playa Lake
Mudstone
Gas
Oil
Caprock
Paleozoic basement
Karatau Mountains
Lake Balkash



Unconformity-related
Vein deposits
Sandstone/Roll front
Volcanic-hosted deposits
Calcrete deposits
Black shale deposits
Leucogranite deposits
IOCG
Paleoplacers
10,000 t U
100,000 t U
1000 t U
100 t U
McArthur River
Cigar Lake
Collins Bay
McClean Lake
Nabarlek
Key Lake
Midwest
Menzenschwand
Shinkolobwe
Jabiluka 2
Pribram
Aue/Niederschlema
Ranger
Jabiluka 1
Rozna
Streltsov
Yeelirrie
Fanay
Ronneburg
Zobes
Quirke Lake
Inkai
West Rand
Rössing
Langer Heinrich
Mynkuduk
Olympic Dam
Welkom
Grade (% U)
10
1
0.1
0.01
Tonnage (Mt)
0.01
0.1
1
10
100
1000
10000

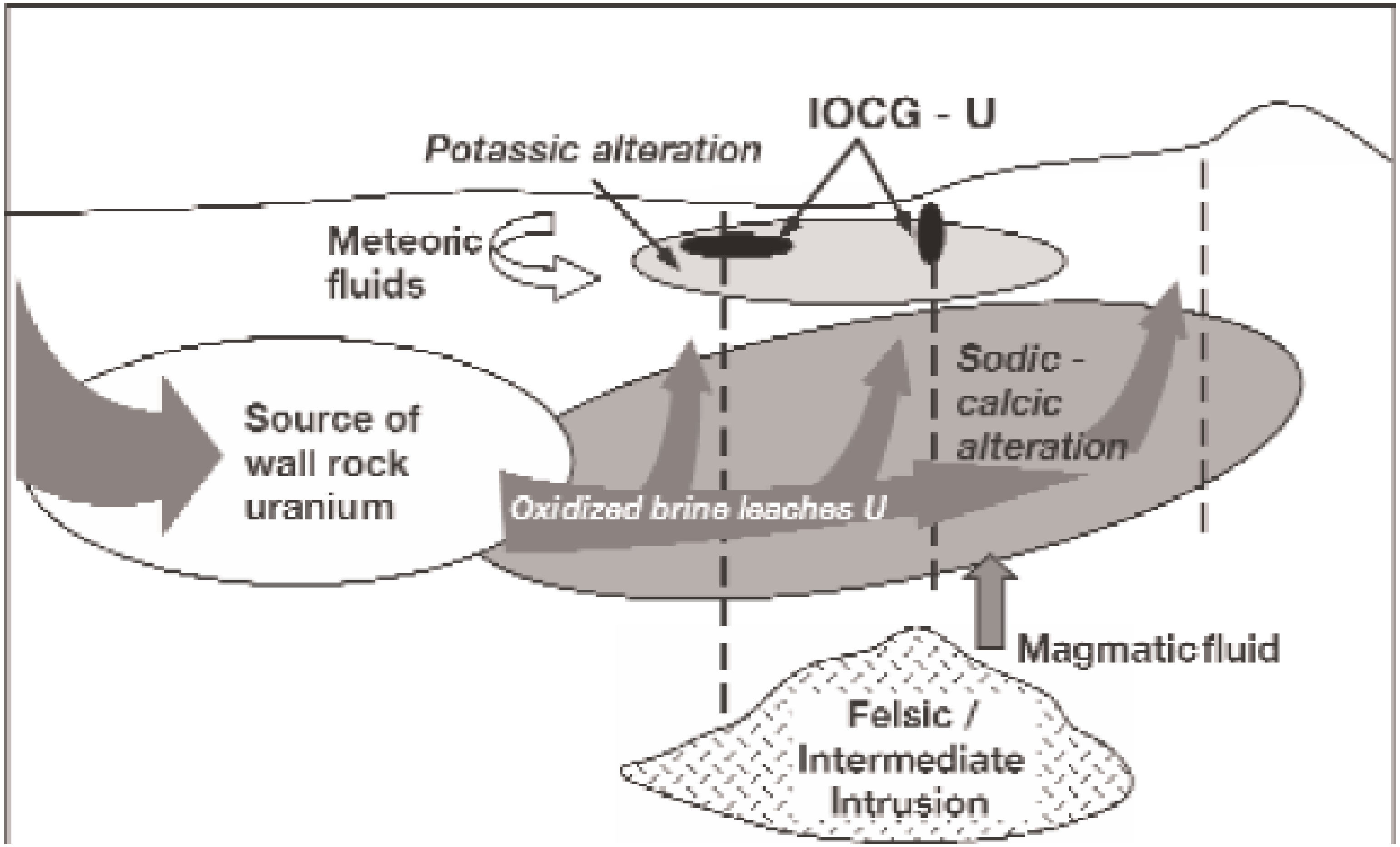
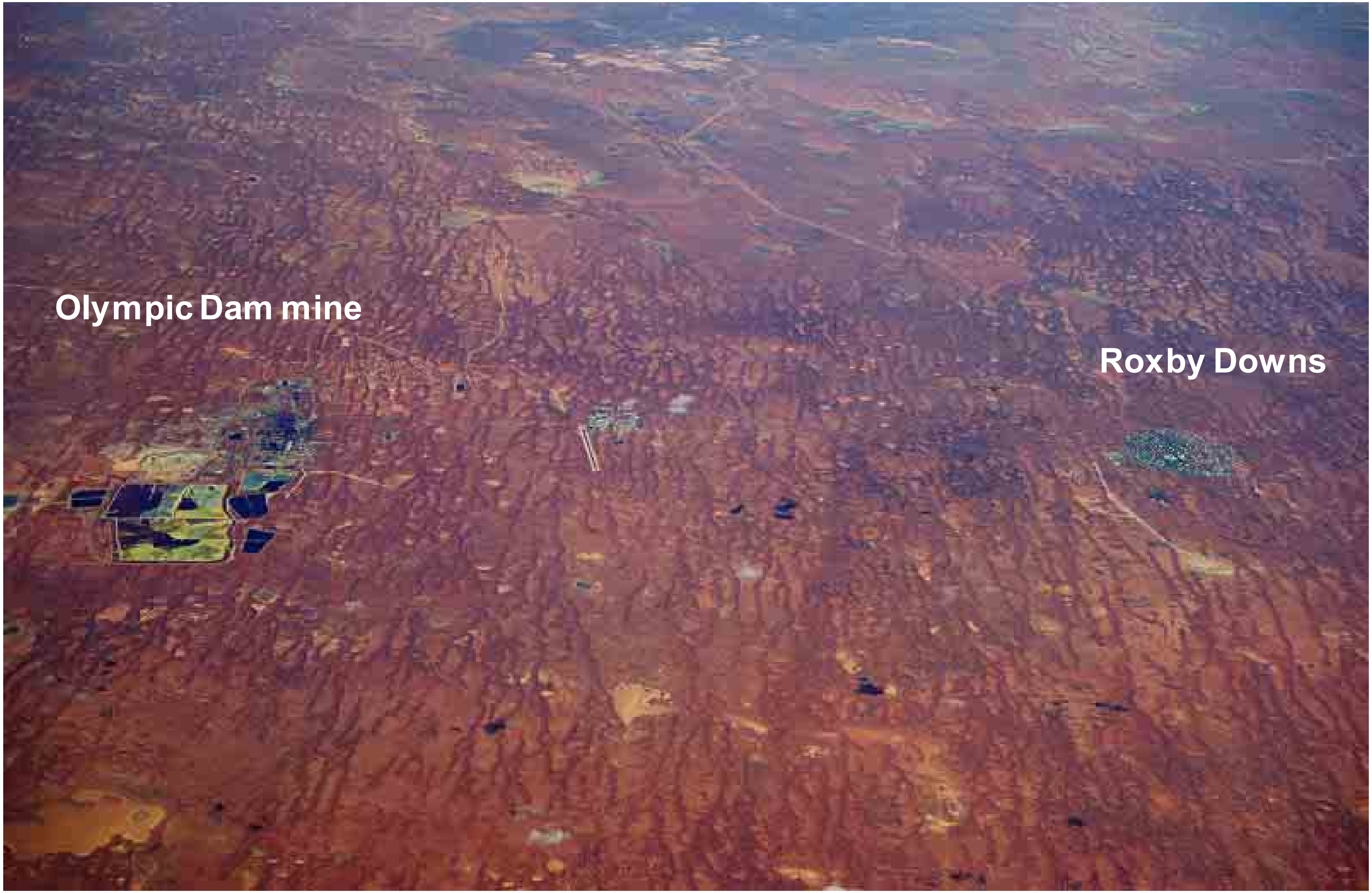


