

**URAM
2014**

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Uranium Raw Material for the Nuclear Fuel Cycle:

Exploration, Mining, Production, Supply and Demand, Economics and Environmental Issues

FORECASTING SANDSTONE URANIUM DEPOSITS IN OIL-AND-GAS BEARING BASIN

Igor Pechenkin

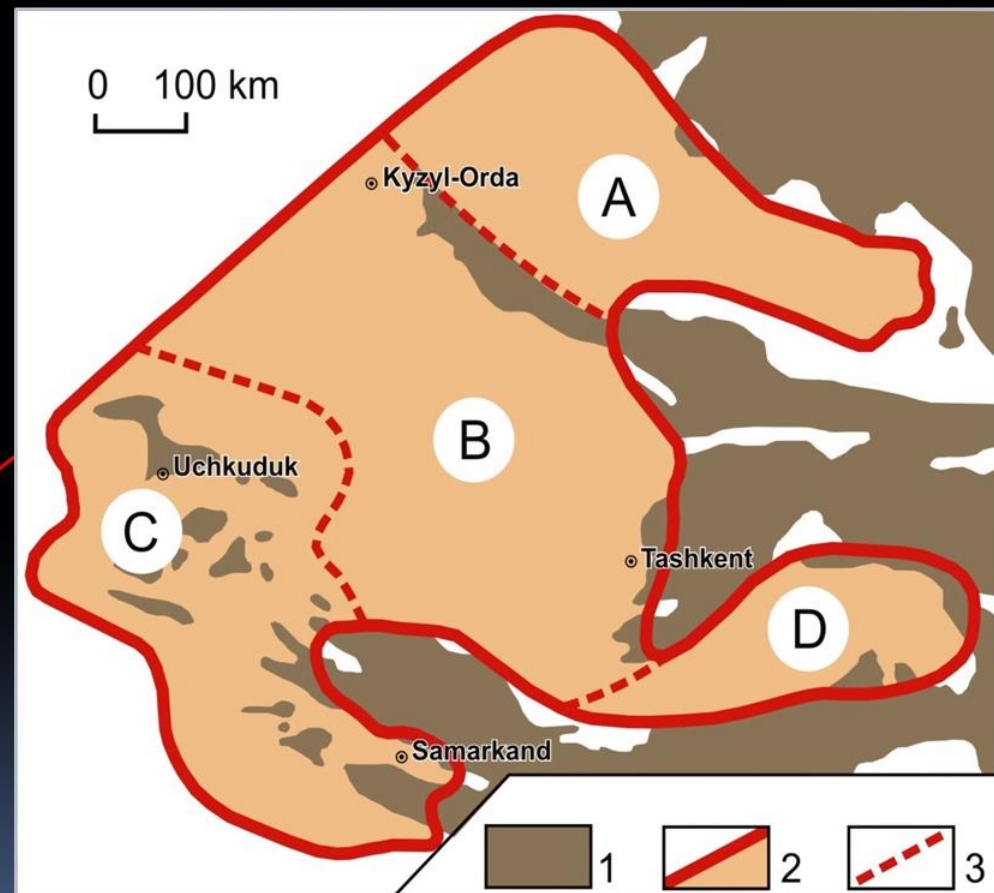
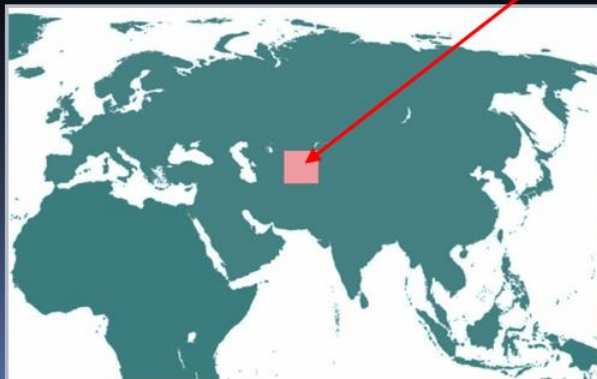
All-Russian Scientific-Research Institute of Mineral Resources
Moscow, Russia

Metallogenic division of the Neartianshan uranium ore megaprovince

1, Exposures of crystalline basement rocks.

Boundaries of: 2, Neartianshan megaprovince; 3, Ore provinces.

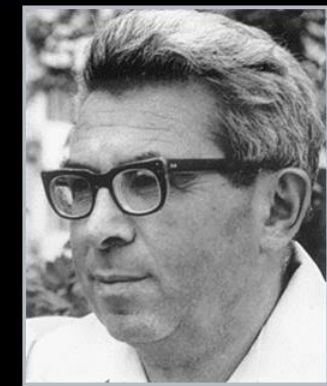
Uranium ore provinces: A, Chu-Sarysu; B, Syr Darya; C, Central Kyzylkum ; D, Fergana uranium ore region.



Synthesis of science and practice



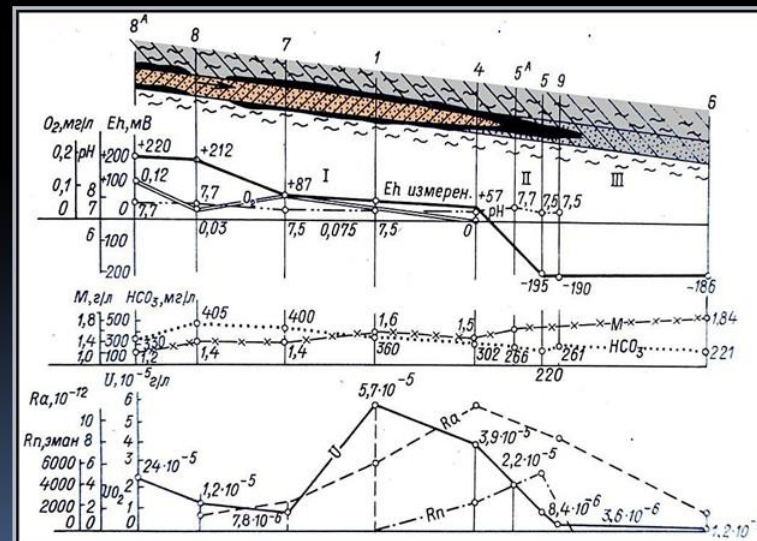
Scientists of VIMS
*E. Shmariovich (left), M. Kashirtseva,
 E. Golovin (Tashkent, 1962)*



