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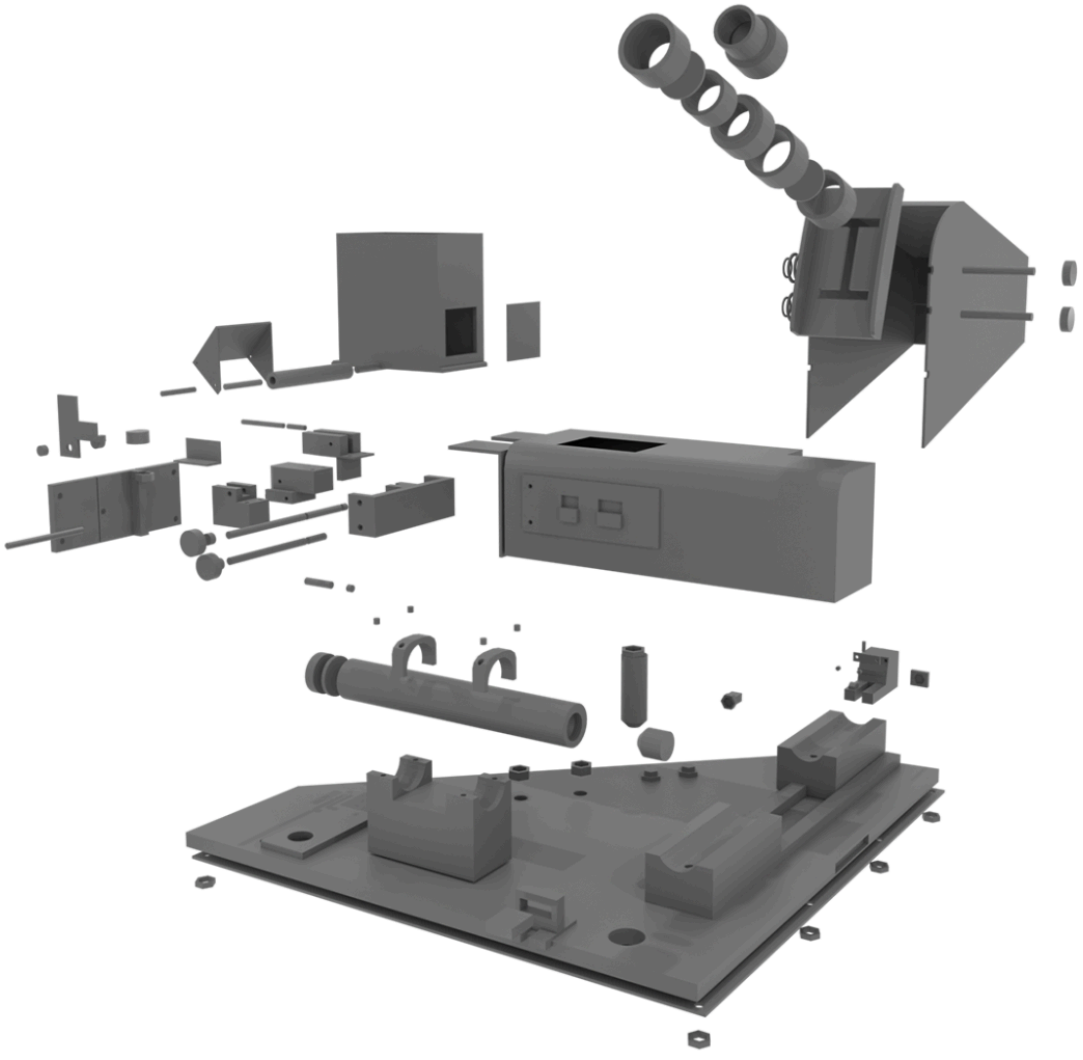
COMMUNITY COLLEGE

OPERATING INSTRUCTIONS

VREELAND MODEL 6A

SPECTROSCOPE



INDEX

USES & PURPOSE

The Vreeland spectroscope is used to identify elements in a sample by burning the sample and turning it into a gas. The wavelengths produced by those gases are then used to determine what elements are present. This makes the instrument useful in mineralogy for analyzing collected samples.

The spectroscope can quickly and accurately identify many common metals and their components, making it especially useful for identifying stainless steels and detecting impurities in metallurgical processes.

It can also be used to measure air and water pollution after contaminants have been collected on a filter and ashed, or evaporated to a residue.