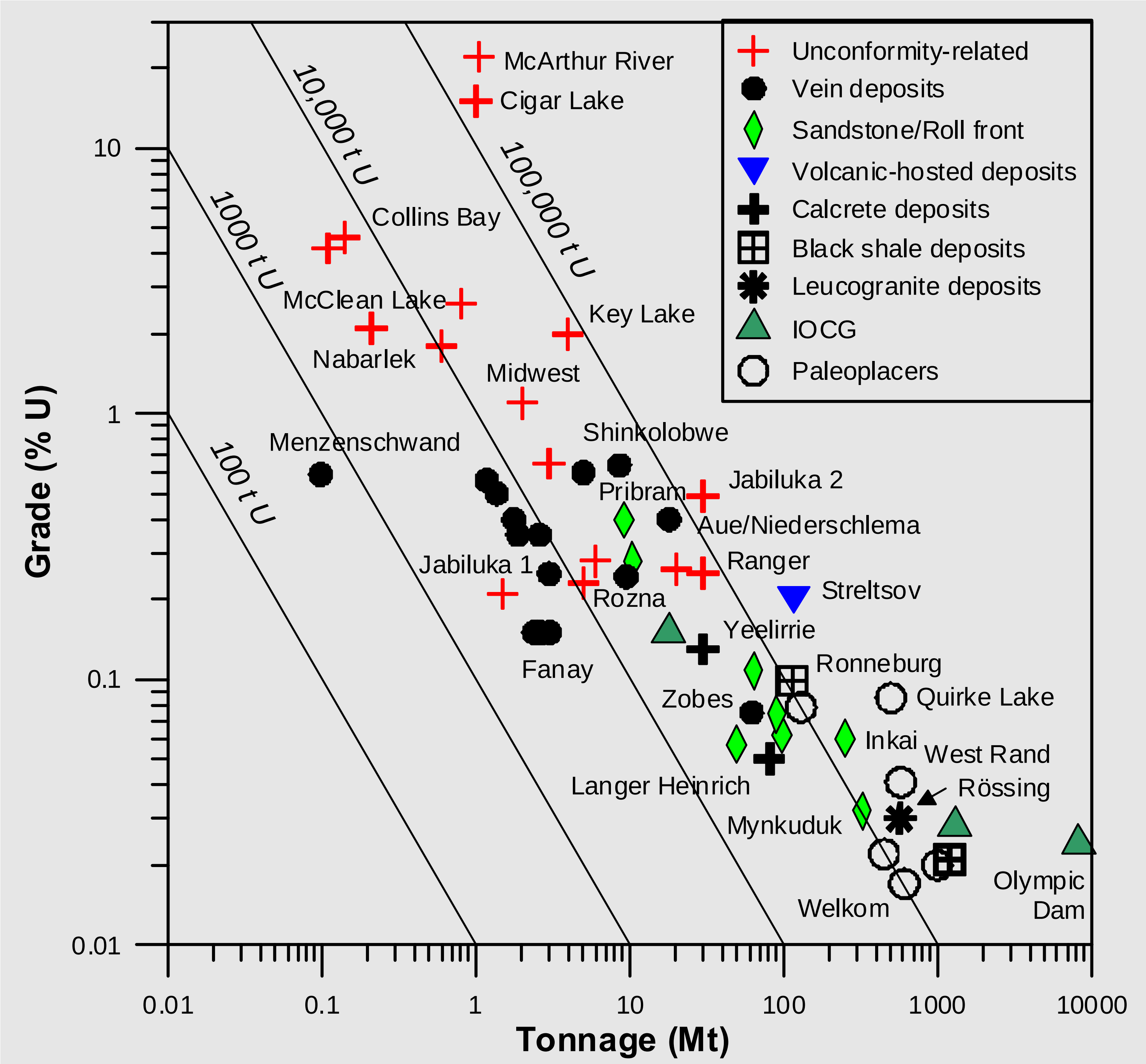
FIG. 2. Schematic model for the formation of uranium-rich IOCG deposits. In this model, uranium-rich IOCG deposits probably require a rich source of wall-rock uranium within the host-rock sequence altered as part of the IOCG system. Additional uranium could also be contributed by magmatic or meteoric fluids.

Hitzman and Valenta (2005) EG 100: 1661

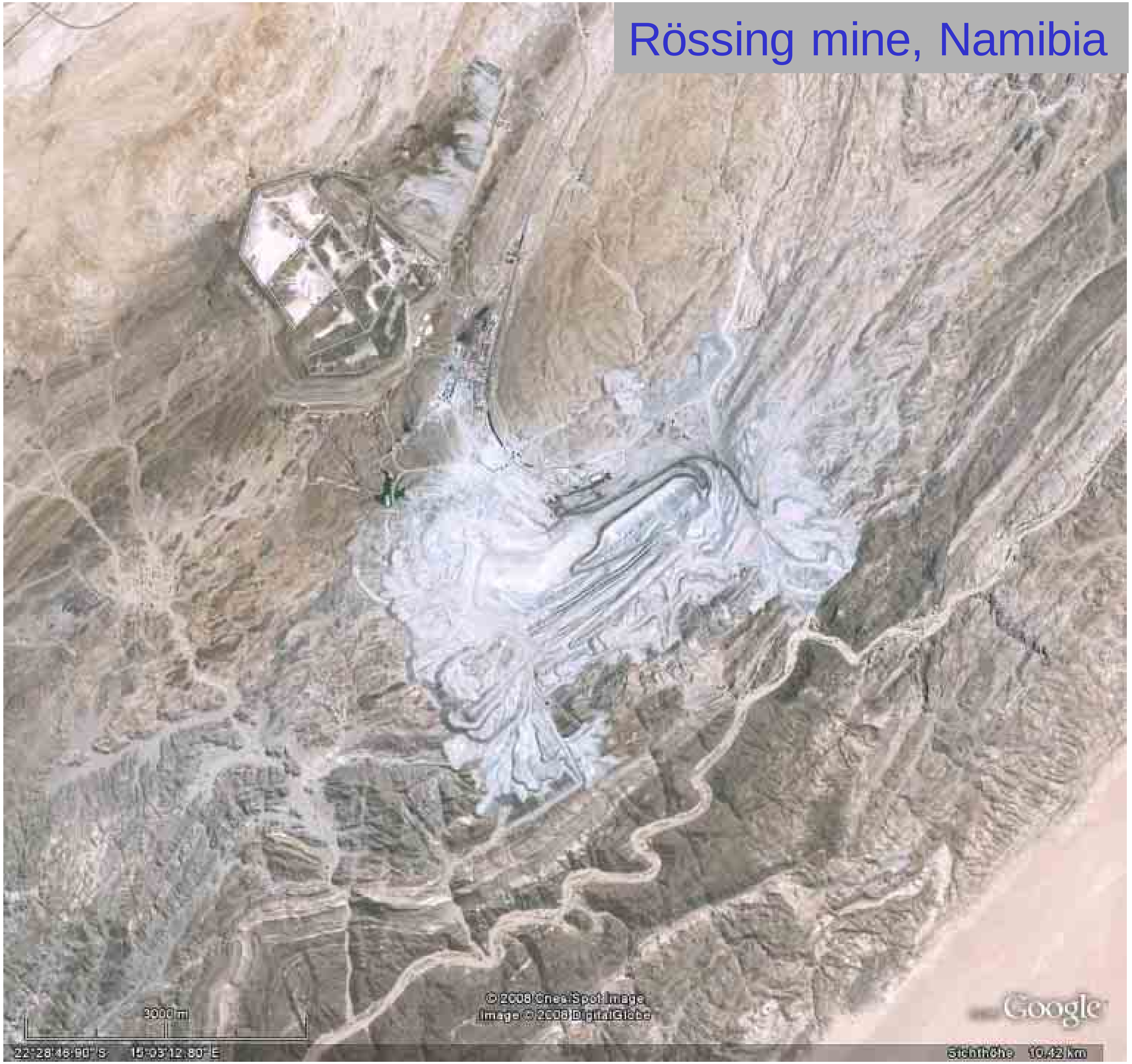


Olympic Dam resources (2008):

