Healdsburgite - a New Tektite and Associated Tektite Strewnfield in North Central California

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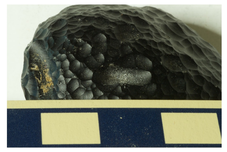
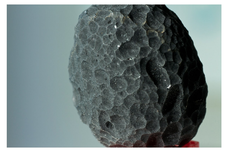
Clast 15. ~3cm ovoid tektite with simple pitted surface.
Dry Creek Valley, Le Brett collection.

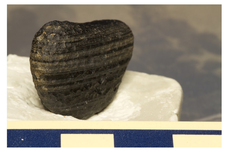


Clast MOO, View 1. ~3cm ovoid tektite.
Simple pitted surface with two small grooves.
Dry Creek Valley, author's collection.

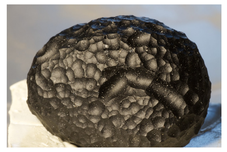


Clast MOO View 2. ~3 cm ovoid tektite.
Simple pitted surface with 2 short grooves superimposed.
Dry Creek Valley, author's collection.

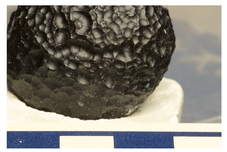
Clast 1. ~4 cm diameter spherical tektite.
Pitted surface with one short groove superimposed.
Near upper size limit. From Dry Creek Valley, Bernier collection.



Clast 25. ~2.5 cm irregularly shaped tektite showing strong layering.
Surface pitted, no grooves.
From Dry Creek Valley, Le Brett collection.

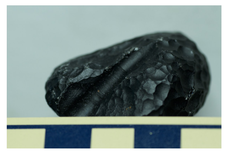


Clast 9. ~3cm ovoid clast, with single groove cutting a pitted surface. Note the groove is segmented.
Origin of groove texture is unknown.
From Dry Creek valley, Le Brett collection.



Clast 19. ~3.5 cm spherical tektite with single segmented vermicular groove.
From Dry Creek Valley, Le Brett collection.

Clast 17. ~4 cm irregularly shaped tektite with internal layering.
A single deep groove lies parallel to the layering.
From Dry Creek Valley, Le Brett collection.



Clast PLEAS. ~3 cm ovoid tektite.
One long groove cuts the pitted surface; note striae on wall of groove oriented normal to the long axis of the groove.
Origin of texture unknown.
From Pleasant's Creek, author's collection.

Creighton Bell took the pictures now in this poster.

	TEKCHEM1 ACTLABS	TEKCHEM2 ACTLABS	TEKCHEM3 SGSLAB	TEKCHEM4 ACTLABS
SiO_2	76.13	75.64	77.49	76.51
Al_2O_3	12.62	12.92	12.65	12.50
Fe_2O_3	1.73	0.53	1.27	0.48
MnO	0.03	0.03	0.04	0.02
MgO	0.05	0.10	0.06	0.04
CaO	0.46	0.49	0.45	0.47
Na_2O	4.46	4.49	4.05	4.42
K_2O	4.53	4.27	3.76	4.28
TiO_2	0.09	0.111	0.10	0.090
P_2O_5	0.02	0.03	<0.01	0.02
LOI	0.03	0.73	0.23	0.45
Ba	468	466	430	443
Sr	8	14	5.8	7
Y	44	40	41.0	40
Sc	3	3.02	2.8	2
Zr	238	212	--	229
Ga	19	--	--	19
Ge	1.2	--	--	1.8
Rb	177	138	188	183
Y	42.7	40	41	42.5
Nb	15.7	--	11.2	11.0
La	31.3	30.9	31.8	32.7
Ce	60.5	53	62.4	61.9
Pr	6.54	--	8.19	6.90
Nd	26.1	22	30.2	26.8
Sm	5.81	5.81	6.0	6.14
Eu	0.294	0.37	0.33	0.265
Gd	6.23	--	6.40	6.35
Tb	1.04	1.2	1.16	1.16
Dy	6.47	--	6.52	6.69
Ho	1.37	--	1.54	1.32
Er	4.29	--	4.59	4.57
Tm	0.695	--	0.68	0.715
Yb	4.52	4.12	4.7	4.38
Lu	0.658	0.62	0.67	0.692
F	580	--	--	--
Cl	0.10	--	653	--
FeO titration	1.57%	0.80 titration	0.70%	0.77 titration
H2O plus	0.45%	0.16%	0.40%	0.08%
H2O minus	0.08%	0.02%	<0.01	0.13%

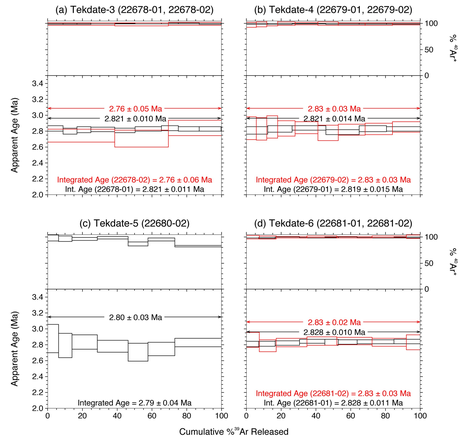
Detailed Chemistry of Four Tektites.