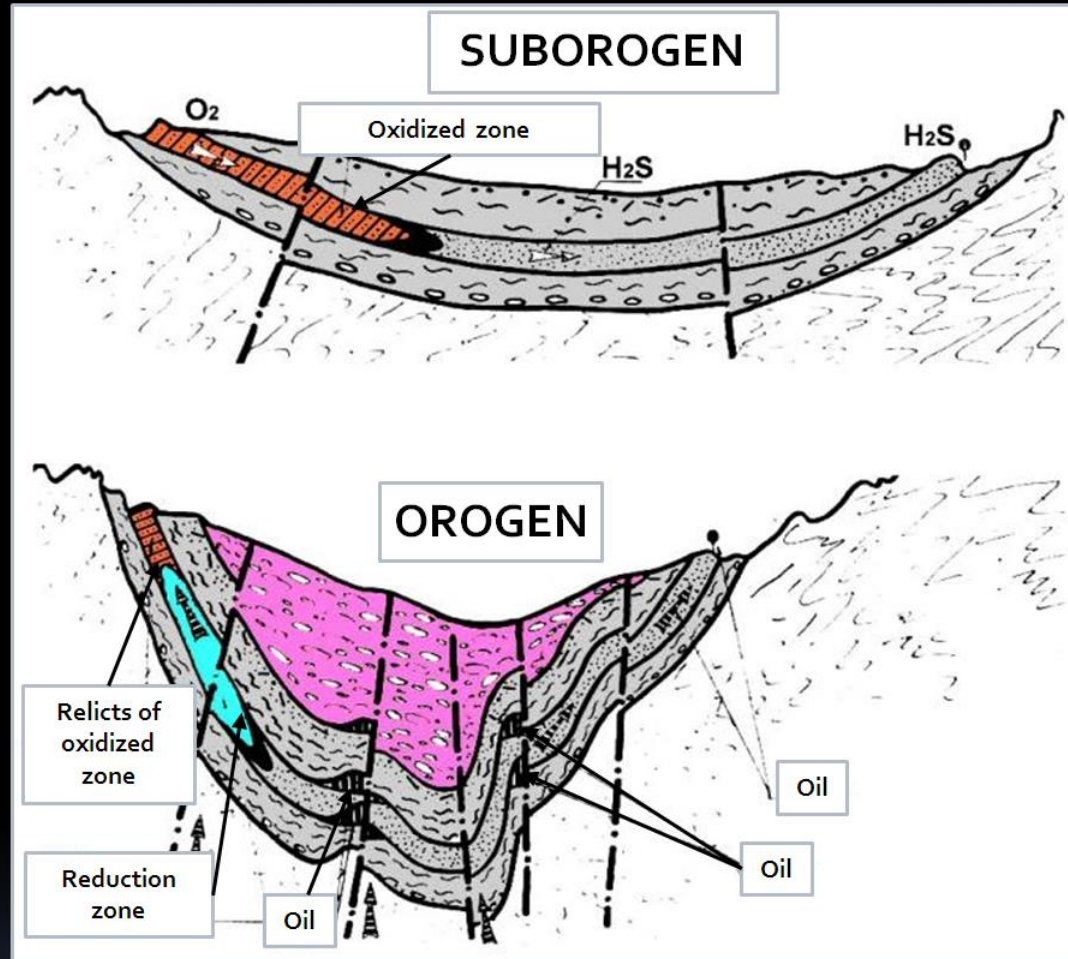
Geochemist –
*A. Perelman
 (IGEM RAS, 1960)*



Geology team #25 in Uchkuduk (06.04.1956)
*Left to right: V. Mazin, P. Boukreev, V. Makarov,
 A. Pak, A. Tsygankov, G. Pechenkin, V. Kondrashkin*

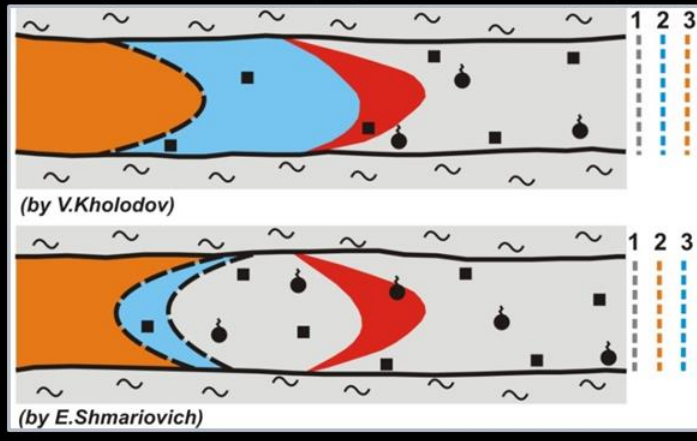


Typical hydrochemical section (Uchkuduk)
(After K. Kernosova, 1958 & A. Glazov, 1959)



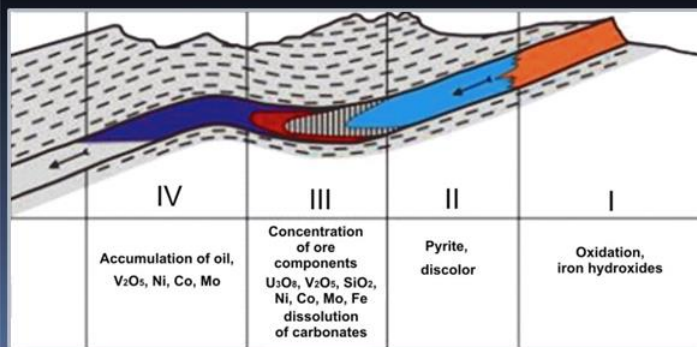
Analysis of ore-bearing basins shows that uranium deposits are concentrated within two tectonic belts: Collisional and Suborogenic. Within the intermountain areas of the Collisional (orogen) belt there are uranium deposits of the sandstone type in the terrigenous sediments with oil and gas reduction.

Sequence of epigenetic changes

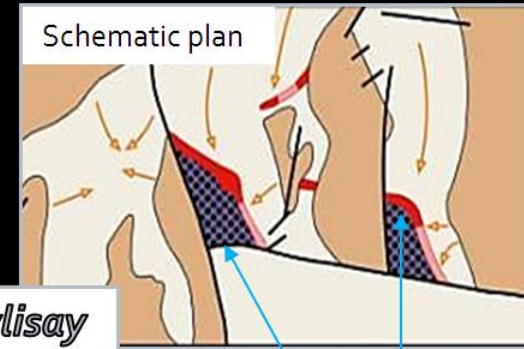
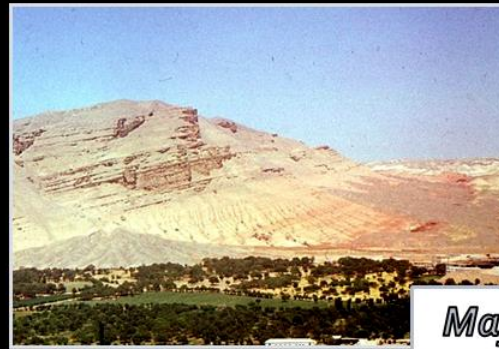


V. Kholodov
(1950)

Epigenetic zonation

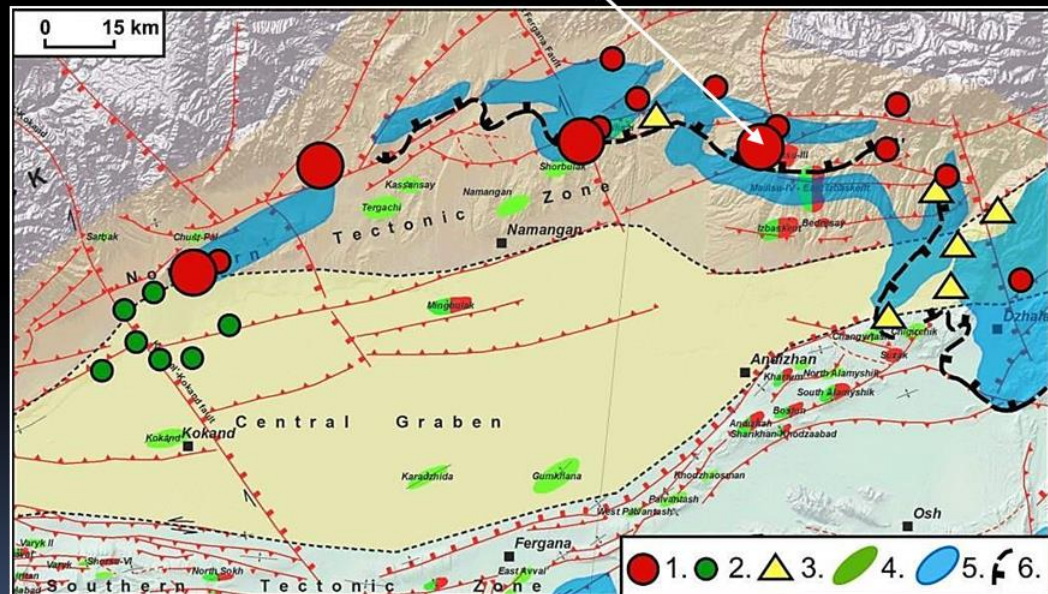


The Fergana basin



Maylisay

Oil Ore



Deposits: 1 - uranium, 2 - copper, 3 - sulfur, 4 - hydrocarbons; 5 - reduction zone, 6 - boundary of oxidized zone

