Potential Benefits of Minerals and Metals as Added Value to Oil Shale in Jordan

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Oil

Spent

Minerals

Acknowledgements

- The Conference Organizers
- Jordan University of Science & Technology
- Dr. Jan Krason

Objectives

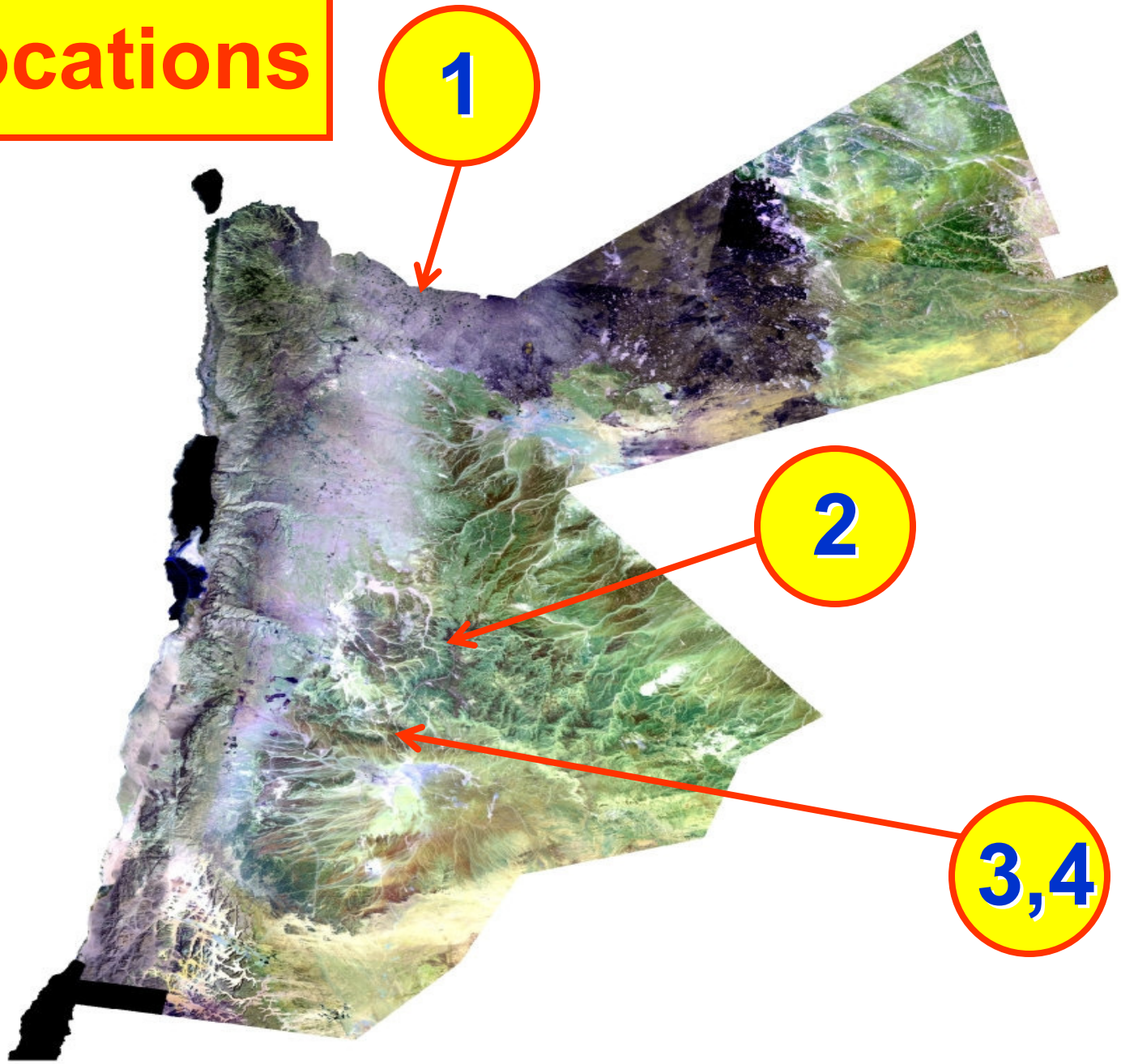
The objectives of this presentation and research are:

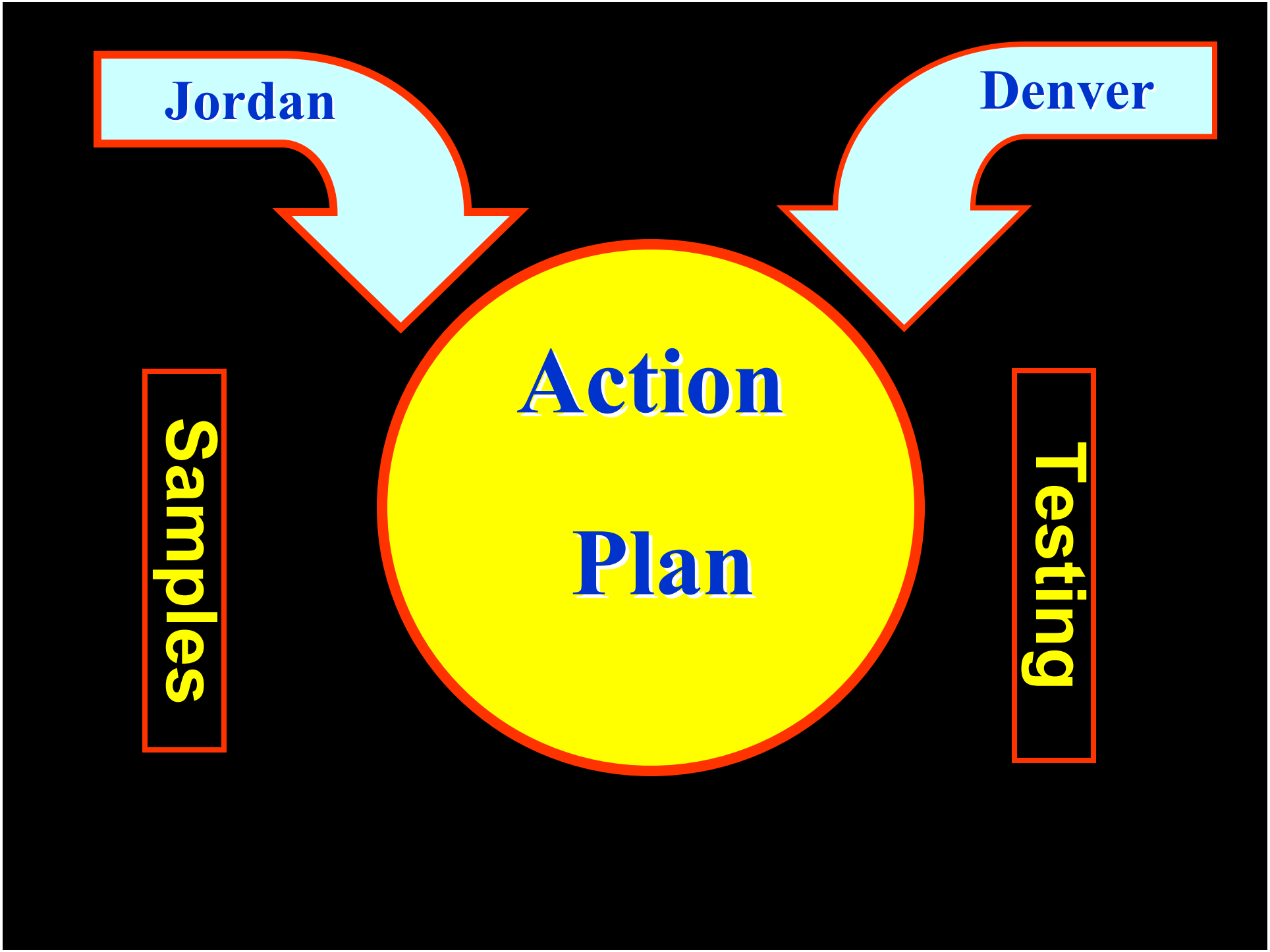
- **to re-examine Jordanian oil shale**
- **to determine the products most likely to add value, and their beneficial use**

Expected Outcomes

- Oil shale and black oil shale commonly host metals, especially precious metals, as finely disseminated native metal particles
- Determination of their presence and abundances will require application of various analytical procedures, most likely including unconventional ones
- We anticipate that the outcome of such analysis of oil shale, including particularly of spent shale, will result in commercial operations, with economic benefits, and minimal environmental impact