Measured resource	1.3 Gt @ 1.11 % Cu, 0.28 kg/t U, 0.32 g/t Au, 2.17 g/t Ag
Total resource	8.3 Gt @ 0.88 % Cu, 0.24 kg/t U, 0.31 g/t Au, 1.50 g/t Ag


Grade (% U)
Tonnage (Mt)
10
1
0.1
0.01
0.01
0.1
1
10
100
1000
10000
100 t U
1000 t U
10,000 t U
100,000 t U
Unconformity-related
Vein deposits
Sandstone/Roll front
Volcanic-hosted deposits
Calcrete deposits
Black shale deposits
Leucogranite deposits
IOCG
Paleoplacers
McArthur River
Cigar Lake
Collins Bay
McClean Lake
Nabarlek
Key Lake
Midwest
Menzenschwand
Shinkolobwe
Jabiluka 2
Pribram
Aue/Niederschlema
Jabiluka 1
Ranger
Rozna
Streltsov
Yeelirrie
Fanay
Ronneburg
Zobes
Quirke Lake
Inkai
West Rand
Langer Heinrich
Rössing
Mynkuduk
Olympic Dam
Welkom

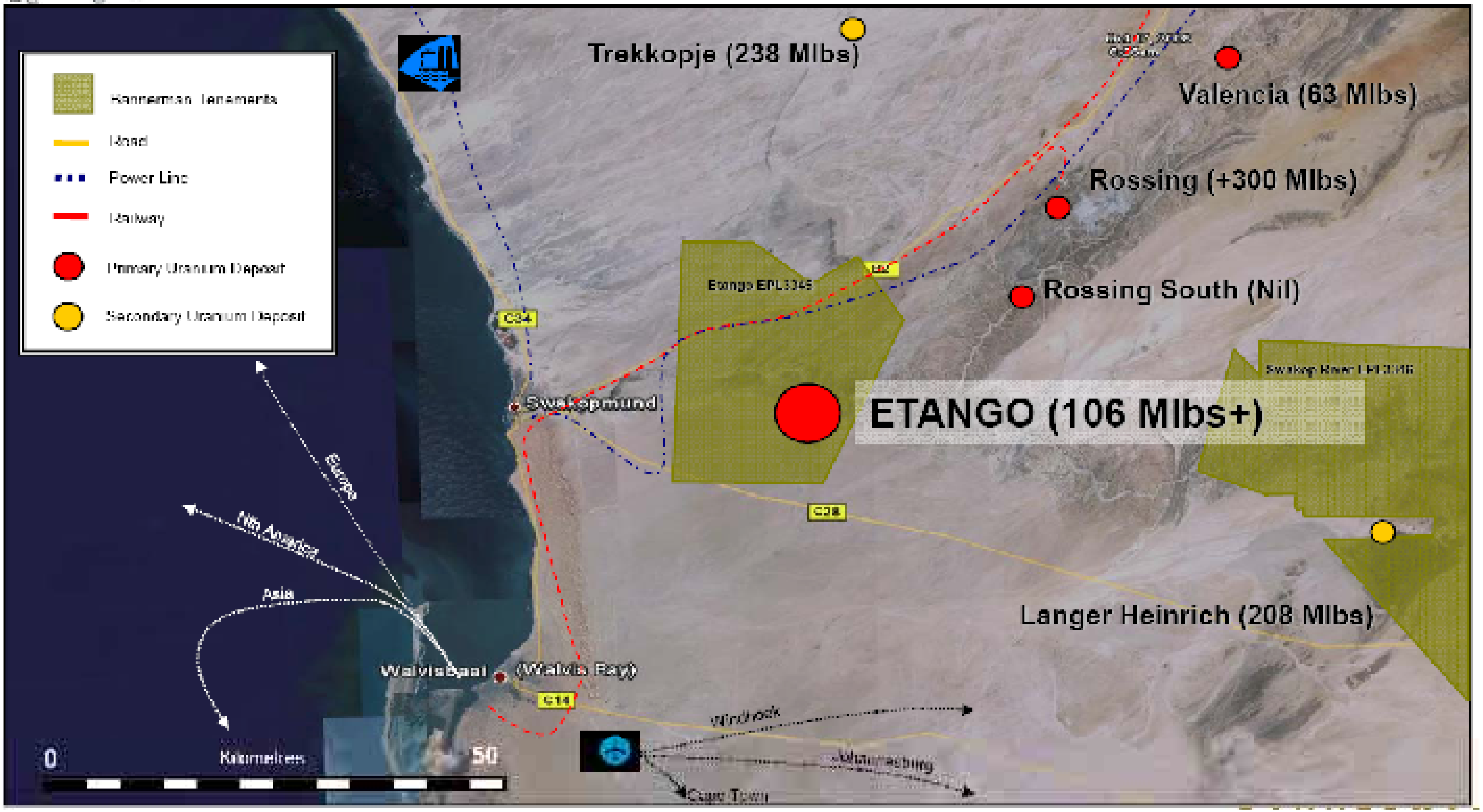
Rössing mine, Namibia



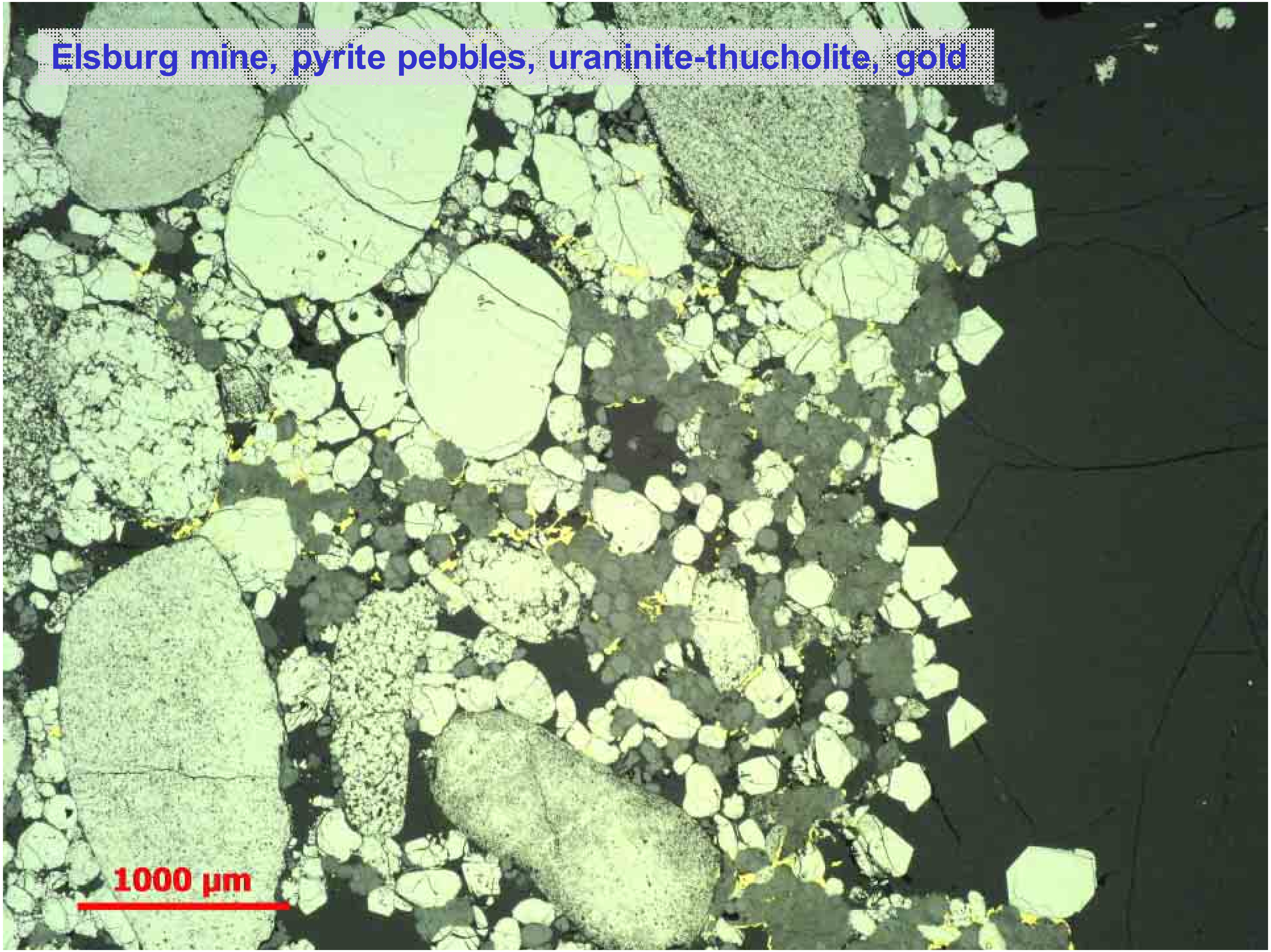
Rössing mine, Namibia in alaskite: 100,000 t U (0.037 % U)
4,000 t U/a; 69 % Rio Tinto, 16 % Govnt of Iran

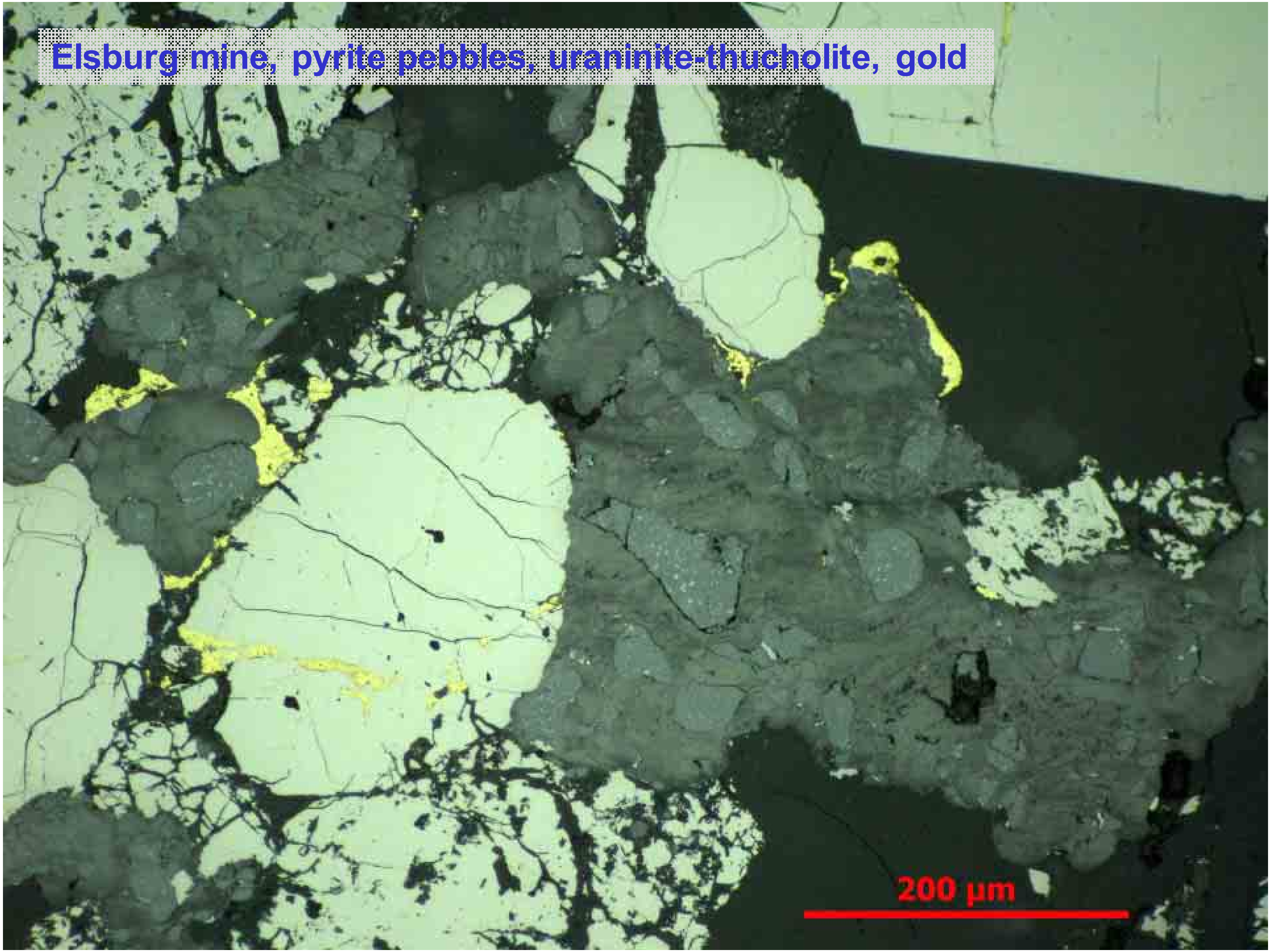
Rössing:
Alaskite (Leucogranite)