The Sabyrsay deposit



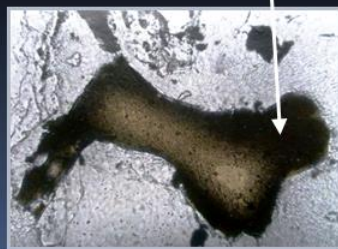
Primary gray-colored rock



Primary red rock



Bituminization



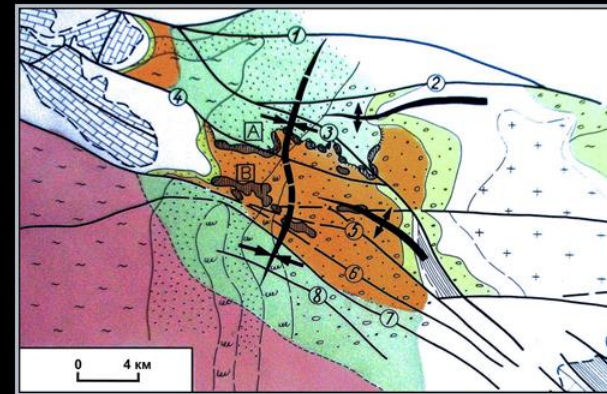
Bitumen



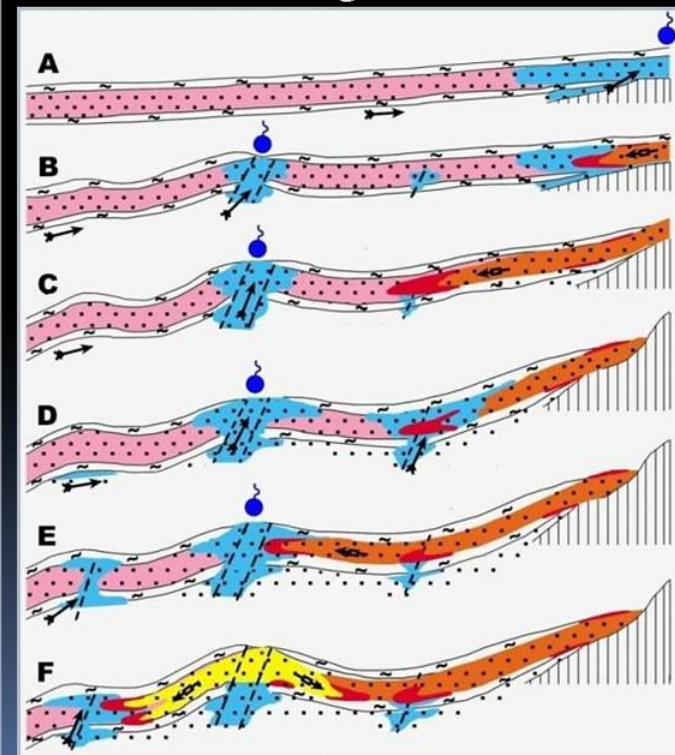
Secondarily oxidized rock



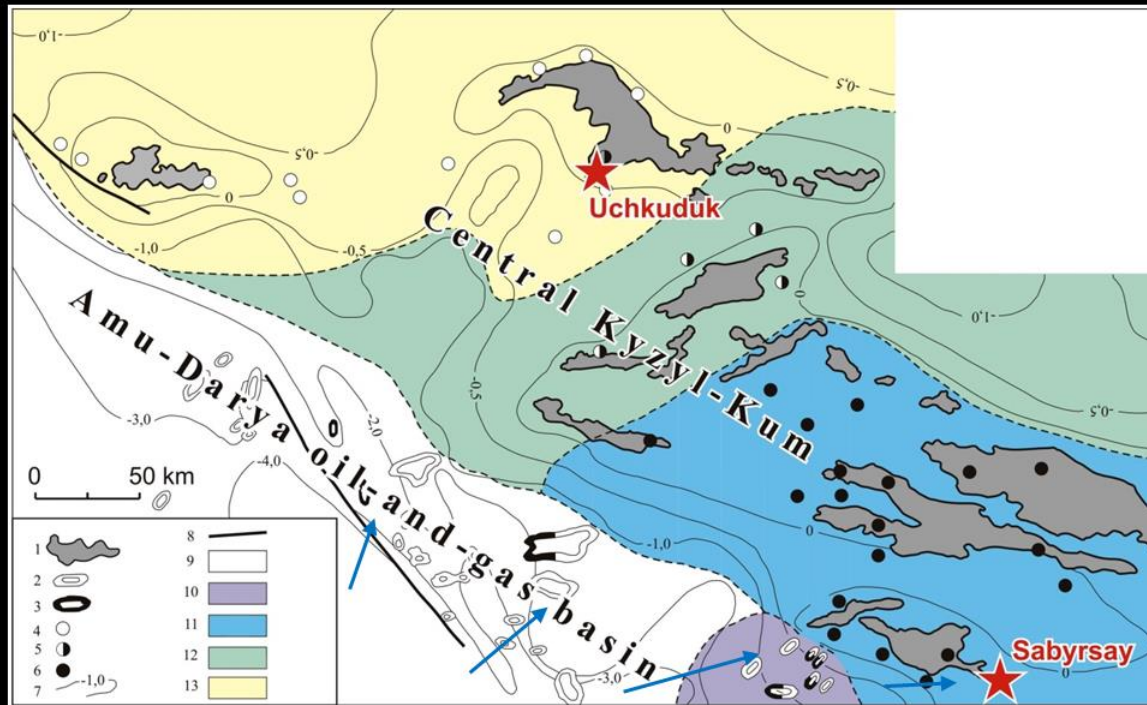
Native selenium



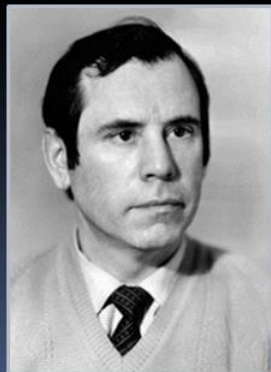
The sequence of epigenetic changes in the marginal part of oil-and-gas basin



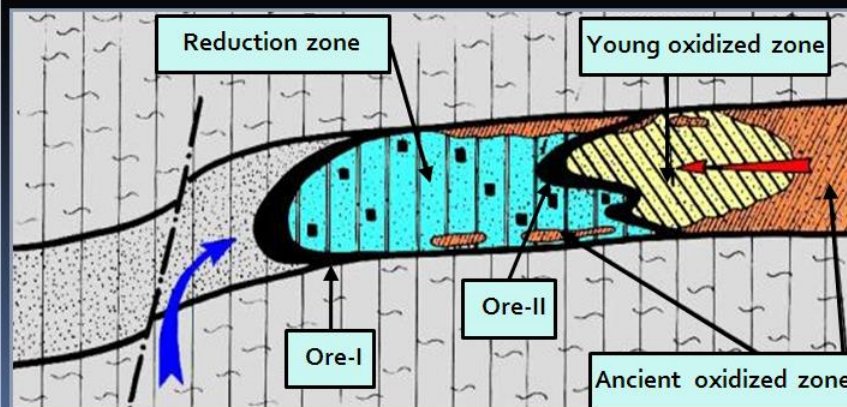
New epigenetic formation of reduction series



