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

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Metallogenic division of the Neartienshan uranium ore megaprobvince

1. Exposures of crystalline basement rocks.


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.
The Fergana basin

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

Secondarily oxidized rock

Bitumen

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.

Scientists of VSEGEI

V. Schetochkin
Scientist of VIMS

I. Onoshko
G. Grushevoi

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Examples of relationships between oxidizing and reducing processes

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

Objects over collapsing oil-and-gas deposits

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

B. In limestones of Paleogene

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The Tajik depression

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

(After I. Kondratieva et al., 1960)
The Texas Coastal Plain

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

South Texas Uranium Region

GEOCHEMICAL CHANGES IN THE AQUIFER HORIZON

<table>
<thead>
<tr>
<th>STAGE</th>
<th>PRIMARY RED ROCK</th>
<th>ORE</th>
<th>POST ORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-ore</td>
<td>Reducing -1</td>
<td>Oxidizing</td>
<td>Reducing -2</td>
</tr>
</tbody>
</table>

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

Reduction after oxidation

Reduction

Reduction

Bituminization

Oxidation

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An Example of a reduction-oxidation sequence

- Sandstone
- Siltstone
- Stage I
- Stage II
- Stage III
Epigenetic changes in the Dunshen deposit

Relicts of oxidation

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

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.
Thank you for your attention!

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