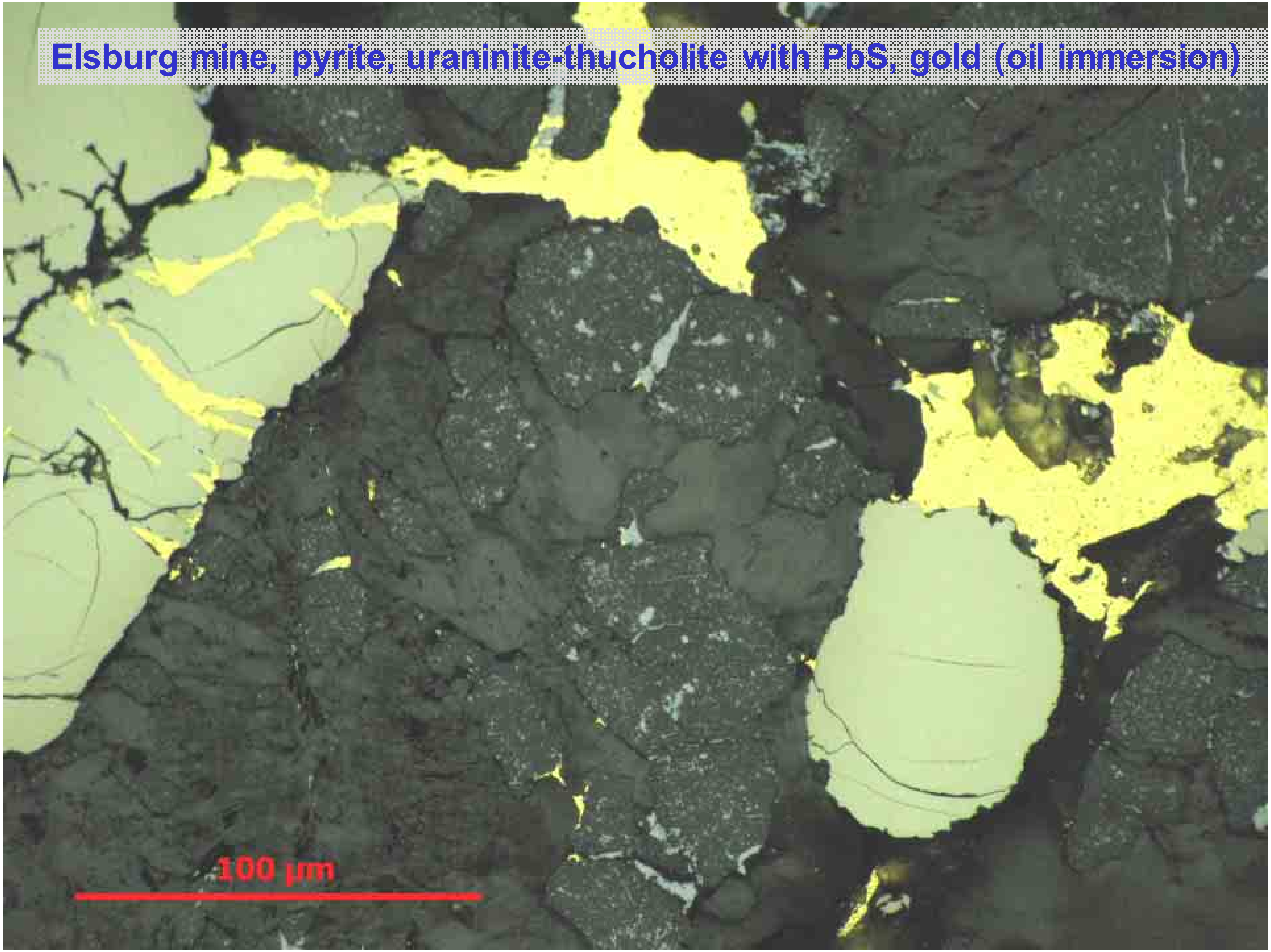
Erongo Uranium Province



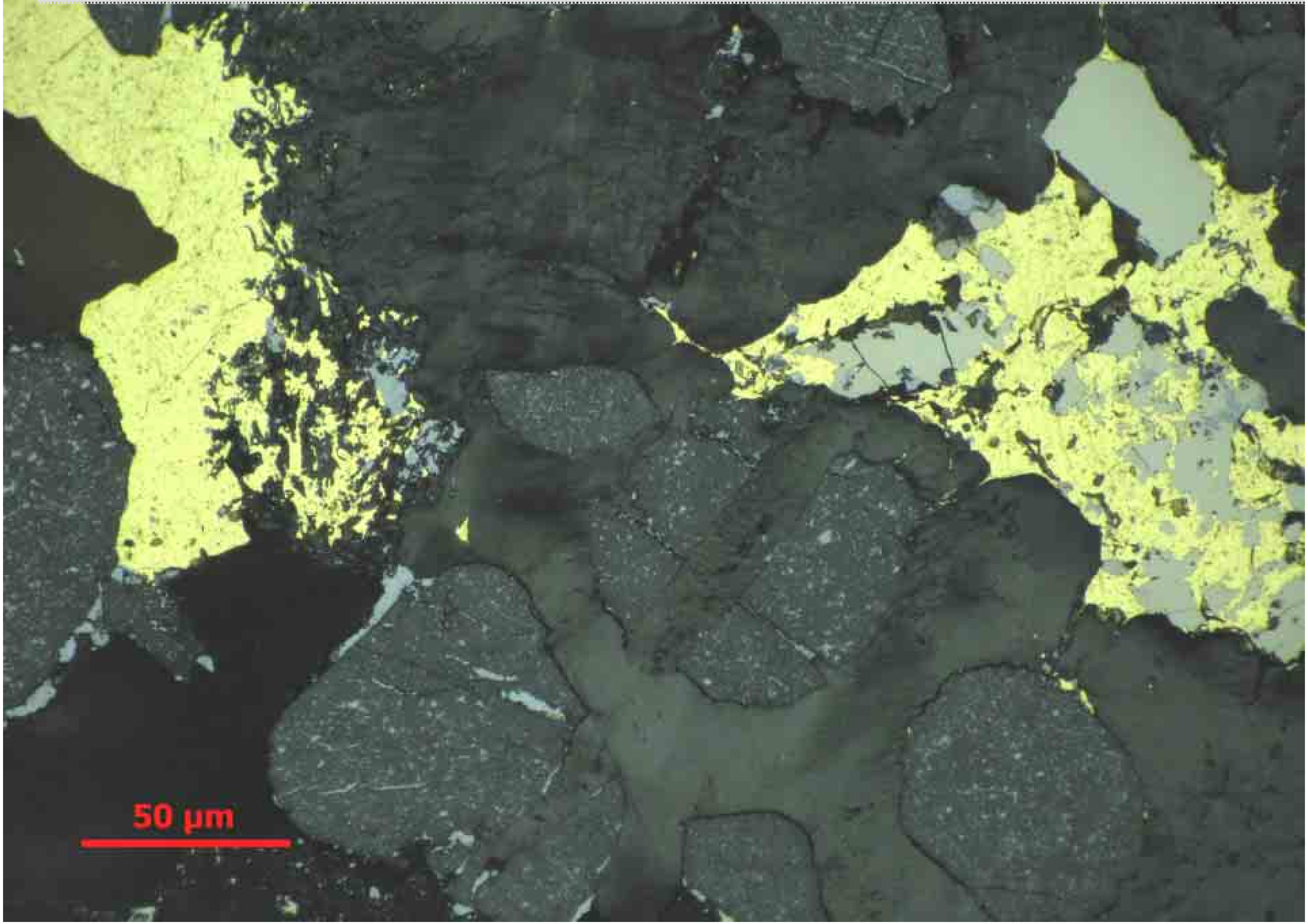
Quartz-pebble meta-conglomerate, Ventersdorp, 2.8 Ga, Witwatersrand, S-Africa


Elsburg mine, pyrite pebbles, uraninite-thucholite, gold
1000 µm


Elsburg mine, pyrite pebbles, uraninite-thucholite, gold
200 µm


Elsburg mine, pyrite, uraninite-thucholite with PbS, gold (oil immersion)
100 µm

Elsburg mine, pyrite, uraninite-thucholite with PbS, gold (oil immersion)