1 - Paleozoic basement; 2 - gas fields; 3 - oil fields; 4 - carbonate "pipe"; 5 - light scattered bitumen; 6 - viscous and solid bitumen; 7 - surface of the pre-Mesozoic basement (in km); 8 - faults; 9 - priority area propagation of gas deposits; 10 - distribution area equal deposits of oil and gas; 11 - area of the predominantly viscous and solid bitumen; 12 - area of the predominantly light scattered bitumen



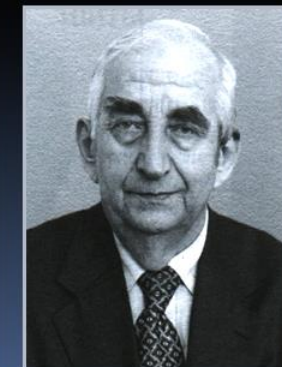
V. Schetochkin
Scientist of VIMS



Scientists of VSEGEI

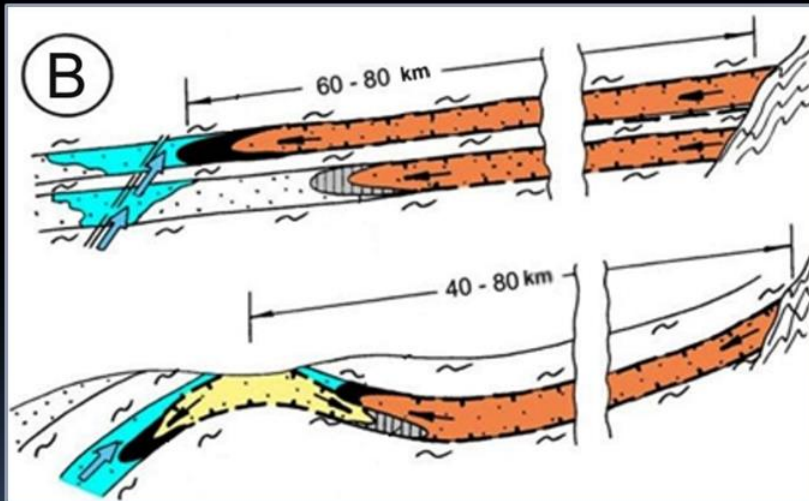
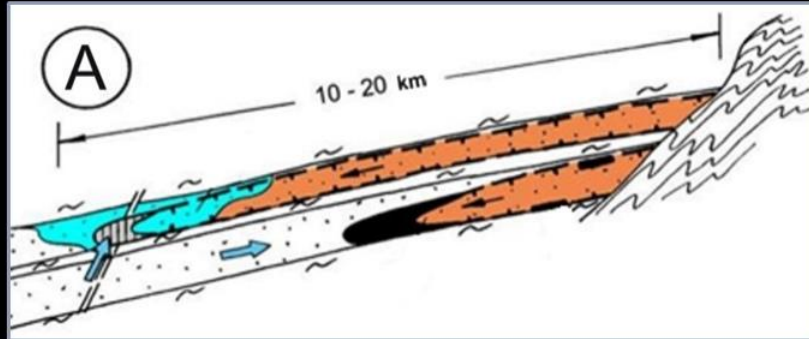


I. Onoshko

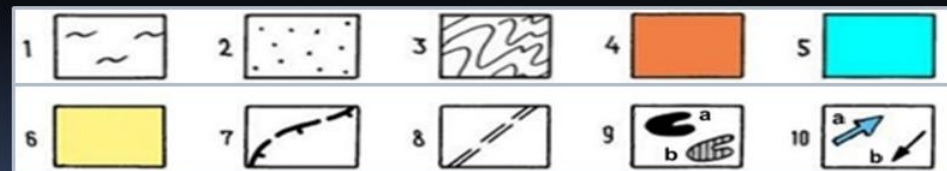
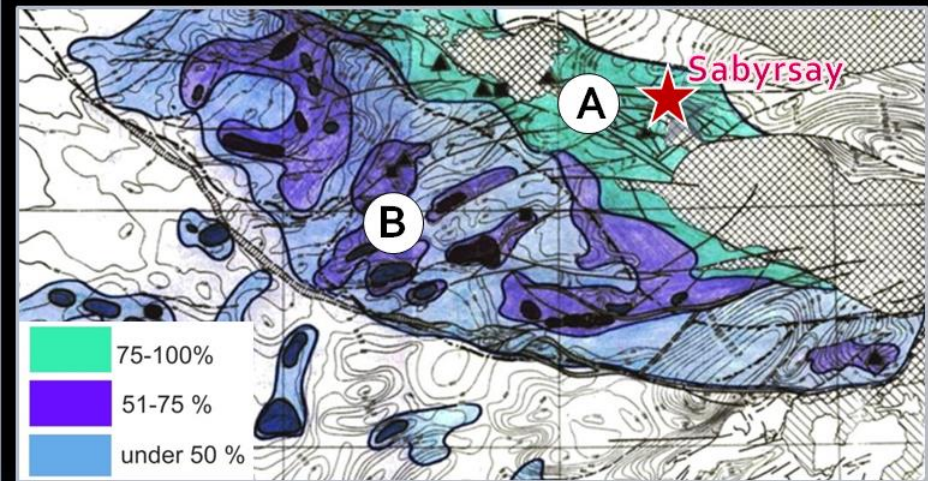


G. Grushevoi

Examples of relationships between oxidizing and reducing processes



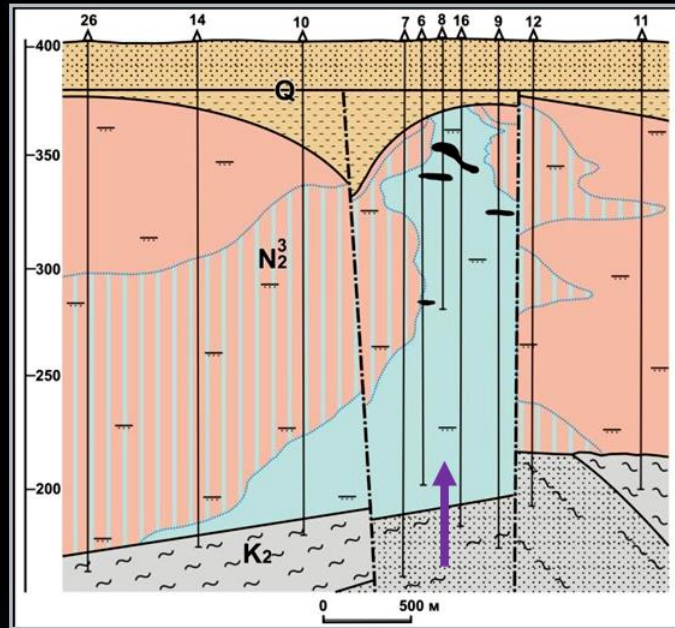
Intensive reduction of sediment
(board of Amudarya oil-and-gas bearing basin)