Locations




Jordan
Denver
Action
Plan
Samples
Testing

Samples

The first Batch

Samples

The second Batch

Photos

The oil shale sample from North before it's processing for geochemical analysis

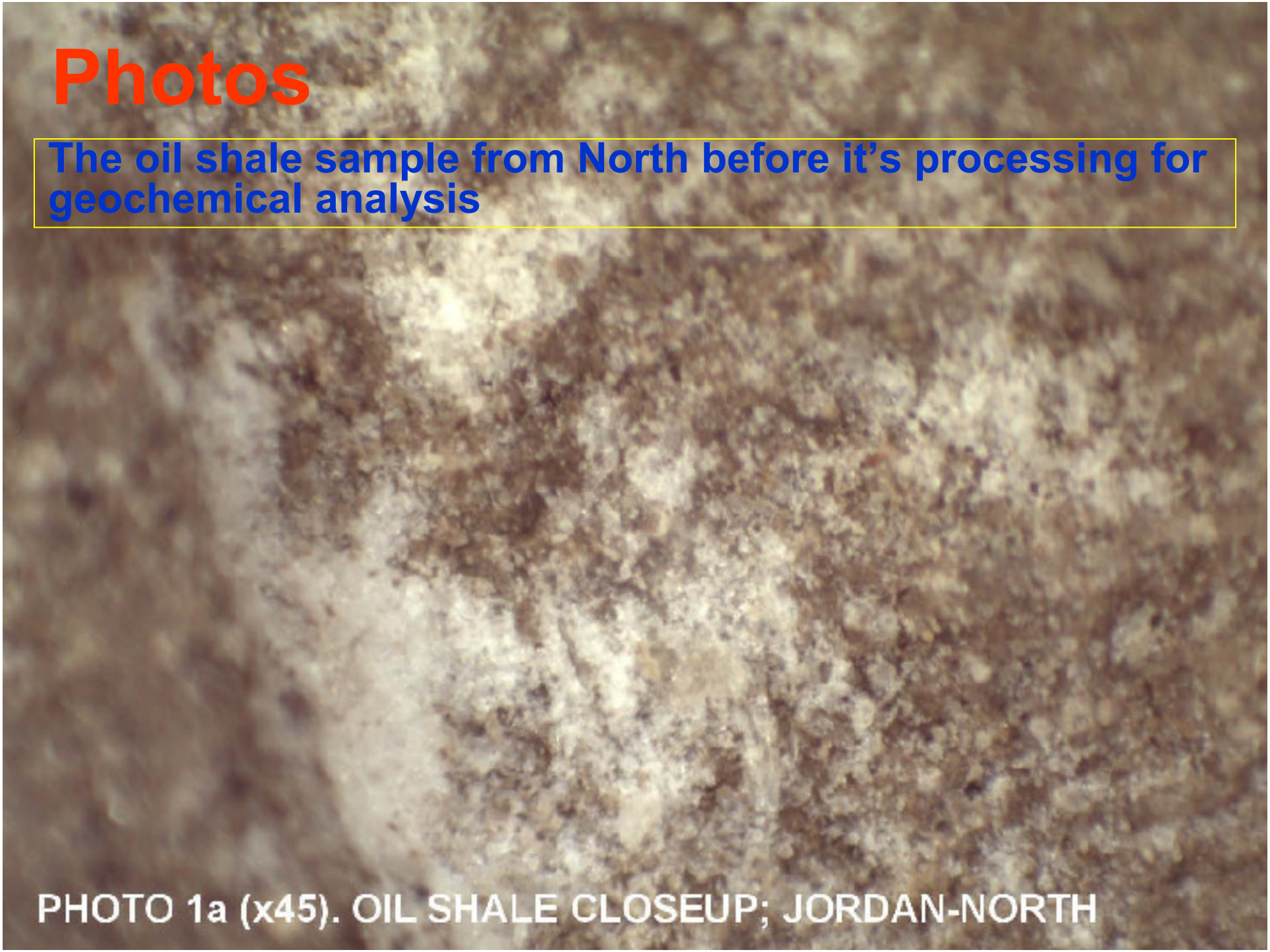
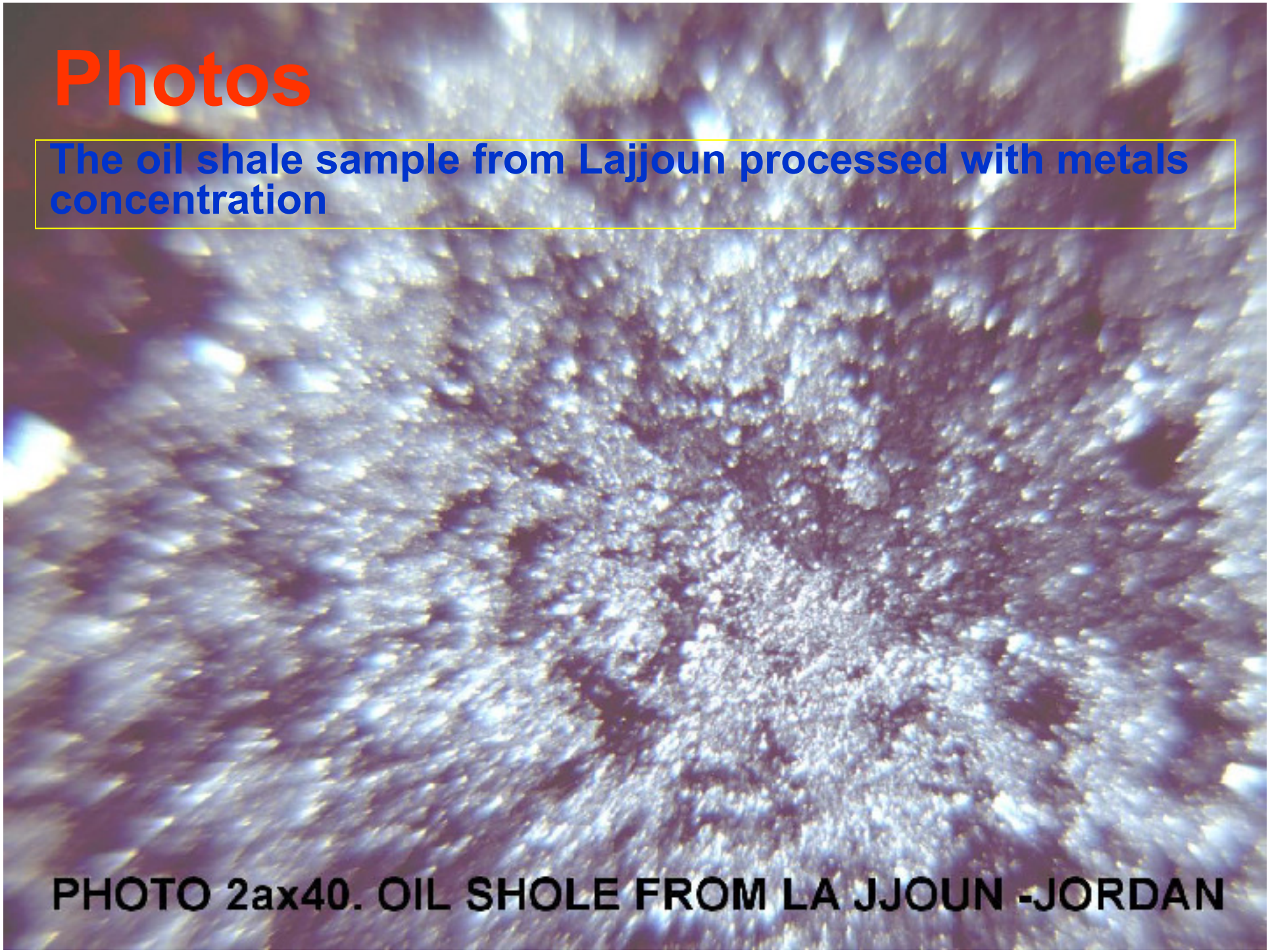