Uranium Isotopic Abundances

Solar system uranium today

^{238}U	99.2745 %
^{235}U	0.7202 ± 0.0006 %

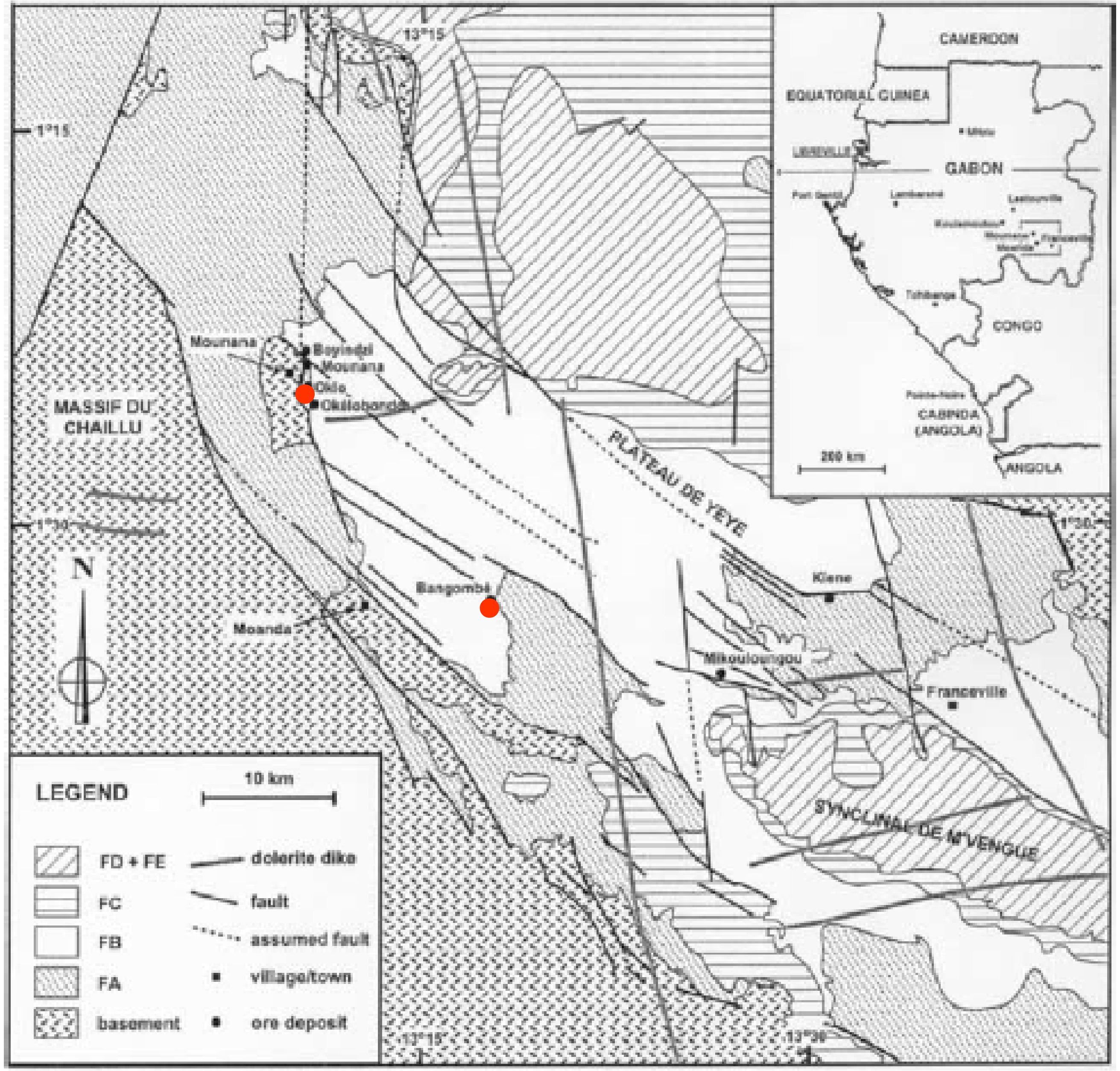
OKLO ^{235}U

First measurement : 0.7171 % (a diff of 0.42 %)

Typical value in Oklo fossil reactors: 0.65 %

Lowest measurement : 0.29 %

Geological map of the Franceville basin, Gabon



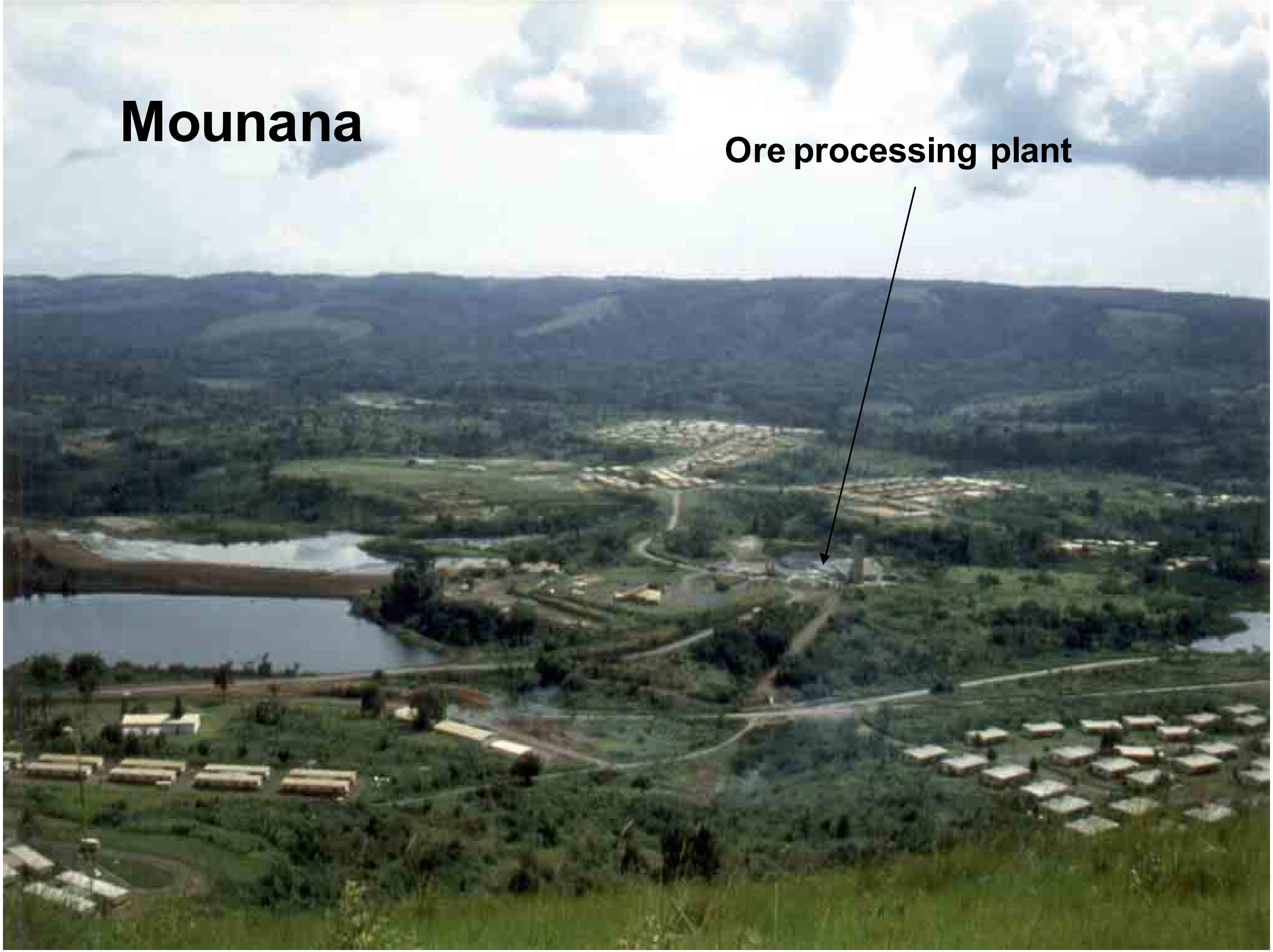
Unconformity-related sandstone hosted deposits in sandstone-black shale sequence on top of 3.0-2.6 Ga granite basement

FC-FE Chert, dolomite, volcanic rocks
FB Black shale
FA (100-1000 m) Sandstone, conglomerate