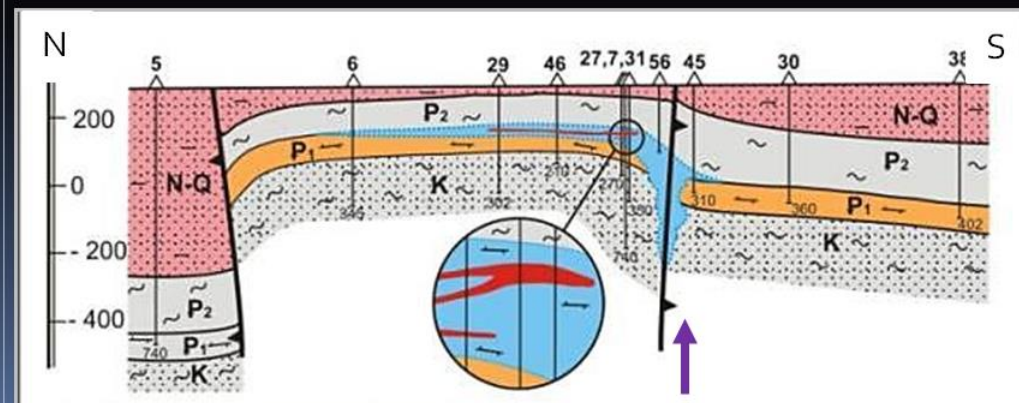
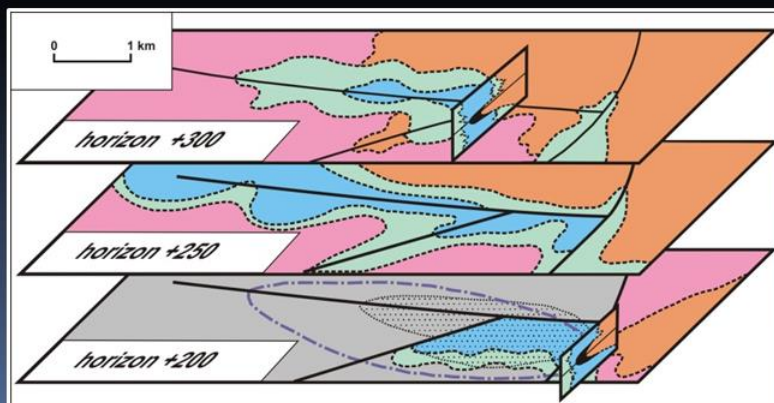
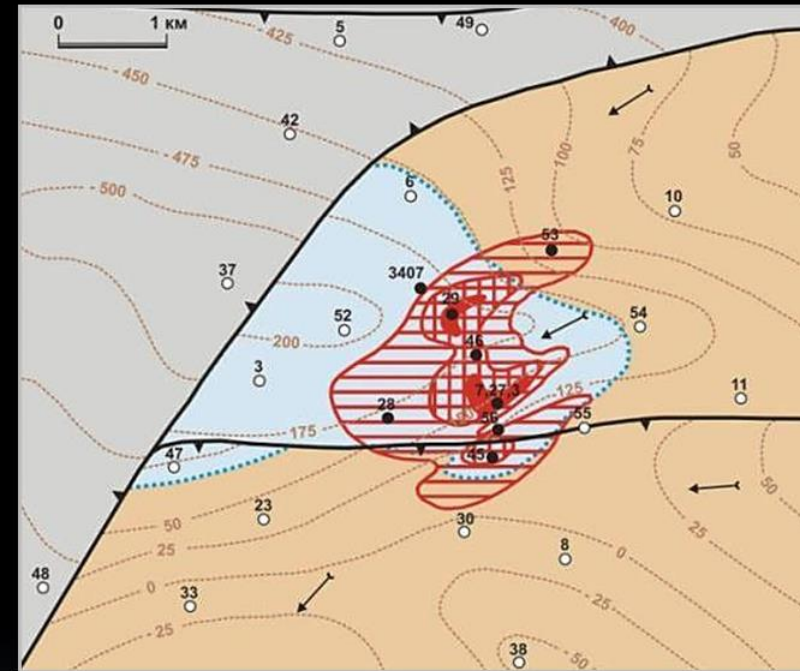
1 – clay, 2 – sand, sandstone, 3 – basement rocks, 4 – oxidation, 5 – reduction, 6 – "young" oxidation, 7 – boundary of oxidation zone, 8 – faults, 9 – mineralization: a - industrial, b - non industrial, 10 – direction of movement of fluids: a - reduction, b - oxidation

Objects over collapsing oil-and-gas deposits

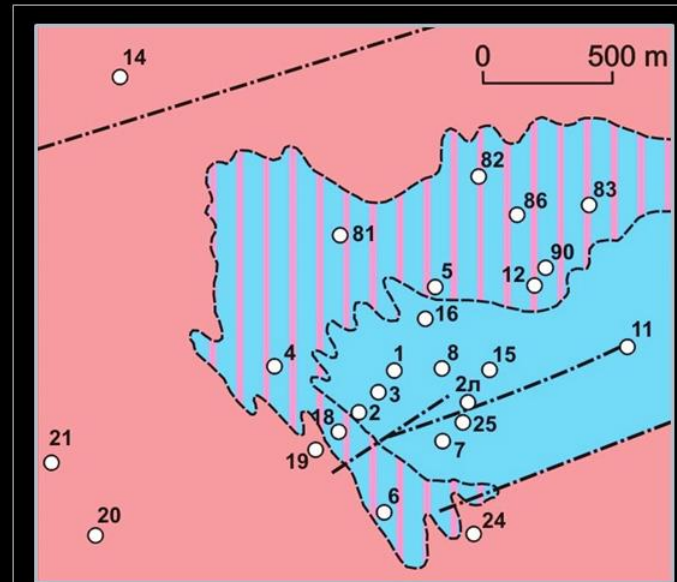
A. In sandy-silty sediments of Neogene
(After V. Shumlyanskiy, 1980)



B. In limestones of Paleogene

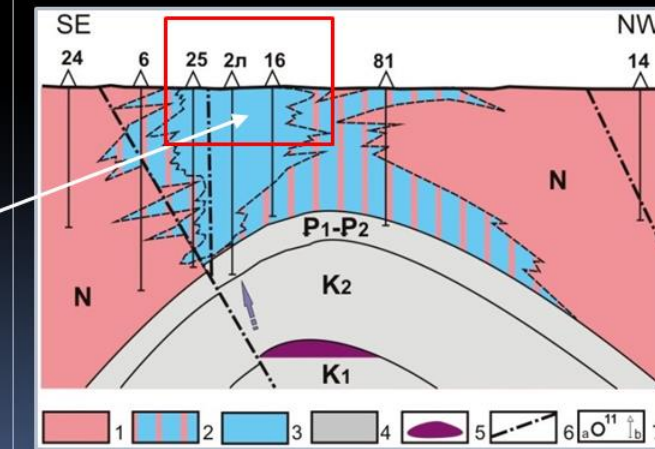
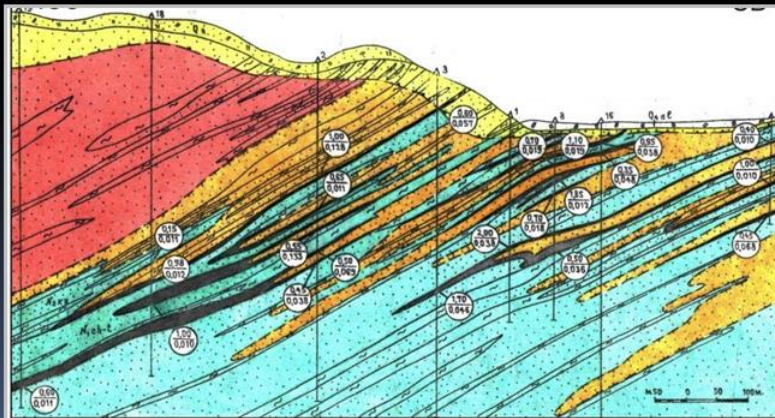


The Tajik depression



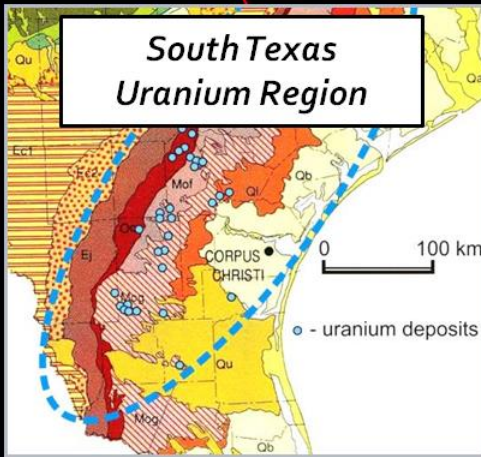
(After I. Kondratieva et al., 1960)