PHOTO 1a (x45). OIL SHALE CLOSEUP; JORDAN-NORTH

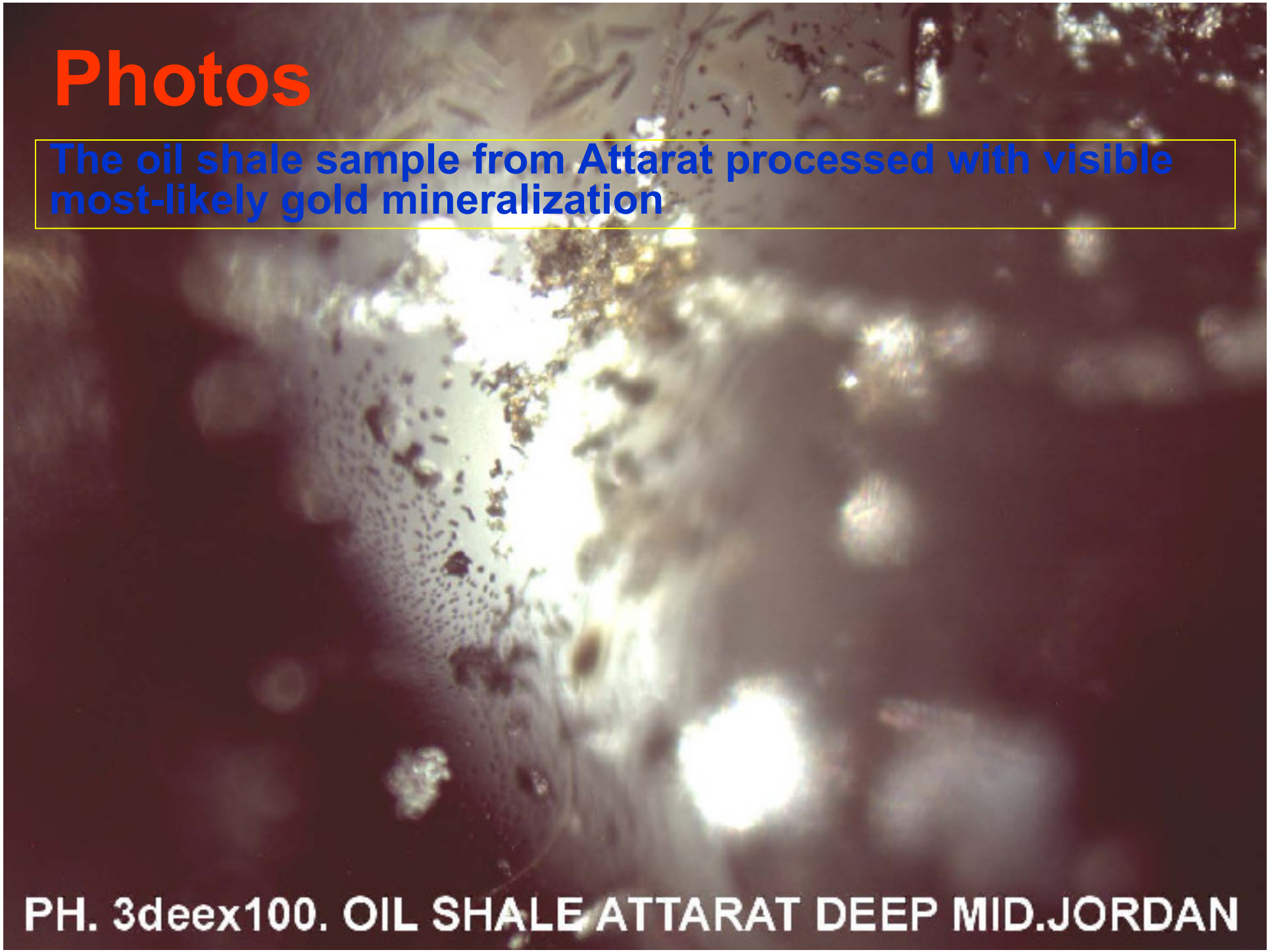
Photos

The oil shale sample from Lajjoun processed with metals concentration



Photos

The oil shale sample from Attarat processed with visible most-likely gold mineralization