Franceville Series (1000-4000 m) 2.0 Ga

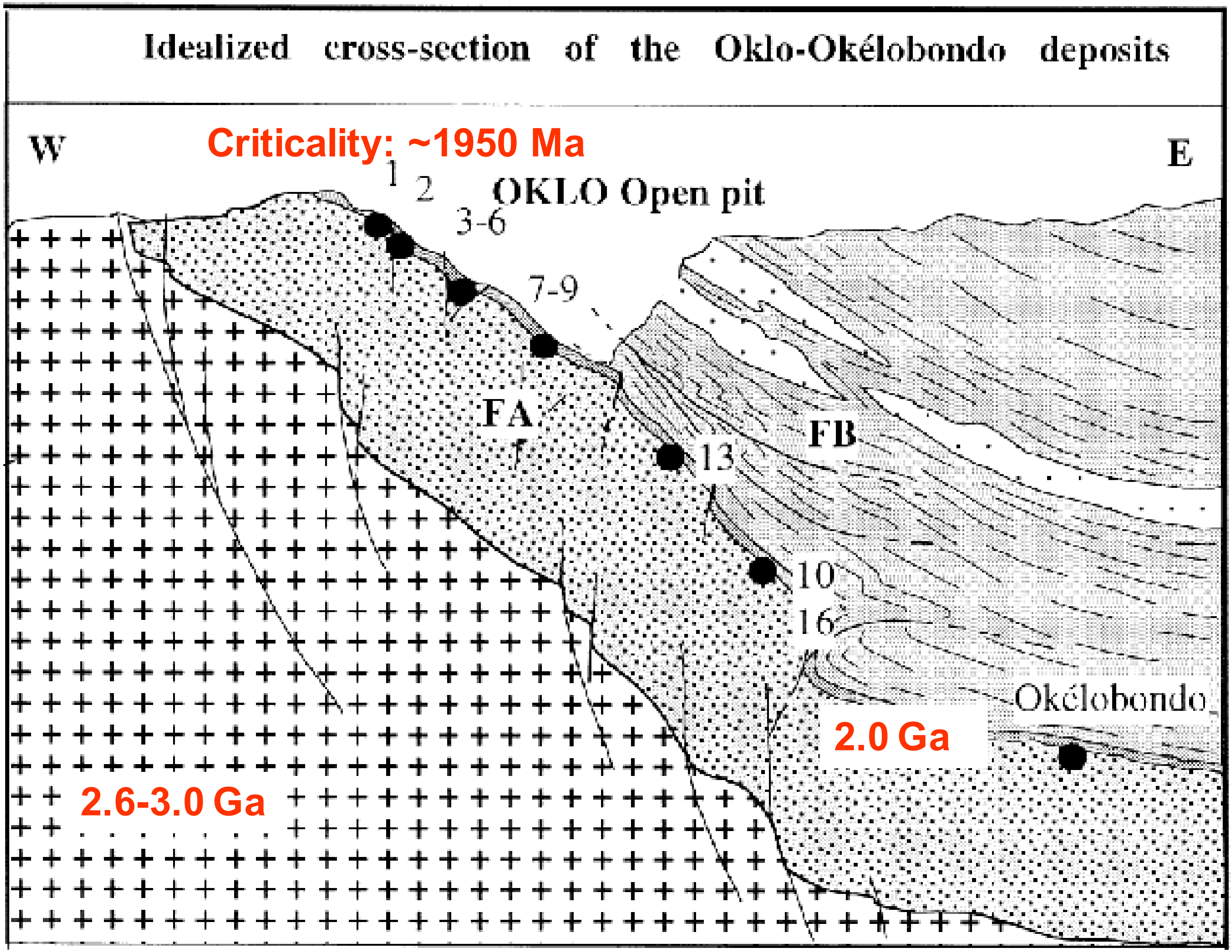
U ore deposits are all hosted in FA (average 0.1-1.0 % U, ore shoots up to 80 % U) and formed during early burial and diagenesis from mixing of oxidized uraniferous basin fluids and oil.
Criticality in 15 high-grade zones (14 at Oklo, 1 at Bangombé was reached ~1950 Ma ago