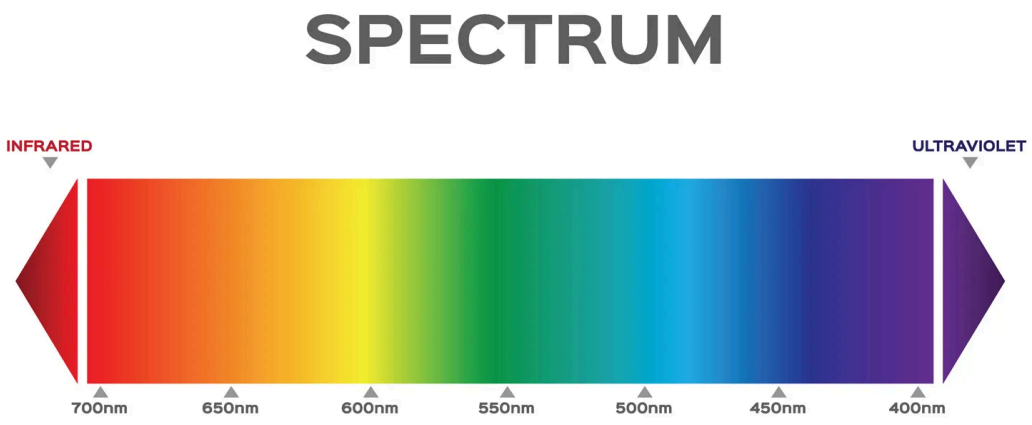
Because the spectroscope has reference films for all major inorganic elements, it is well suited for detecting trace inorganic elements in materials such as leaf compressions, soils, and similar samples.

In an academic setting, the spectroscope is useful for demonstrating optical principles such as diffraction and for showing how spectra are produced and interpreted.

HOW IT WORKS

The spectroscope uses a heat source to fuse minerals which has a heat index of 2000 to 3000 degrees celcius. This incredibly high heat index allows materials like minerals to fuse as quickly as possible, giving us accurate results.

The instrument then separates the light emitted by the heated sample into its individual wavelengths, creating a spectrum that can be observed by the human eye. Different elements produce different colors and spectral patterns, allowing them to be identified. When atoms are heated, their electrons absorb energy and move to higher energy levels. As the electrons return to lower energy levels, they release energy in the form of light. Because each element has a unique electron arrangement, it produces a unique spectrum that can be used for identification (Figure 1).



SAFETY PRECAUTIONS

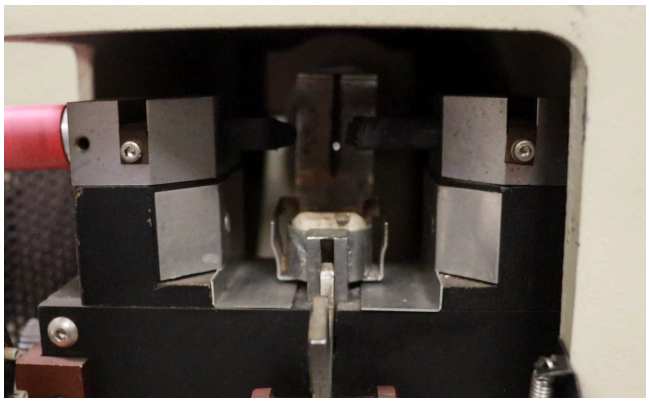
1. Use only under a fume hood.

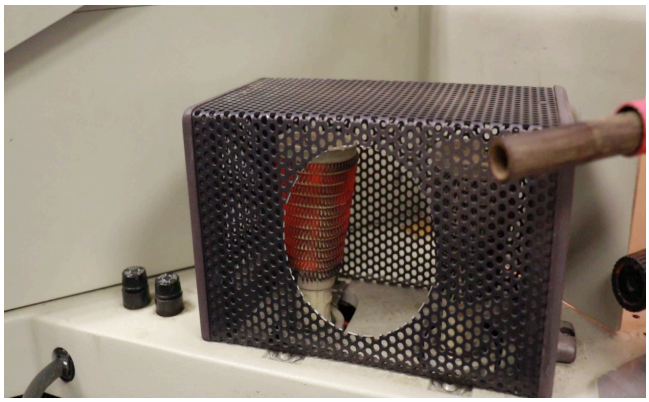
2. Do not come anywhere near the electrodes (Figure 2) while the machine is plugged in.

3. Do not touch the resistors (Figure 3) while it is plugged in.

4. Only watch the process through the welding glass.

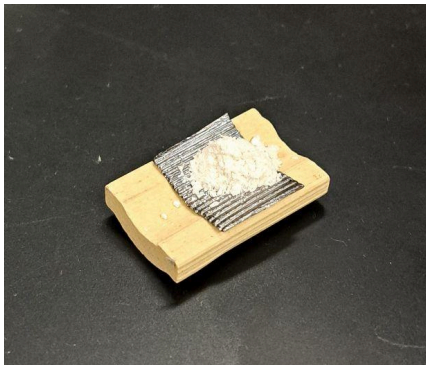
5. Wear safety glasses while grinding samples.