The Komsomolskoe deposit (section)

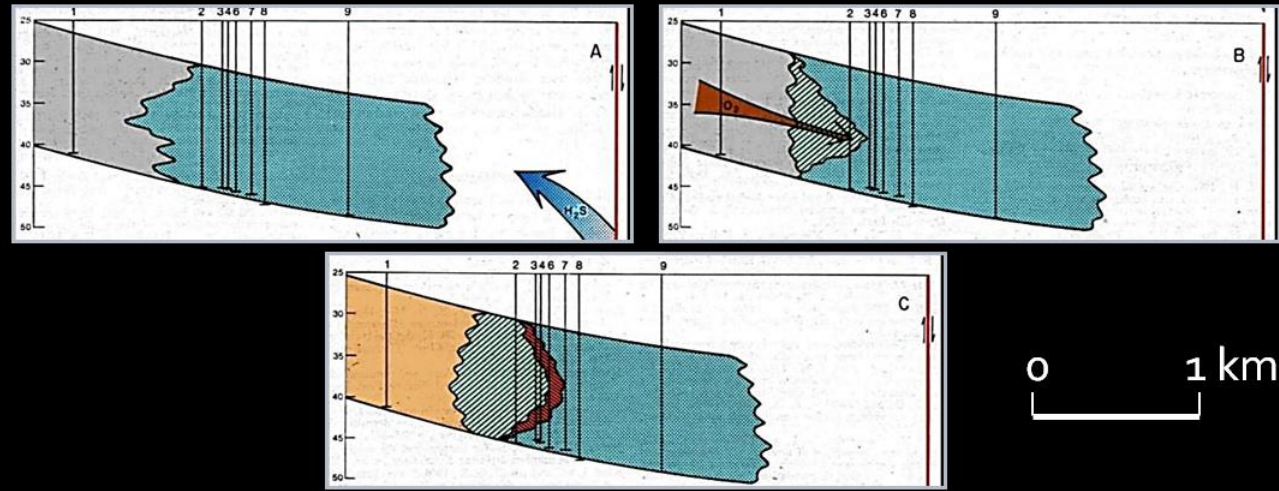


1 – red rock, 2 – partial reduction, 3 – total reduction, 4 – gray rock, 5 – oil, 6 – fault, 7 – borehole: a - on plan, b - on section

The Texas Coastal Plain

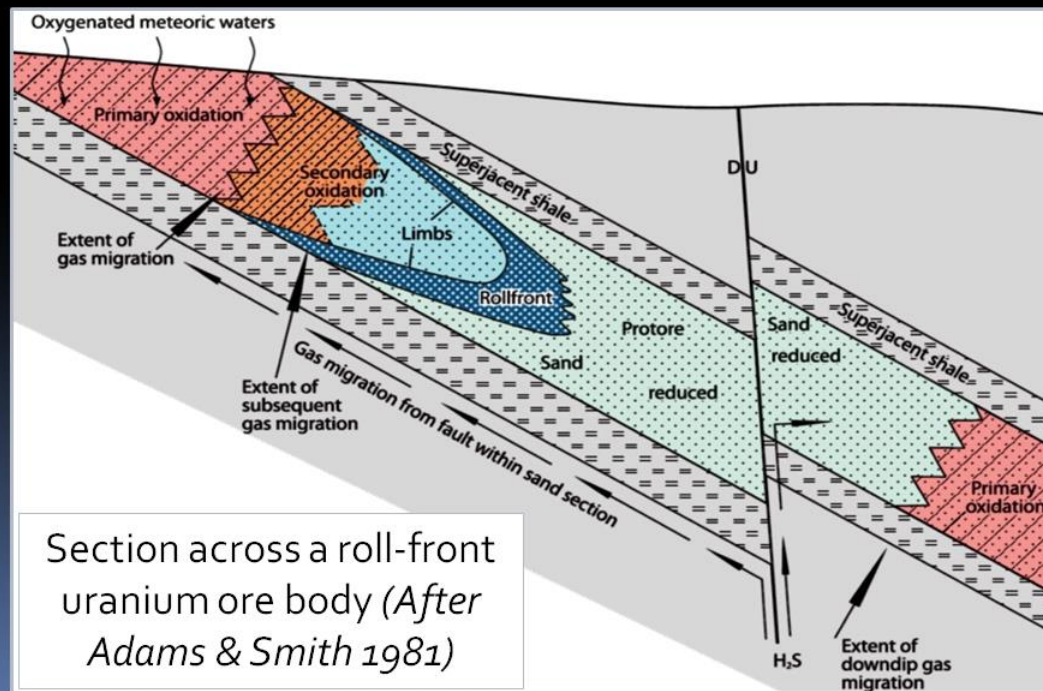


Stages in the evolution of Benavides (After Goldhaber et al., 1978)



GEOCHEMICAL CHANGES IN THE AQUIFER HORIZON

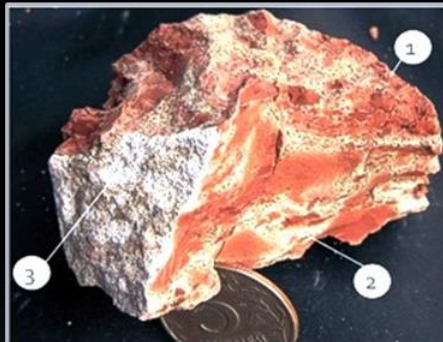
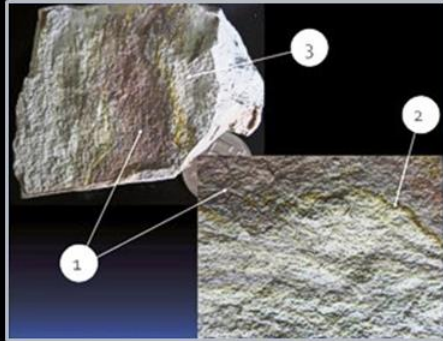
S T A G E			
	Pre-ore	Ore	Post ore
Primary red rock	Reducing - 1	Oxidizing	Reducing - 2



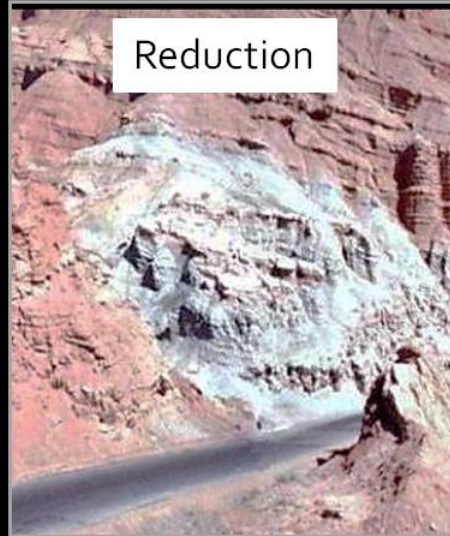
Section across a roll-front uranium ore body (After Adams & Smith 1981)