Photos

Close-up before processing for geochemical analysis

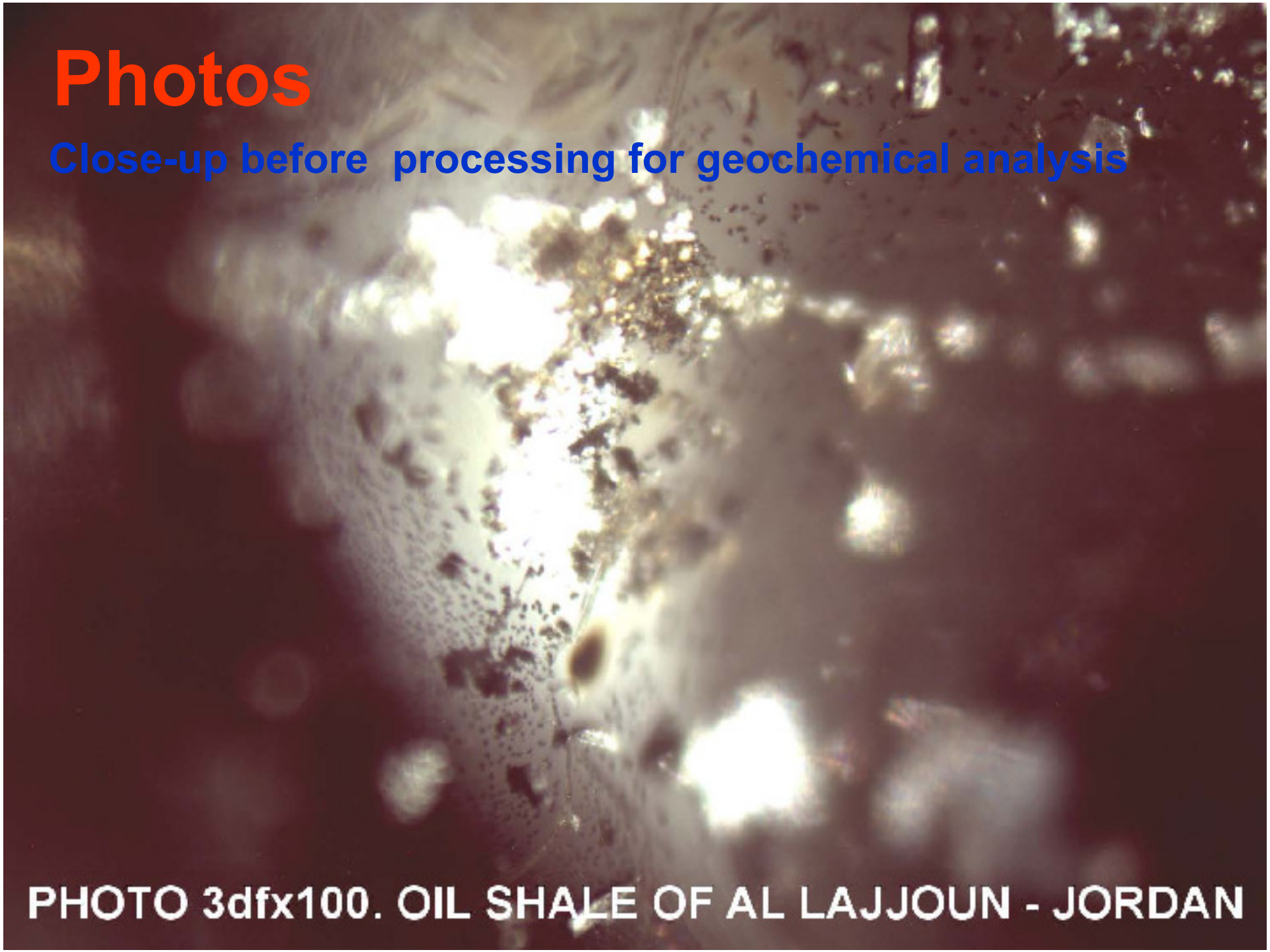


PHOTO 3dfx100. OIL SHALE OF AL LAJJOUN - JORDAN

Photos

Close-up before processing for geochemical analysis

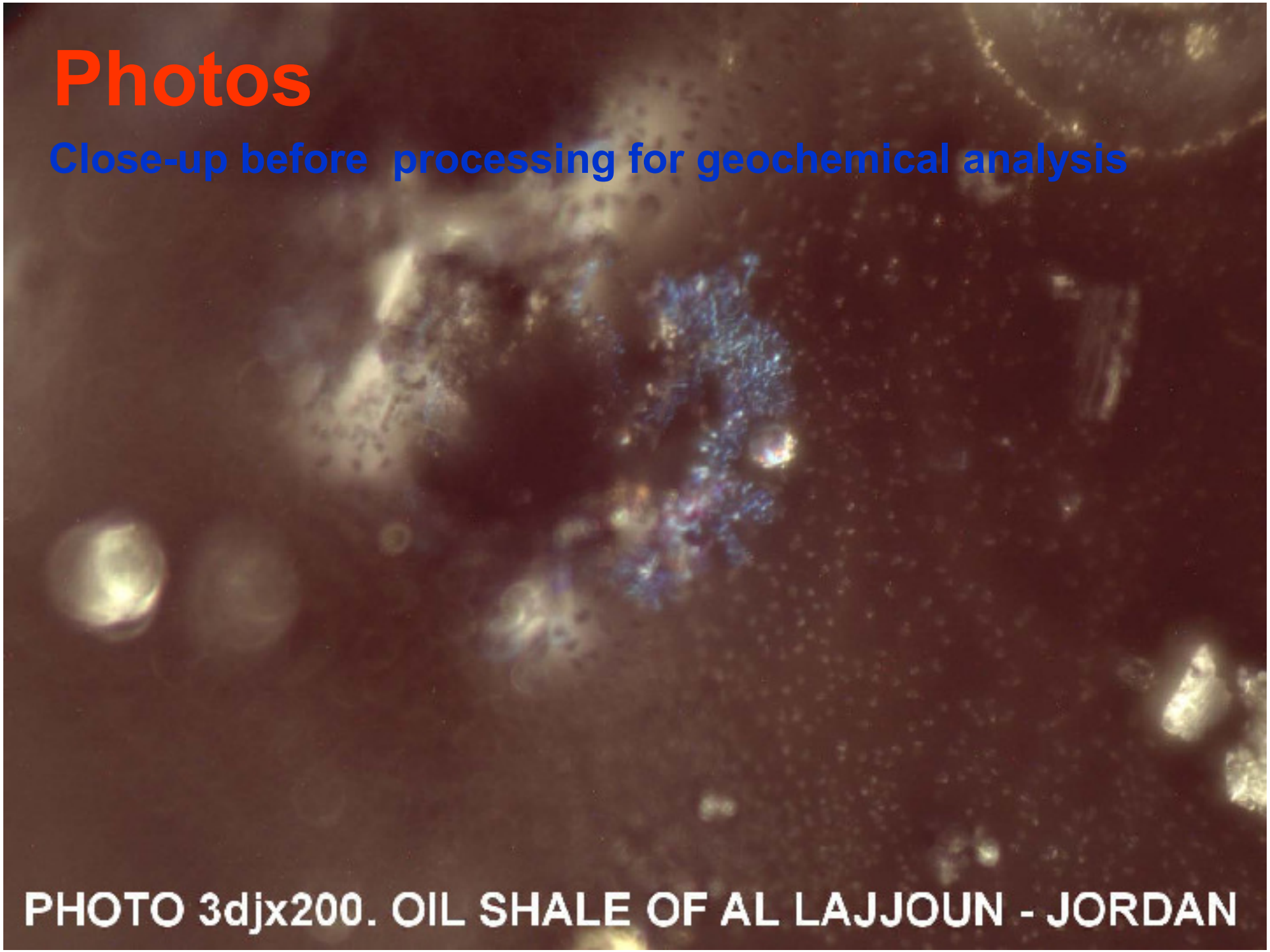
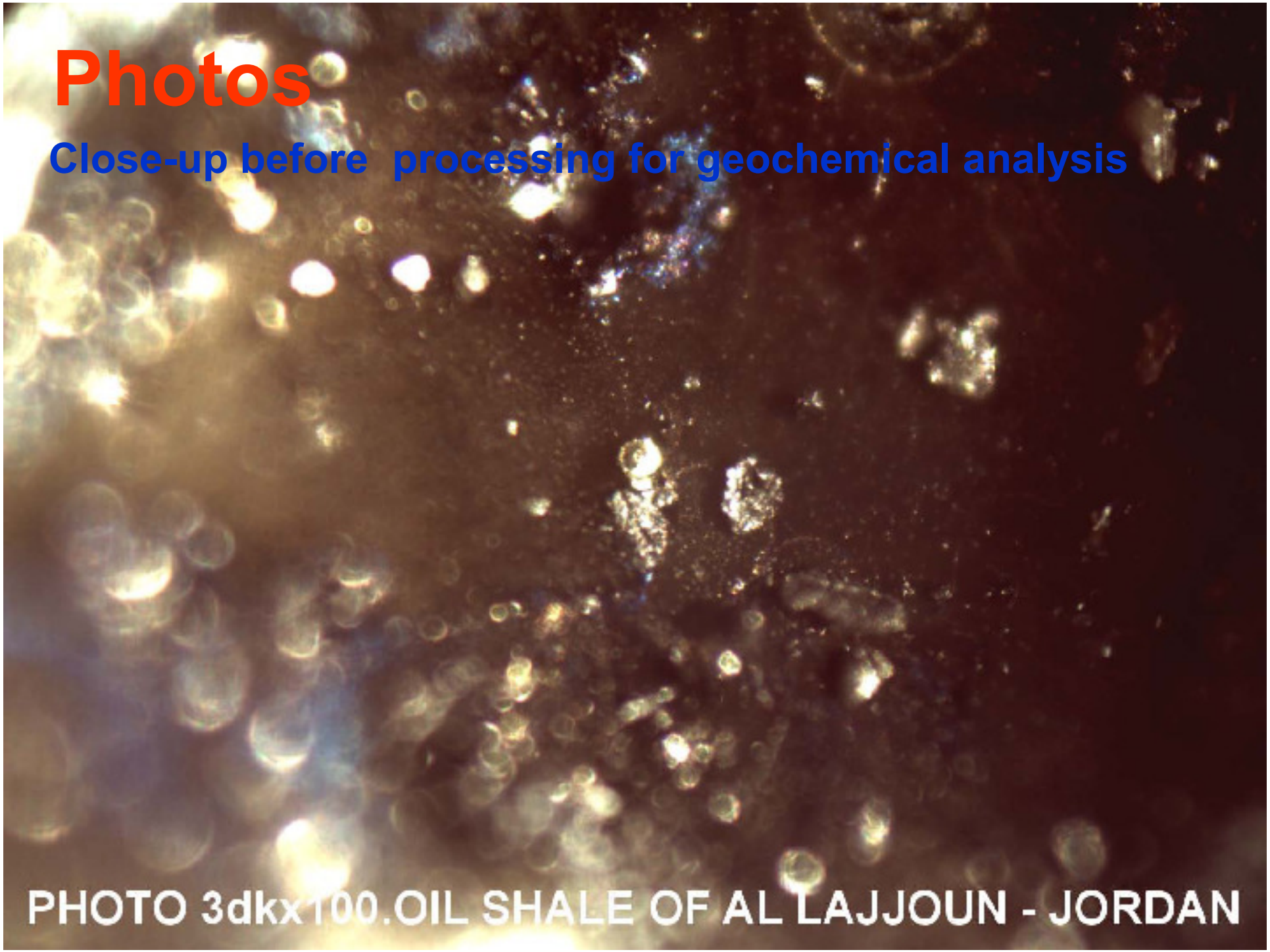