Acknowledgements

Several people in addition to the authors greatly assisted in this study of potential tektites. Paul Bernier, Paul LeBrett, and Tim Unruh freely provided samples from their private collections. Diane O'Connor helped greatly in early field studies.
Last, a great many citizens allowed us to walk around on their land and look for tektites; sometimes successful, sometimes not, and we thank them too.

Field Picture of Healdsburgite Tektite in situ in Pebbly Sandstone,
Dry Creek Valley,near Healdsburg

Four tektites fresh from a vineyard, Dry Creek Valley, near Healdsburg.



40Ar/39Ar incremental heating spectra for four glass samples attributed to the Healdsburgite strewn field. All spectra agree within uncertainty, and yield an overall mean age of 2.823+0.006 Ma (MSWD = 0.45, n=7)

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I A Distinctive Glass Clast Population

In numerous localities in Sonoma and Solano Counties in north central California, over an area of ~500 km^2, distinctive~1-5 cm dominantly ovoid to spherical glass clasts are found as part of the pebble population in young sediments. They are composed of very dark black massive aphyric nonvesicular translucent glass whose surfaces are totally covered with a texture of adjoining small deep pits and grooves. The pits are hemispherical, 1-10 mm across, and join at sharp edges composed of straight segments. The grooves, where present, are the width and depth of the pits and may be up to several cm long and vermicular. Some clasts have internal flow layers. We have collected over a thousand of them and other local collectors have gathered at least that many. They are especially common in vineyards around the town of Healdsburg and in neighboring Dry Creek Valley, so to date we have called them Healdsburg glass. These glass objects were brought to our attention by a local resident, Mrs. Diane Moore, some 20 years ago.

Four samples of potential healdsburgites were dated by the laser incremental heating 40Ar/39Ar method at the Berkeley Geochronology Center. Sample preparation consisted of simple crushing to 0.6-1.0 mm prior to irradiation.

Three of the four samples were analyzed in replicate. All experiments yielded plateaus across the entire release spectrum, with plateau ages and integrated ages all agreeing within uncertainty. The overall weighted-mean average of the plateaus is 2.823+0.006 Ma, calculated against the FC sanidine standard with a reference age of 28.20 Ma.

Chemical analyses of the 10 major and 26 minor elements, in 4 widely separated clasts, were made by commercial laboratories. The clasts are all rhyolites that plot nearly identically on the TAS diagram of Le Maitre et al (2002).

All available data show that all these pitted and grooved clasts are part of a single population. (Unpitted glass clasts are also present in the local sediments and are believed to have another source in local obsidian flows and recycled conglomerates).

II The Clasts are Tektites

We believe these distinctive glass clasts to be **tektites** for the following reasons:

1. The pits are always present and wholly cover the clast surface. Perhaps half the clasts also have distinctive irregular vermicular grooves superimposed on the pitted surface. This surface pattern is like those on other long-recognized 'classic' tektites like indochinites. The clasts **look** like tektites; compare McCall (2001, Figure 2.30) for example.

2. The clasts show no significant weathering. Once cleaned of adhering sediment, they are solid and vitreous. If weathering had occurred the distinctive surface texture would have been obliterated, not formed. There are also no cases of partial development of the distinctive surface texture, as might be expected if it were a consequence of *in situ* weathering.

3 The clasts do not have a detrital origin; they are not obsidian pebbles. They have not been transported any significant distance by streams. Such action would have quickly ground off the pit and groove texture. A loss of the surface texture like this can be seen partially developed on some clasts taken from gravel bars in Dry Creek.

4. The clasts are not volcanic lapilli, (i.e., 'apache tears'). The pit and groove texture contrasts with the relatively smooth surface of apache tears and the clasts bear no resemblance to any class of lapilli.

5. The pit and groove pattern is fragile and could not have survived much transport. The texture is found uniformly well developed on clasts all over the present strewnfield, and clasts bearing it must have been dropped close to where they are now.

Their distinctive appearance, plus their identical ages and uniform chemistry, suggests that these objects are tektites in a strewnfield, only a very small part of which has been identified to date. The strewnfield has been disrupted and individual tektites mixed with other clasts. No related impact site has been identified, but clast composition suggests a continental target. We suggest these clasts, informally called Healdsburg glass till now, be recognized as tektites and called **healdsburgites**, in the manner of other tektites. Several of these objects, tektites as we define them, will be available for checkout and study in the Geology department office at Sonoma State University.

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