Evins et al. 2005, GCA 69: 1590

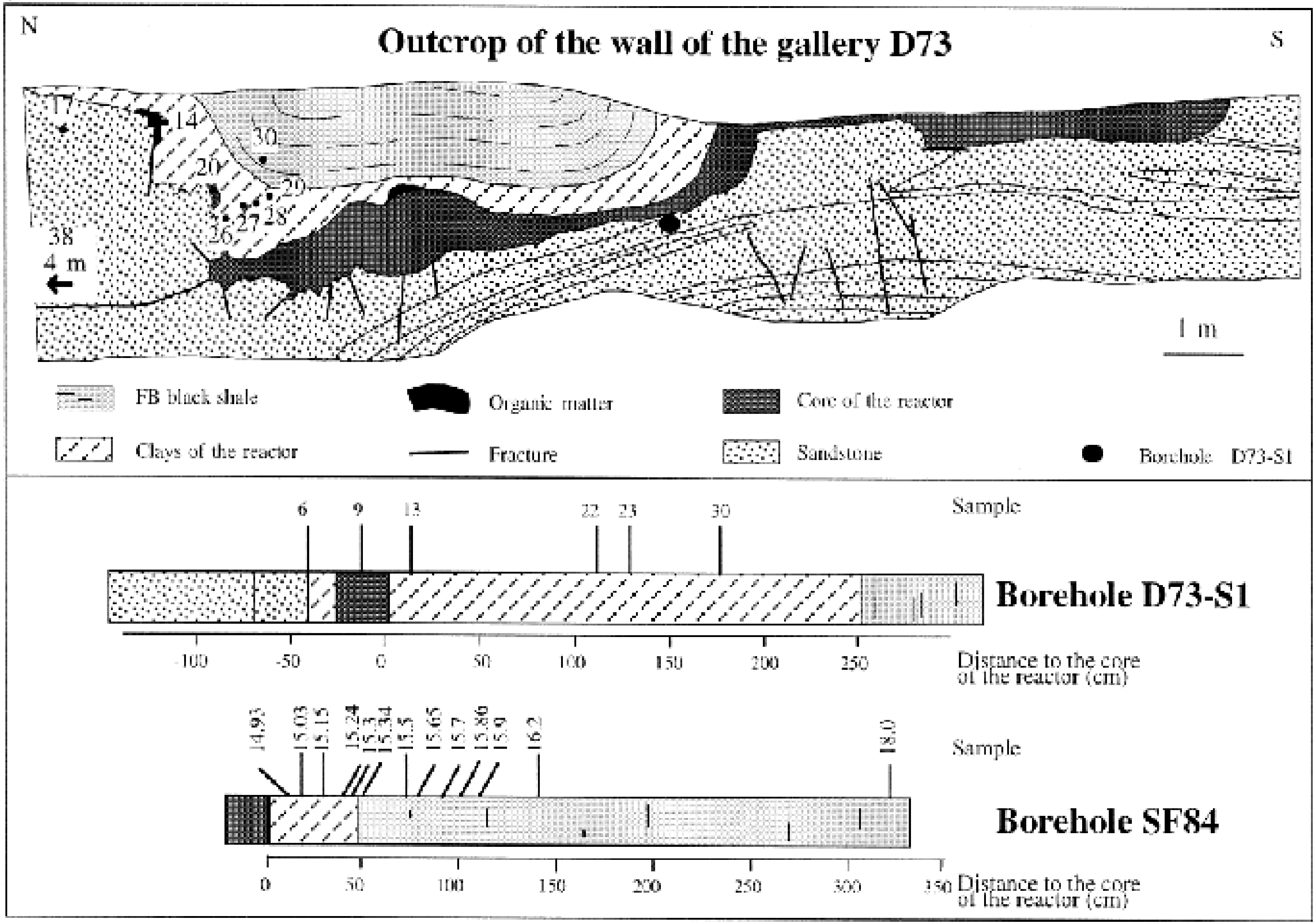

Mounana
Ore processing plant

Oklo Today

Mining ceased in 1979



Pourcelot and Gauthier-Lafaye (1999) Chem Geol 157: 156



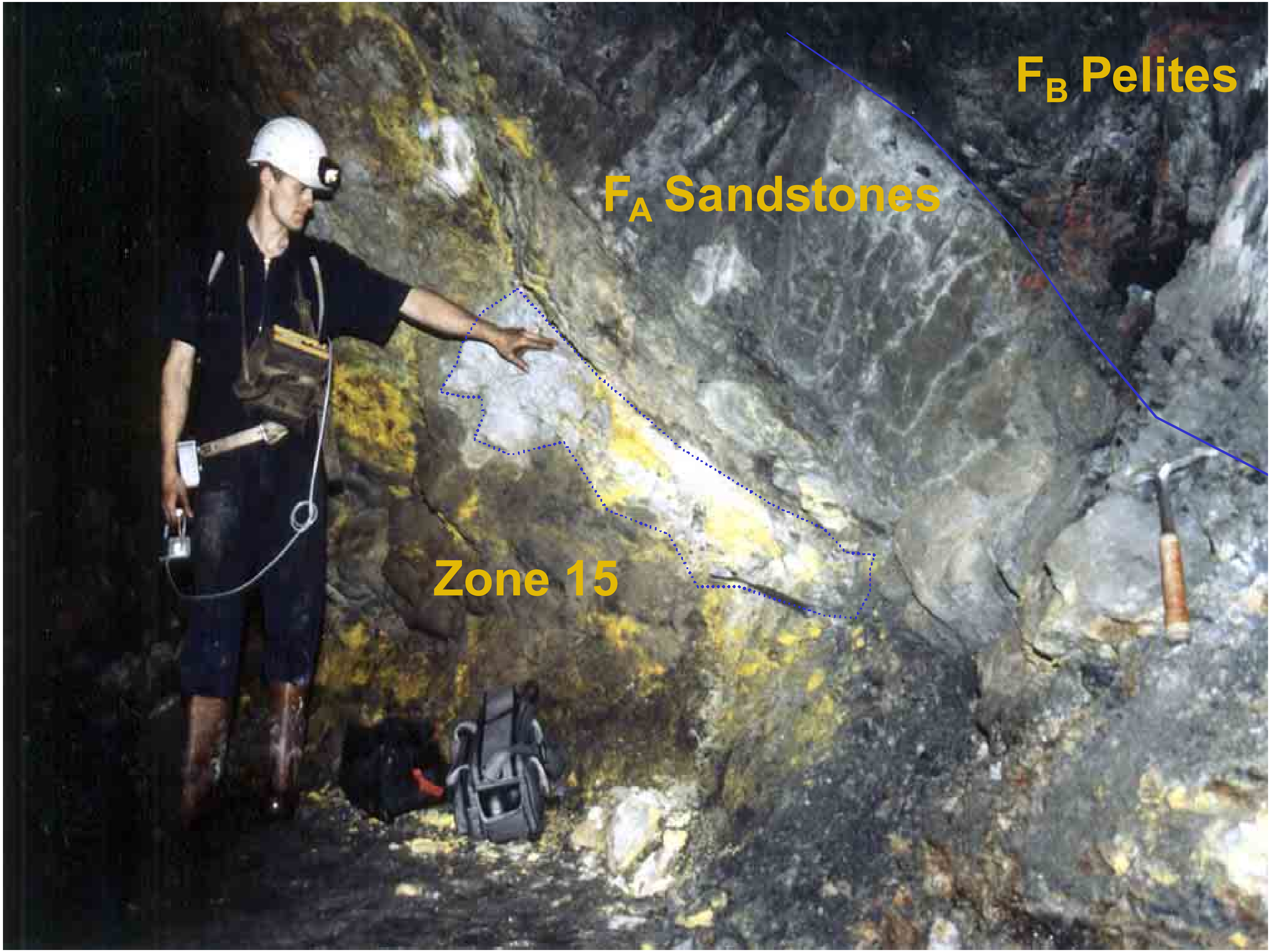
Pourcelot and Gauthier-Lafaye (1999) Chem Geol 157: 157


10
13
14
12
9
2
1


Zones 7, 8 & 9


Zone 10
Doleritic
Dyke
Zone 13
Zone 14


Zone 2
Entrance to Zone 15


F_B Pelites
F_A Sandstones
Zone 15

Reactor Requirements

Uranium

Reactor: ^{235}U 1-10 %

Natural ^{235}U 0.72%

U Fuel Quality

Free of neutron poisons (Cd, REE)

FISSION REACTOR

Moderator