PHOTO 3djx200. OIL SHALE OF AL LAJJOUN - JORDAN

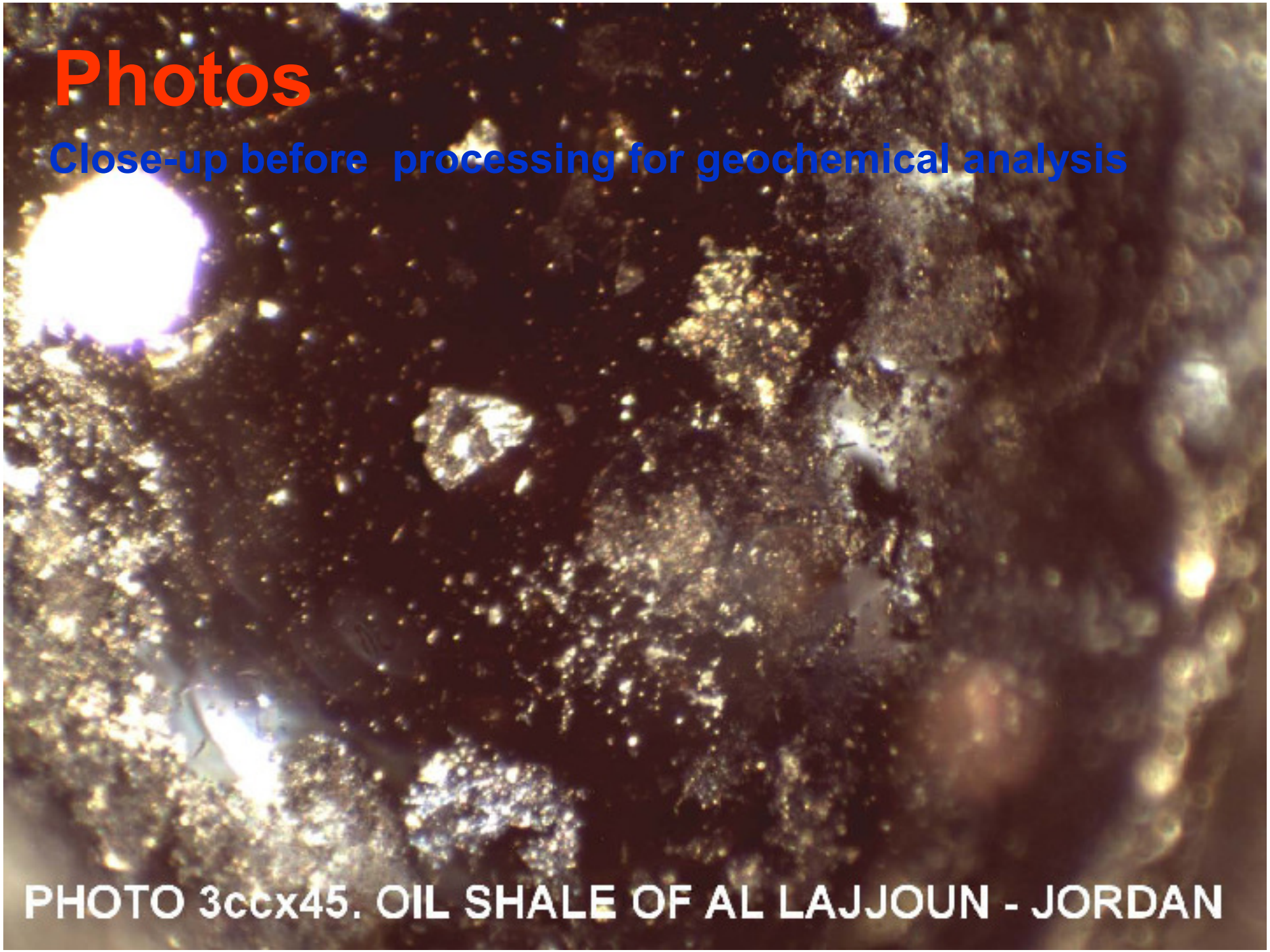
Photos

Close-up before processing for geochemical analysis



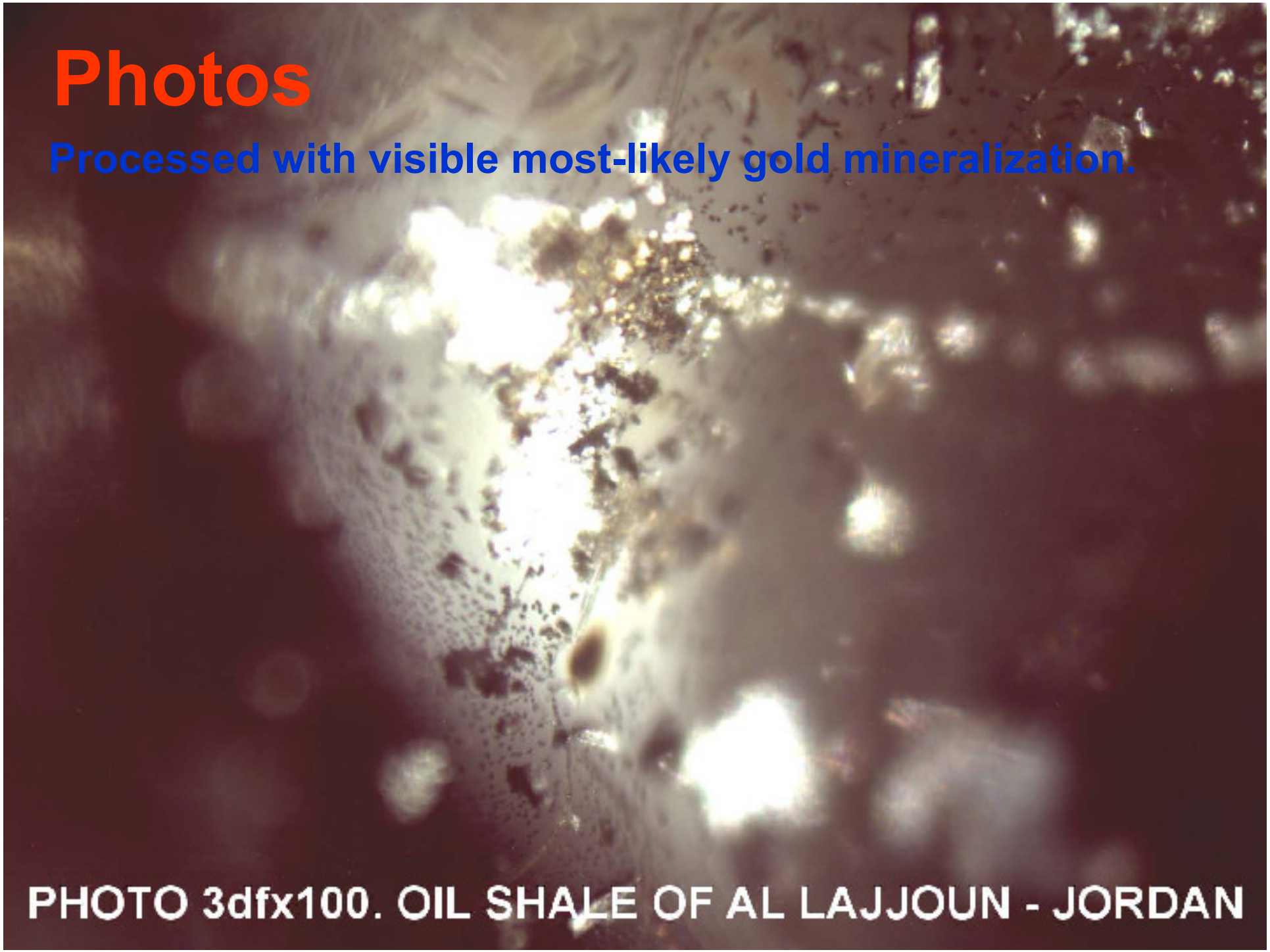
Photos

Close-up before processing for geochemical analysis



Photos

Processed with visible most-likely gold mineralization.



Photos

Processed with visible most-likely gold mineralization.