Examples of epigenetic changes

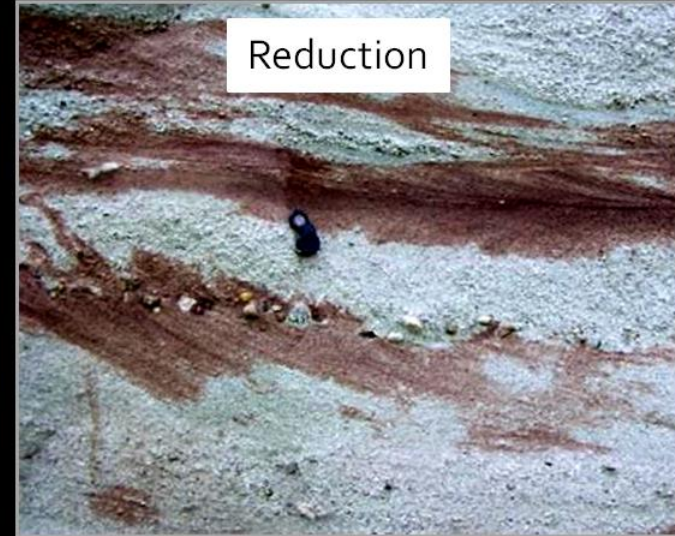
Reduction after oxidation



Reduction



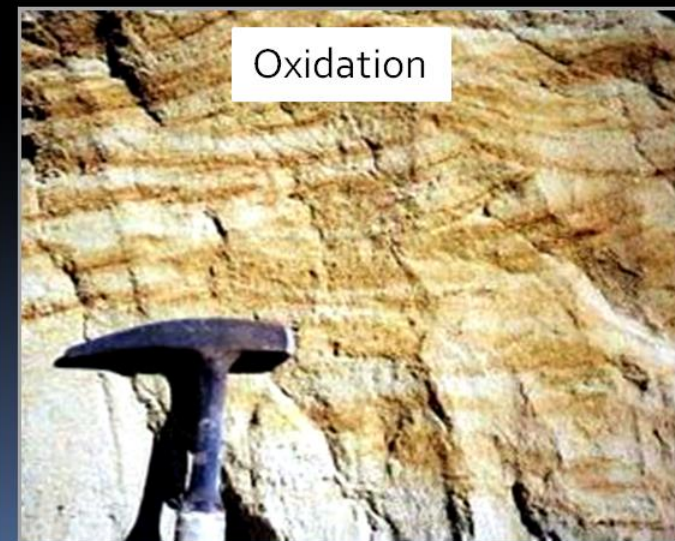
Reduction



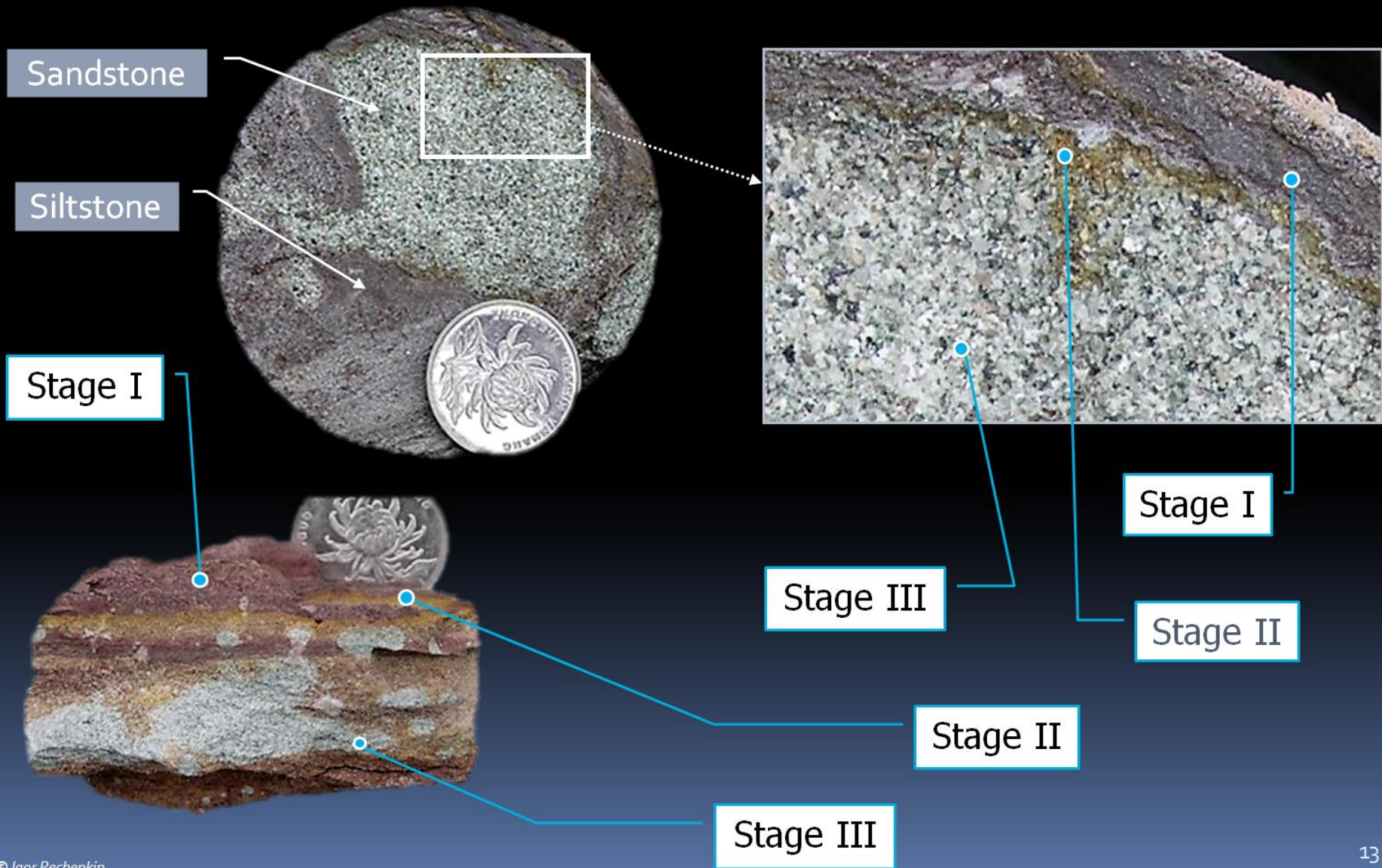
Bituminization



Oxidation



An Example of a reduction-oxidation sequence



Epigenetic changes in the Dunshen deposit



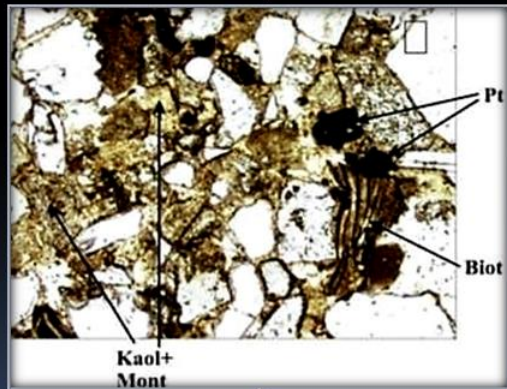
Relicts of oxidation



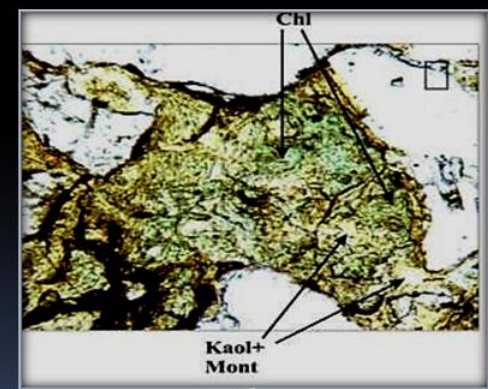
Clay

Relict of organic matter

Primary rock



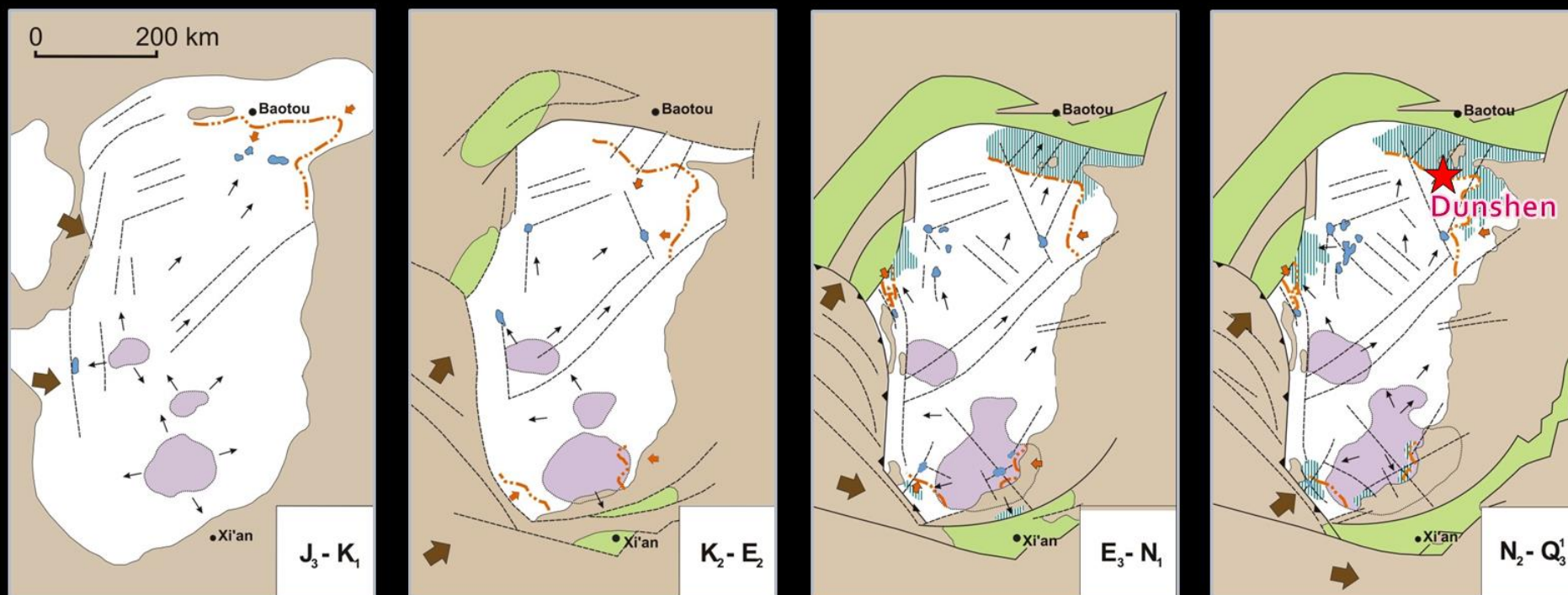
Modified rock



Gray sandstones (biotite and pyrite in sandstone with kaolinite-montmorillonite cement)

Gray-greenish sandstones (kaolinite-montmorillonite cement replacement of colloform chlorite)

The Ordos basin

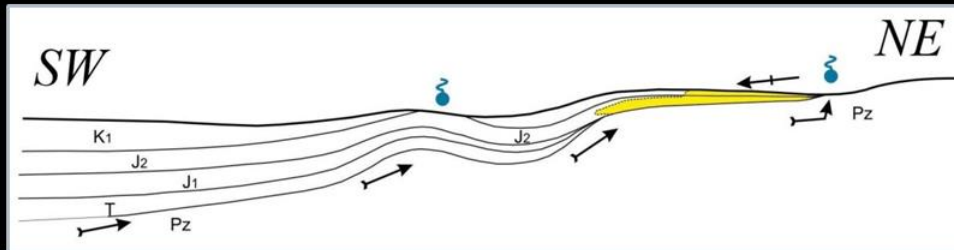


1 – fault 2 – alleged fault, 3 – thrust, 4 – direction of tectonic stress, 5 – mountain framing basin, 6 – Ordos basin, 7 – graben, 8 – boundary of oxidation zone 9 – motion direction of oxidize water, 10 – area of formation of oil and gas, 11 – motion direction of reducing agent, 12 – region of fluid relieving, 13 – area development reduced rocks

Sequence of formation of the Dunshen deposit

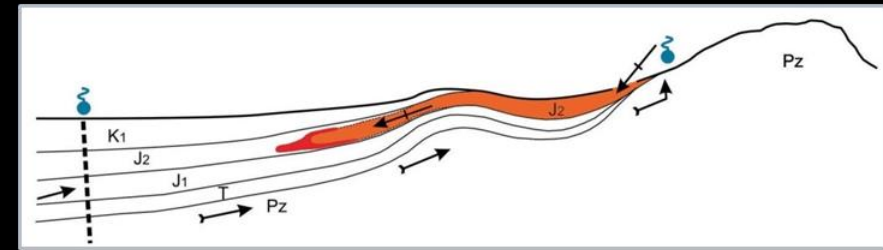
Stage I

Pre-concentration (groundwater oxidation zone)



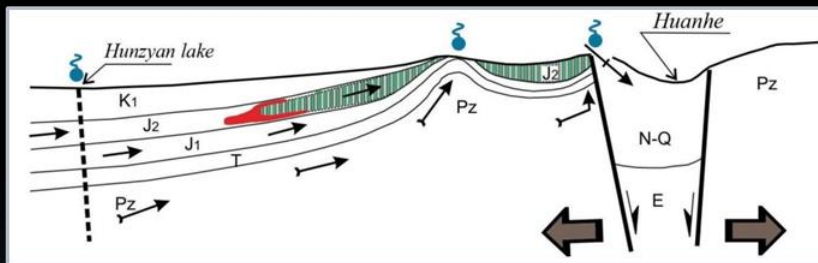
Stage II

Interlayer water infiltration with uranium ore



