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Density and composition map of the massive Ikizdere obsidian flow, East Pontides, Turkey

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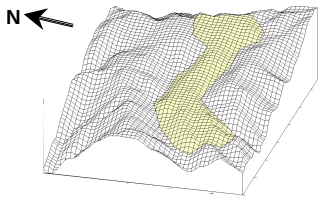
The location

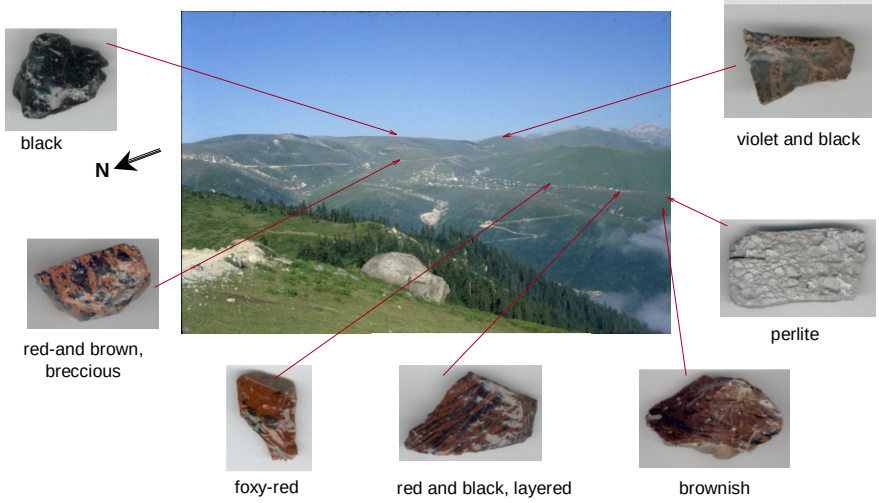
Massive obsidian characterizes the area around the summer village Büyük Yayla, East Pontides, 25 km SSE of the Black Sea port Rize and 7 km NE of the townlet Ikizdere at altitudes from 1800 to 2800 m above sea level /1/. Starting from the highest point, a massive obsidian lava flow of age and thickness extends 6 km to the west. The obsidians were formed between 1.7 and 1.9 Ma.



3-D-plot of the obsidian flow

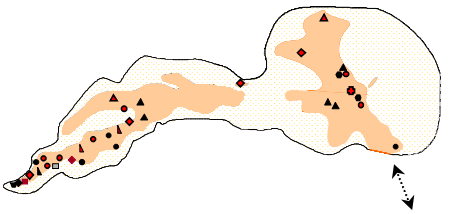
The color

The color of the obsidian varies in a wide range from deep black to foxy red. Single-colored huge blocks are as common as streaky textures in a millimeter to centimeter range.



The density

Density and chemical mapping of more than 70 well localized obsidian samples collected during three field trips in 1995, 1999 and 2001 now permits to draw a more detailed picture of the genesis of the impressing massive obsidian lava flow at Ikizdere.



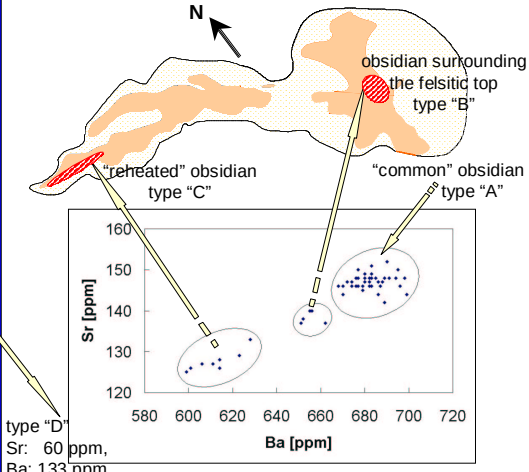
The density is:
- 2342.5…2345 kgm^{-3}
- 2345 …2347.5
- 2347.5…2350
- …
- 2352.5…2355
- 2355 …2357.5
- 2357.5…2360
- 2360 …2362.5
- 2362.5…2365
- 2365 …2367.5
- …
- 2375 …2377.5

The color is:
- black
- foxy red and black
- violet and black
- violet
- brown
- grey
- …

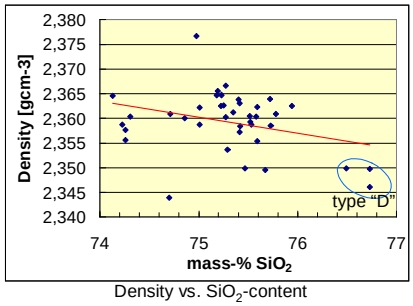
obsidian crystalline rhyolite

The composition

The chemical composition of the different types of obsidian is remarkably homogeneous throughout the whole flow but is not necessarily indicative for a single eruption event.



Sr vs. Ba subgroups



Density vs. SiO_2-content

Differences in the density of the Ikizdere obsidian come up with a magnitude of up to ± 1% ΔD/D (2340 to 2380 kg/m³) and can not be explained by simple chemical fluctuations. Mass density differences of natural glass is not only caused by the chemical composition but also by the thermal history the glass has suffered during geological times. Here, reheating events may have played an important role in the history of the obsidian lava flow. This is strongly implied by vertical density inhomogeneities at the southwestern end of the flow.

Mean chemical composition of the four different types of Ikizdere obsidian:
A: "common" obsidian
B: obsidian surrounding the felsitic top
C: "reheated" obsidian in the weathering zone at the SW bottom of the flow
D: separate appearance at Sehitlik peak

	Mean A	Mean B	Mean C	Mean D
mass-%				
SiO2	75,09	75,10	75,27	76,26
TiO2	0,16	0,16	0,15	0,09
Al2O3	13,87	13,76	13,64	13,48
Fe2O3 (T)	1,05	1,02	0,95	0,70
MnO	0,05	0,05	0,05	0,04
MgO	0,10	0,09	0,08	0,03
CaO	0,89	0,87	0,84	0,85
Na2O	4,02	3,99	3,93	4,03
K2O	4,90	4,95	4,93	4,65
P2O5	0,02	0,02	0,02	0,01
SO3	<0.05	<0.05	<0.05	<0.05
Total	**100,16**	**99,99**	**99,86**	**100,14**
LOI	0,22	0,16	0,19	0,20
ppm				
Ba	683	655	612	133
Rb	131	137	141	183
Sr	147	138	128	60
Y	15	15	14	15
Zr	163	155	147	85

References:
- Sadiklar, B., Gerth, K., Völksch, G., Hartmann, E. (1996). Obsidian from Büyüksulata and Sirikli Tepe, East Pontides, Turkey: a glass-chemical study. *Chemie der Erde – Geochemistry*, 56, 313-322
- Yegingil, Z., Boztug, D., Er, M., Oddone, M., Bigazzi, G., Timing of neotectonic fracturing by fission track dating of obsidian in-filling faults in the Ikizdere-Rize area, NE Black Sea region, Turkey, Terra Nova 14 (2002) 169-174
- Kloess, G., Dichtefluktuationen natürlicher Gläser, Habilitationsschrift, Jena 2000

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