Thermalised neutrons

H_2O or C

Reactor Size

Able to utilise neutrons

Fuel assemblage vol of cubic metres

Reactor Requirements

Uranium
Reactor: ^{235}U 1-10 %
Natural ^{235}U 0.72%
Oklo ~3%

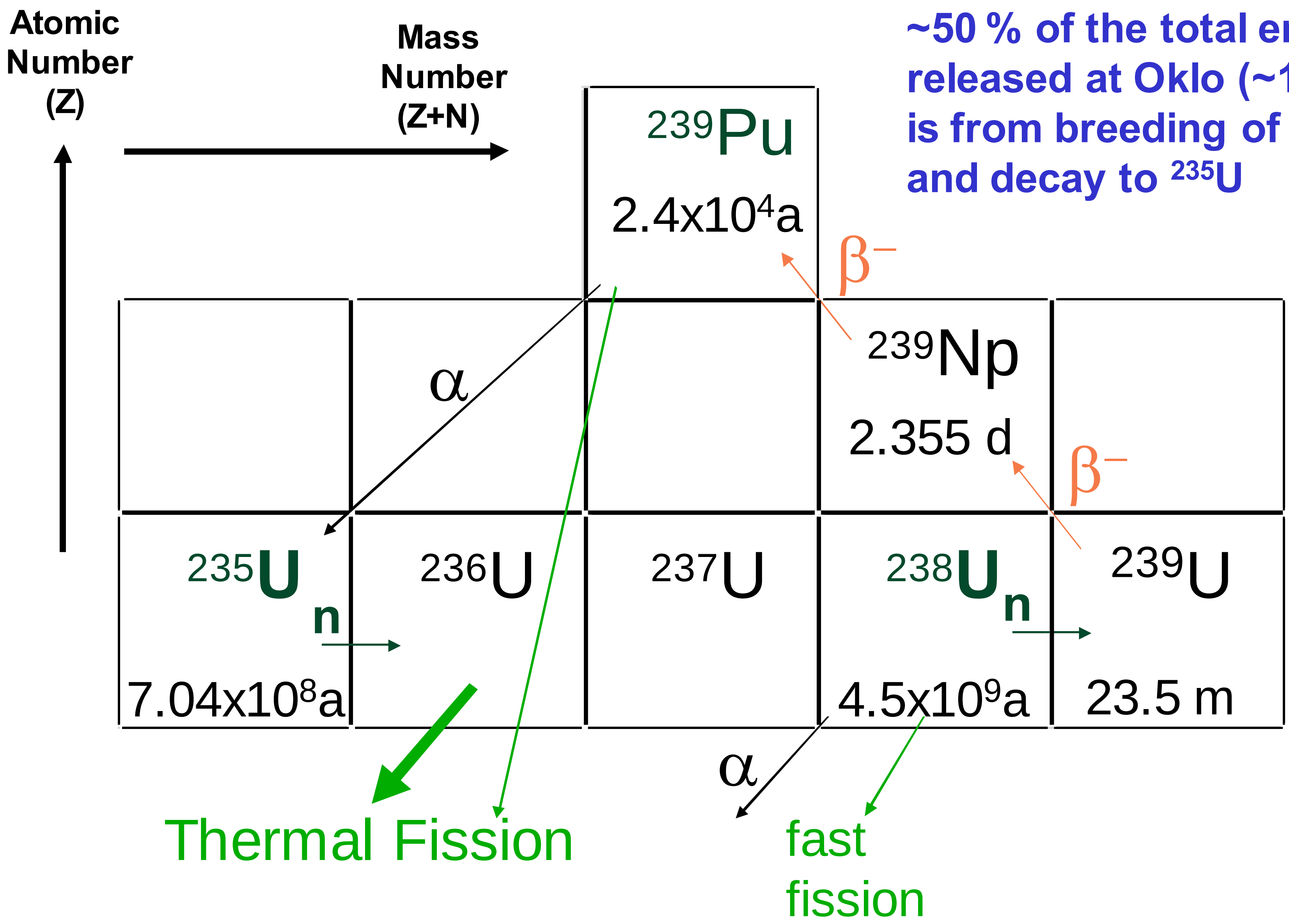
U Fuel Quality
Free of neutron poisons (Cd, REE) √

FISSION REACTOR

Moderator
Thermalised neutrons
H_2O or C

Reactor Size
Able to utilise neutrons
Fuel assemblage vol of cubic metres √

Oklo: a “Breeder” reactor



~50 % of the total energy released at Oklo (~15 GWa) is from breeding of ^{239}Pu and decay to ^{235}U

Retention of Fission Products at OKLO