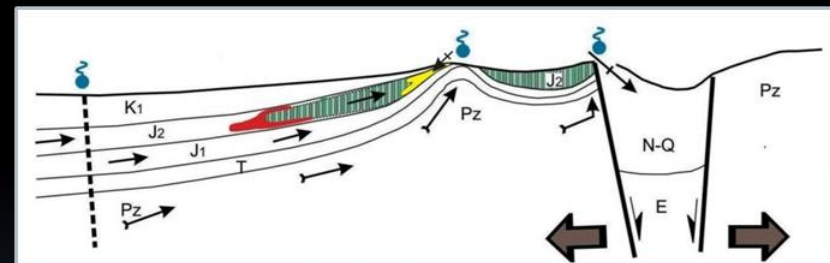
Stage III

Ore preservation brought about by reducing fluids



Stage IV

Groundwater oxidation without ore



1 – faults: a - main, b - alleged, 2 – primarily gray rocks, 3 – wrench fault, 4 – direction of tectonic stress, 5 – interlayer oxidation zone, 6 – groundwater oxidation zone, 7 – area development reduced rocks, 8 – uranium ore. Direction of movement : 9 – oxidized water, 10 – reducing agent in Mz rocks, 11 – reducing agent in Pz rocks, 12 – region of fluid relieving, 13 – area of development of reduced rocks

Conclusion

- Uranium and oil deposits in sedimentary basins have complex relationships.
- The interrelation of epigenetic processes determines the distinctive characteristics of ore genesis in different parts of oil and gas basins.
- Their detection by mapping creates the necessary conditions for determining the prospects for both local regions of subsoil assets and large geological structures.
- Mineragenic analysis of sedimentary basins should be based on simulations with the inclusion of space and time characteristics.
- These methods made it possible to carry out metallogenic zoning of the Asian territory in terms of uranium and at the same time to estimate the role of hydrocarbons.

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Thank you for your
attention!

pechenkin@vims-geo.ru