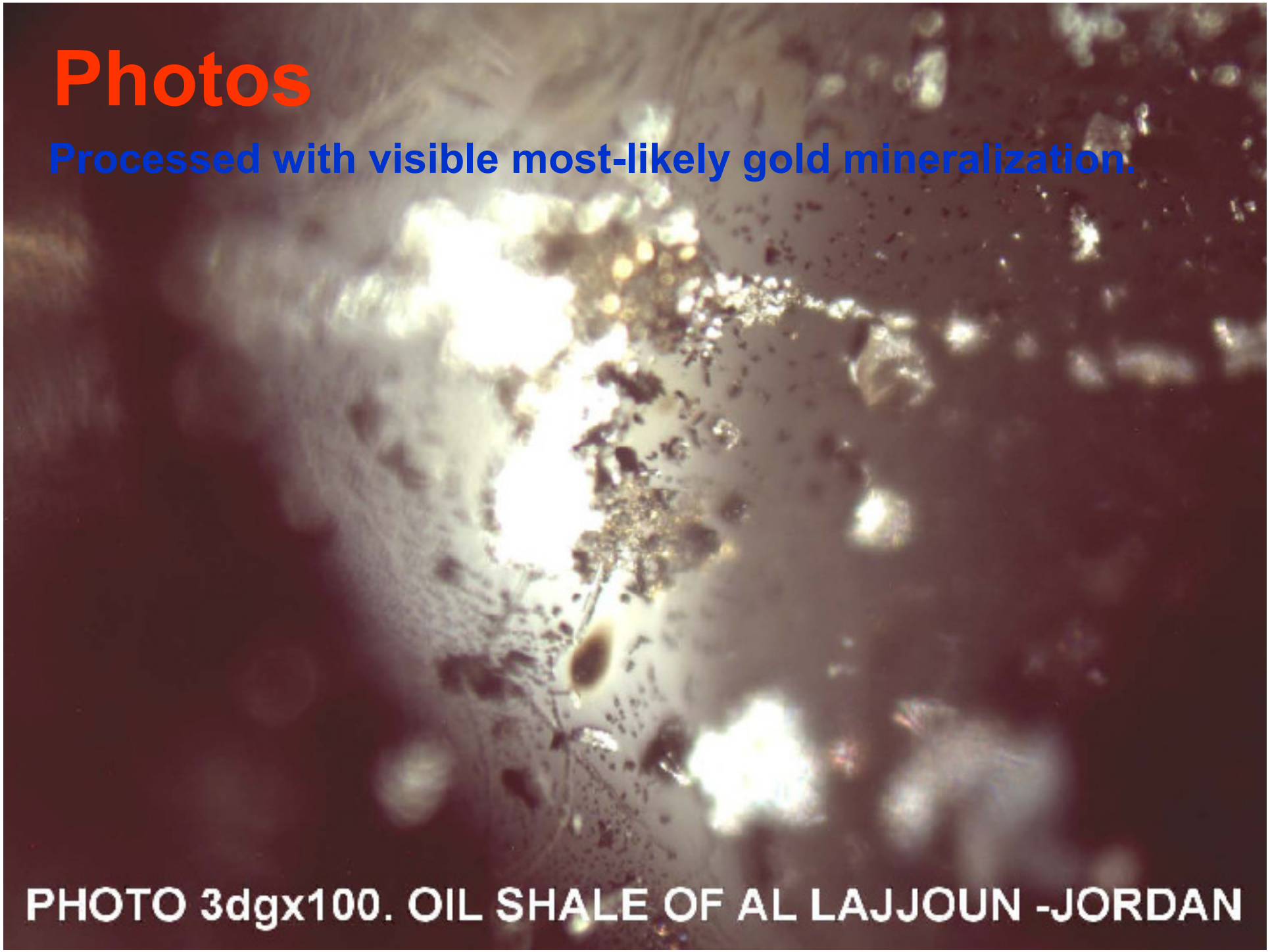
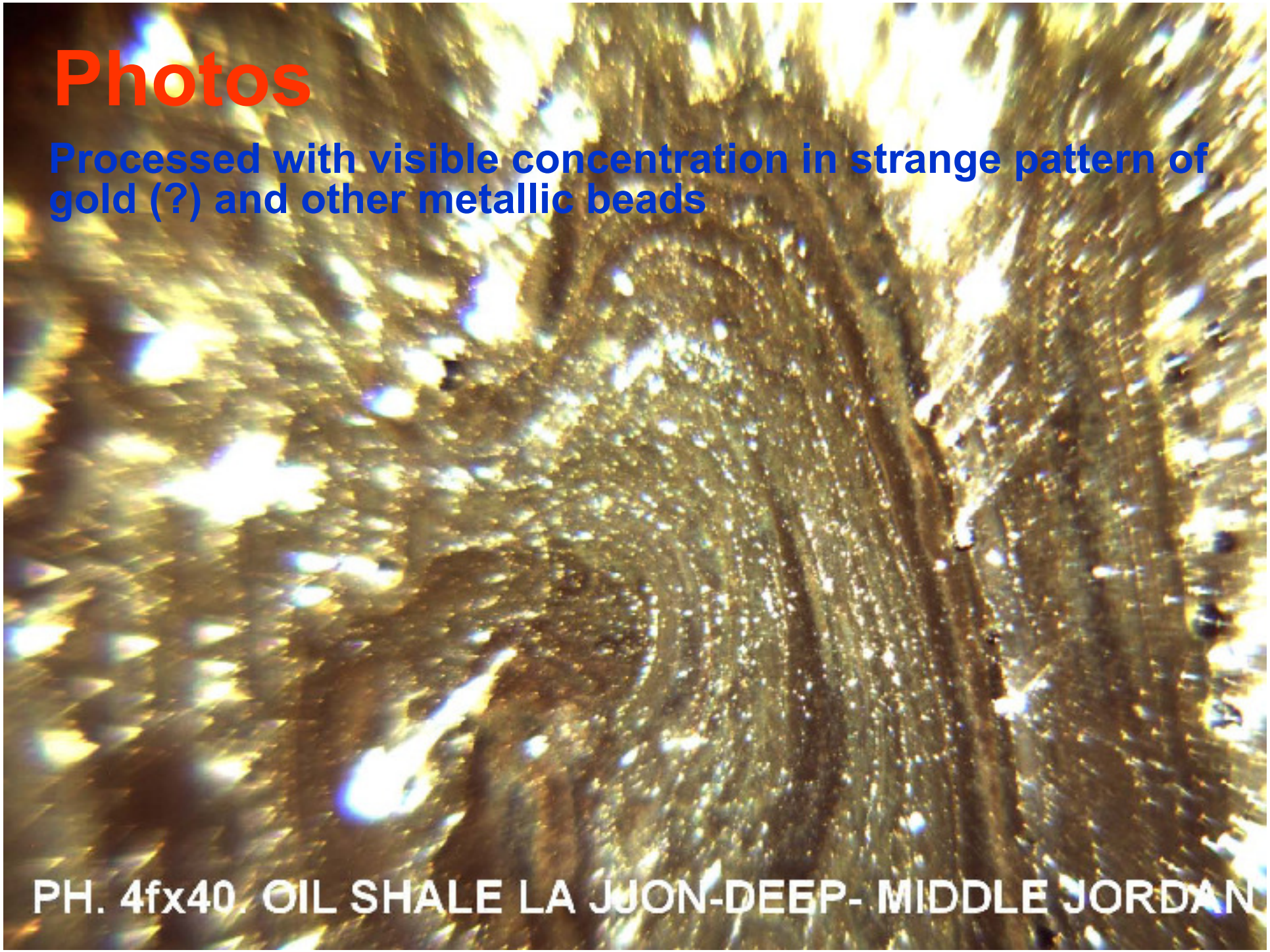


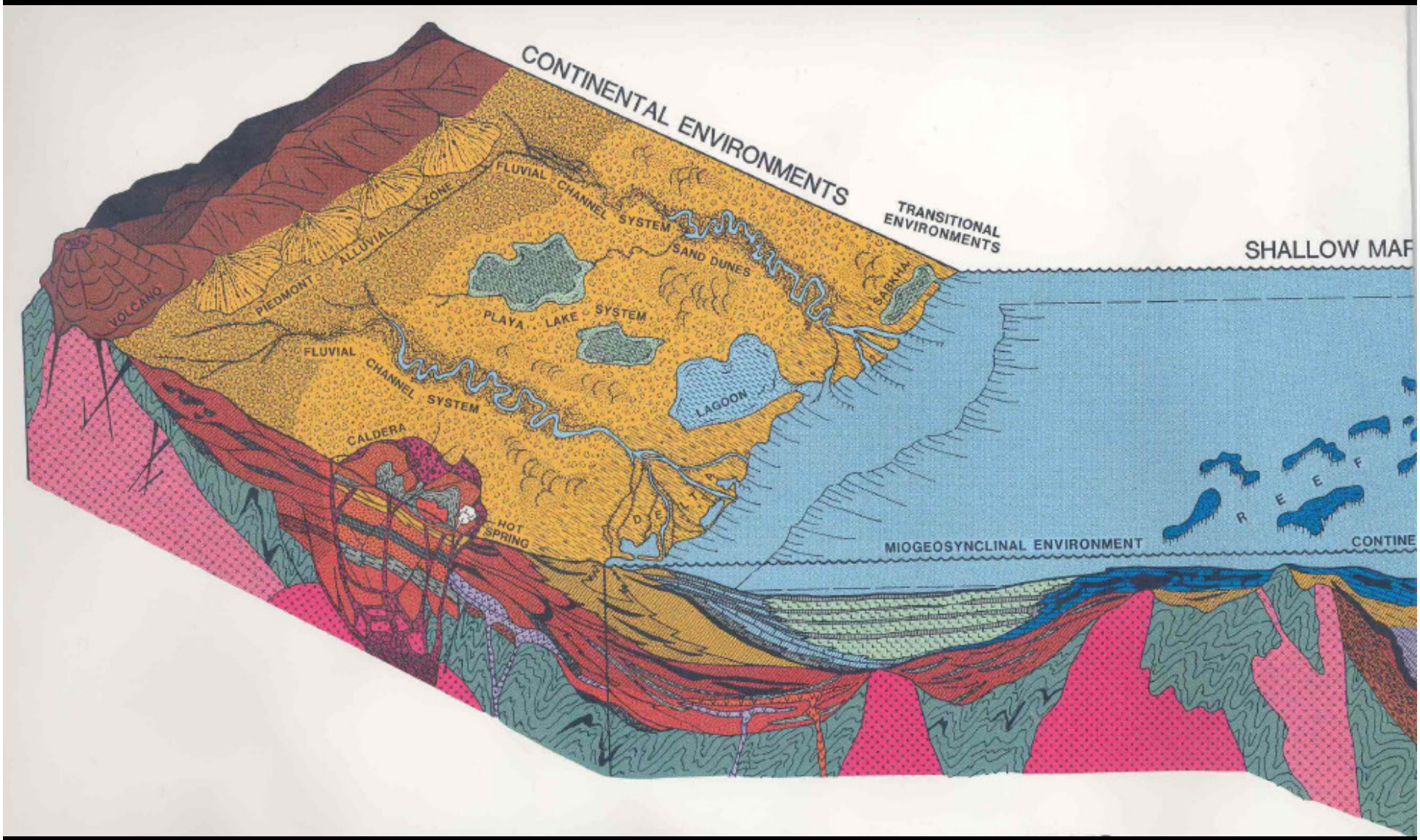
PHOTO 3dgx100. OIL SHALE OF AL LAJJOUN -JORDAN

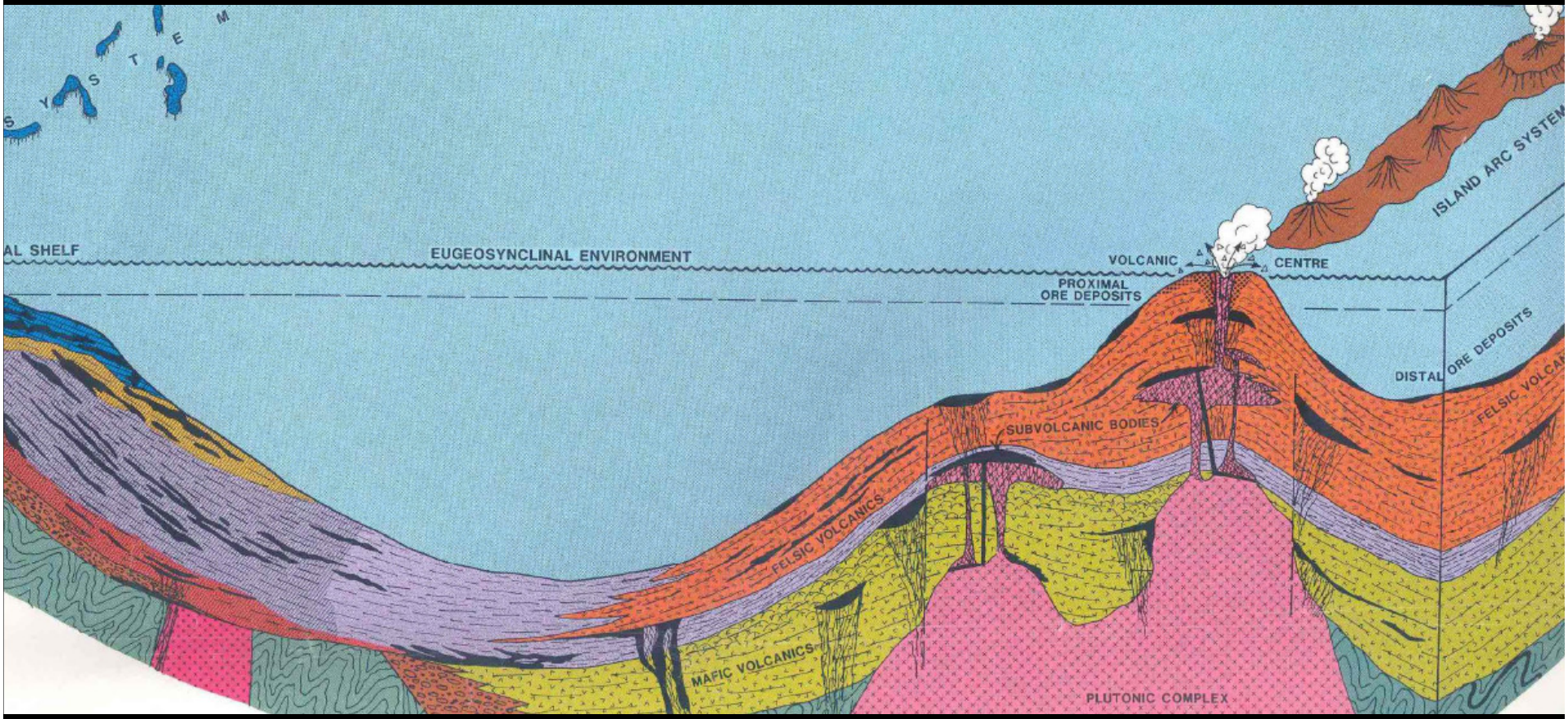
Photos

Processed with visible concentration in strange pattern of gold (?) and other metallic beads

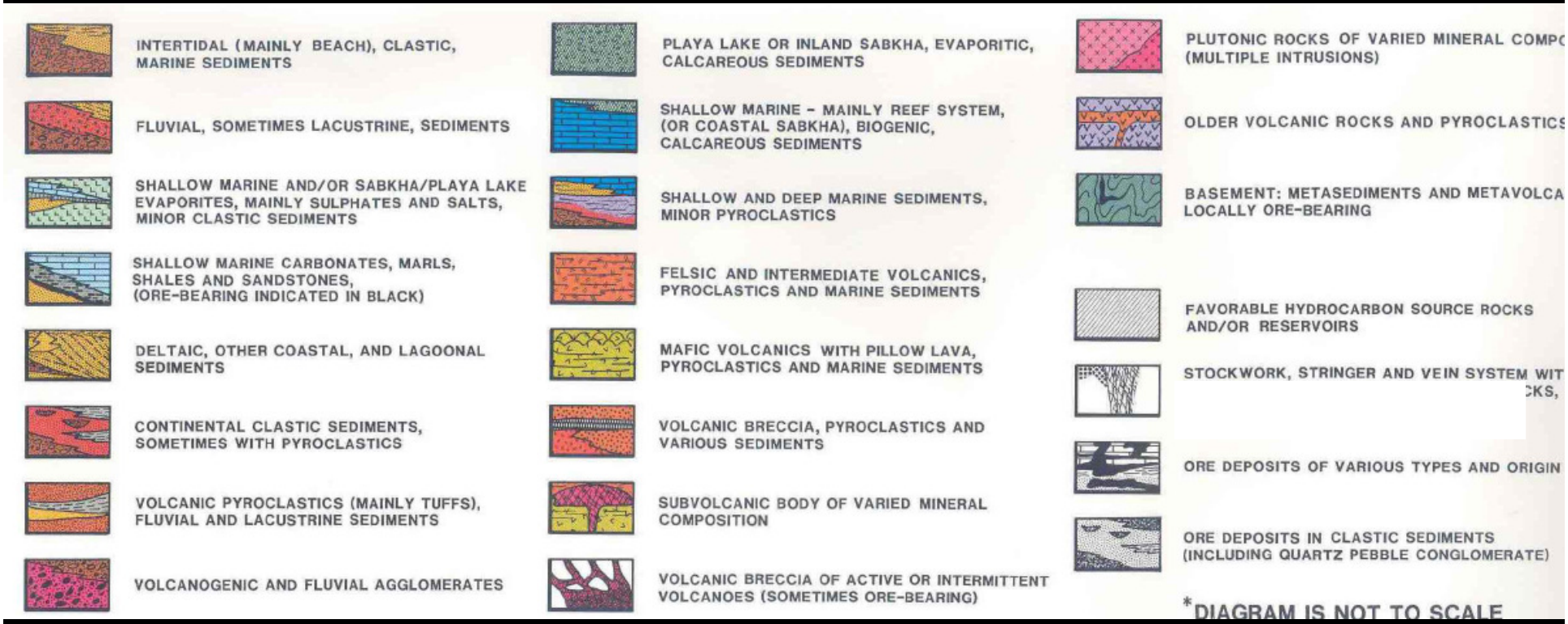


The Poster


CONTINENTAL ENVIRONMENTS
TRANSITIONAL ENVIRONMENTS
SHALLOW MAR
VOLCANO
PIEDMONT
ALLUVIAL
ZONE
FLUVIAL CHANNEL SYSTEM
SAND DUNES
SABKHA
PLAYA LAKE SYSTEM
FLUVIAL CHANNEL SYSTEM
LAGOON
CALDERA
HOT SPRING
DELTA
REEF
MIOGEOSYNCLINAL ENVIRONMENT
CONTINE


AL SHELF
EUGEOSYNCLINAL ENVIRONMENT
VOLCANIC
CENTRE
PROXIMAL
ORE DEPOSITS
ISLAND ARC SYSTEM
DISTAL ORE DEPOSITS
FELSIC VOLCAN
SUBVOLCANIC BODIES
FELSIC VOLCANICS
MAFIC VOLCANICS
PLUTONIC COMPLEX

RELATIONSHIP OF SEDIMENTARY ENVIRONMENTS, HYDROCARBON FAVORABILITY AND METALLOGENY OF STRATIFORM ORE DEPOSITS



INTERTIDAL MARINE	CLASTIC SEDIMENTS		FAVORABLE RESERVOIR	PLACER DEPOSITS	Au,U,Sn,Pt,Ti,Zr	ALLOGENIC AND/OR AUTHIGENIC
FLUVIAL, SOMETIMES LACUSTRINE	COARSE CLASTIC SEDIMENTS		FAVORABLE RESERVOIR			
SHALLOW MARINE, LAGOONAL,SABKHA, LACUSTRINE	EVAPORITIC - CALCAREOUS SEDIMENTS		FAVORABLE RESERVOIR AND/OR SOURCE	REDOX INTERFACE DEPOSITS	Pb,Zn,U,V,Cu,Ag,Fe	DIAGENETIC/ METASOMATIC
SHALLOW MARINE, LAGOONAL/SABKHA	BIOGENIC - CALCAREOUS AND FINE CLASTIC SEDIMENTS		HIGHLY FAVORABLE SOURCE AND/OR RESERVOIR		Cu,Ag,Pb,Zn,P,(V,Mo, Co,Ni,Cr,Sn,As,Sb,Bi, Ga,Ge)	EPIGENETIC: DIAGENETIC/METASOMATIC, SYNGENETIC
SHALLOW MARINE, PRODELTAIC, LAGOONAL, LACUSTRINE	CLASTIC SEDIMENTS	BLACK SHALE, ARGILLITE, SILTSTONE	HIGHLY OR MODERATELY FAVORABLE SOURCE AND/OR RESERVOIR		Cu,Ag,Pb,Zn,U,P, (Mo,Re,Co,Ni,Cr,V,Cd, Bi,Sn,As,Sb,Ga,Ge,In, Tl,Se,Te,Hg,Au,Pt,Pd, Os,Ir,Ta)	
TERRESTRIAL, FLUVIAL, LAGOONAL, DELTAIC, SHALLOW MARINE		SANDSTONE, CONGLOMERATE	HIGHLY FAVORABLE RESERVOIR		Mo,Fe,Mn,(Re,Bi,Cr,Sn, Ni,Cd,As,Sb,Au,Ga,Ge)	EPIGENETIC: DIAGENETIC/METASOMATIC
PLAYA LAKE OR INLAND SABKHA	EVAPORITIC - CALCAREOUS SEDIMENTS		FAVORABLE RESERVOIR AND/OR SOURCE	MISSISSIPPI VALLEY TYPE DEPOSITS	Pb,Zn,Ba,F, (Cd,Ge,Ga,In)	EPIGENETIC/DIAGENETIC, (SYNGENETIC ?)
SHALLOW MARINE - DOMINANTLY REEF SYSTEM (OR COASTAL SABKHA)	BIOGENIC - CALCAREOUS SEDIMENTS		HIGHLY FAVORABLE SOURCE AND RESERVOIR			
MARINE OR CONTINENTAL WITH VOLCANIC EXHALATIONS	CLASTIC, PYROCLASTIC SEDIMENTS AND VOLCANIC ROCKS		GENERALLY NOT FAVORABLE	VOLCANOGENIC DEPOSITS	Pb,Zn,Cu,Ag,Au,U,Mo, W,Sb,Hg,Sn,Cr,Fe,Ni, Be,Li,F	SYNGENETIC/EPIGENETIC, METASOMATIC

Results

Seeing is Believing

First Hand Analysis

1.SAMPLE OF OIL SHALE FROM NORTHERN JORDAN

- ✓ Brownish-gray, silty shale, soft, not clearly stratified, with white alum [$KAl(SO_4).12H_2O$] stains on the surface and in the fracture openings
- ✓ Oil shale processed with clearly visible concentration of metals

2. SURFACE SAMPLE OF OIL SHALE FROM AL LAJJOUN, JORDAN

- ✓ Gray oil shale with whitish irregular seams and lenses of slightly brownish inclusions. Freshly broken smells of hydrocarbons
- ✓ Oil shale processed with metals concentration

First Hand Analysis

3. SAMPLE; FROM ATTARAT-DEEP, MIDDLE JORDAN

- ✓ Light-gray, silty oil shale, with spotty white coatings of alum
- ✓ Oil shale processed with clearly visible gold beads
- ✓ Oil shale processed with visible most-likely gold and platinum mineralization

4. SAMPLE; FROM AL LAJJOUN - DEEP, MIDDLE JORDAN

- ✓ Light-gray, silty oil shale, with spotty white coatings of alum
- ✓ Oil shale with visible concentrations of dead oil
- ✓ Oil shale processed with visible concentration in strange pattern of gold (?) and other metallic beads

Second Hand Analysis

OIL SHALE – JORDAN
ANALYZED BY MINERAL LAB. IN GOLDEN COLORADO
FOR GEOEXPLORERS INTERNATIONAL, INC.

XRF Results for Samples Received; Lab No. 209579

SAMPLE NUMBER	V	Cr	Co	Ni	W	Cu	Zn	As	Sn	Pb	Mo	Sr	U	Th	Nb	Zr	Rb	Y
	in ppm																	
1 JK	32	171	17	65	<10	53	178	<20	<50	<10	<10	418	<20	<20	<10	<10	<10	<10
2 JK	39	184	14	74	<10	51	383	<20	<50	<10	39	322	<20	<20	<10	<10	<10	<20
3 JK	123	181	16	74	<10	53	415	<20	<50	<10	53	323	<20	<20	<10	<10	<10	<10
4 JK	158	143	16	70	<10	66	424	<20	<50	<10	61	269	<20	<20	<10	<10	<10	<10

Second Hand Analysis

OIL SHALE – JORDAN
ANALYZED BY MINERAL LAB. IN GOLDEN COLORADO
FOR GEOEXPLORERS INTERNATIONAL, INC.

XRF Results for Samples Received; Lab No. 209579

SAMPLE NUMBER	Ce	La	Tm	Er	Ho	Dy	Tb	Gd	Pr	Nd
	in ppm									
1 JK	<50	<50	<50	<50	64	140	220	100	93	<50
2 JK	<50	<50	<50	<50	60	150	220	120	68	<50
3 JK	<50	<50	<50	<50	59	140	230	120	86	<50
4 JK	<50	<50	<50	<50	60	150	220	120	73	<50

Second Hand Analysis

OIL SHALE – JORDAN
ANALYZED BY HUFFMAN LAB. IN GOLDEN COLORADO
FOR GEOEXPLORERS INTERNATIONAL, INC.
ICP- MS Results for Samples Received; Lab No. 179509

SAMPLE NUMBER		Ag mg/g	Au mg/g	Pd mg/g	Pt mg/g
3	1-JK	0.21	0.09	0.45	<0.02
3 dup	1-JK	0.19	0.15	0.47	<0.02
4	2-JK	0.50	0.17	0.33	<0.02
4 dup	2-JK	0.53	0.29	0.33	<0.02
5	3-JK	0.57	0.40	0.29	<0.02
5 dup	3-JK	0.51	0.26	0.32	<0.02
6	4-JK	0.45	0.35	0.22	<0.02
6 dup	4-JK	0.43	0.21	0.24	<0.02

Denver, Colorado; Geoexplorers International, Inc. October 14, 2009

Conclusions

Shale oil and gas are the prime targets from oil shale

Our Targets are: Spent shale, minerals and REE

1. No conflict between these targets
2. This research indicates the possibility of utilizing the spent shale for many uses
3. Minerals do exist in the Jordanian spent shale
4. This forms an added value to the overall oil shale industry

Recommendations

1. Further study
2. Economy
3. Technologies
4. Environment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Thank you

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