USING THE SPECTROSCOPE

1. After choosing a mineral or material you would like to analyze, using a mortar and pestle grind your sample into a fine powder weighing about 25mg.



2. Place your sample on a ceramic hearth (figure 4) and deposit it beneath the electrodes, you can use the sample feed knob (#74) to make placement easier.

3. Align the electrodes using the electrode alignment lever (#66) so that the tips of the electrodes touch each side of the lever.

4. Turn the electrode feed knob one half turn clockwise then remove the alignment lever.

5. Set the awning (#46) to a down position

6. Plug the spectroscope in and flip the power switch (#50R)

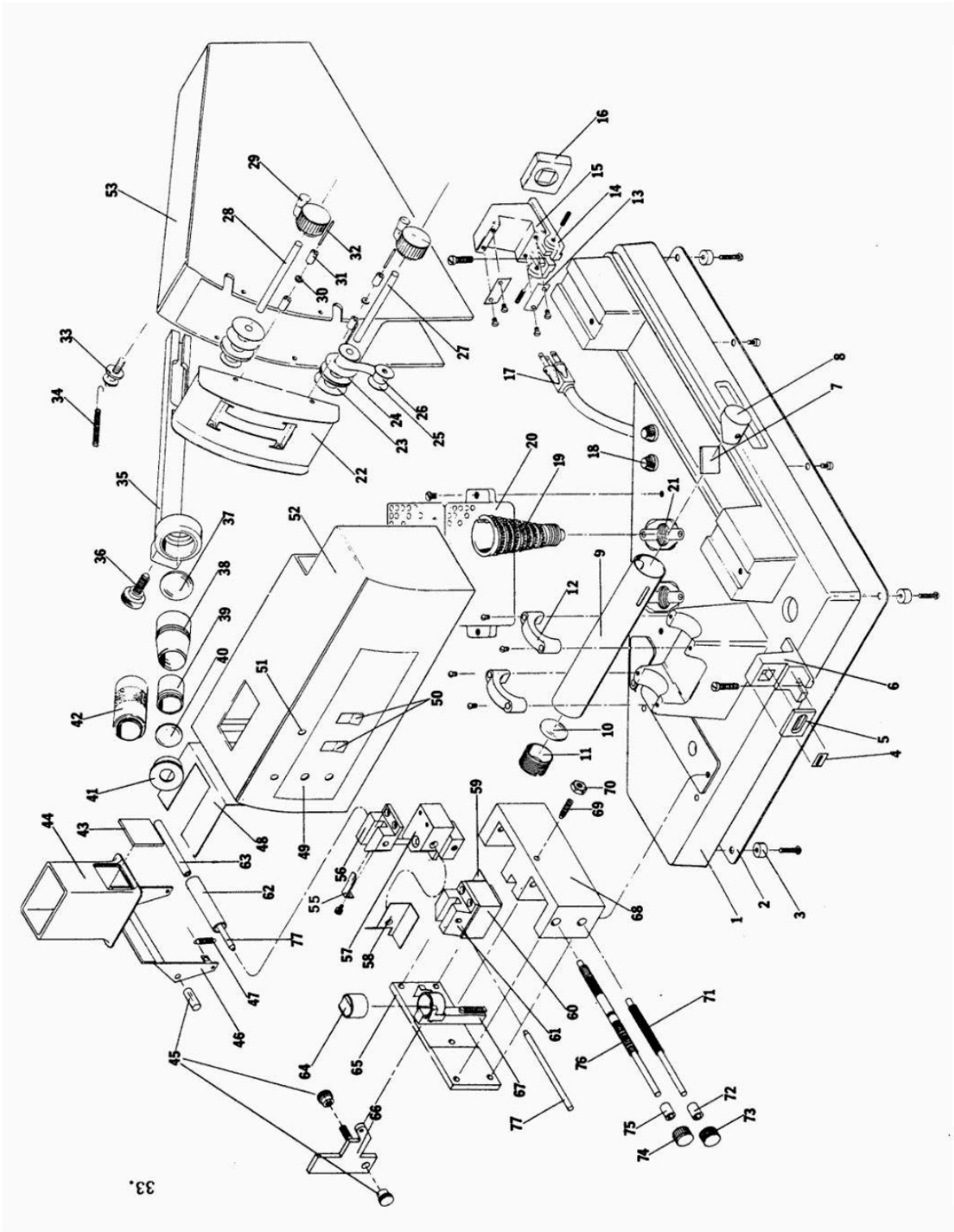
7. Fiddle with the electron feed knob (#73) until you see sparks, an ideal distance between electrodes is usually about 1/8th of an inch.

8. Continuously feed your sample into the arc with the sample feed knob (#74).

9. Swap your attention to the film viewer and referring to the element spectrum spreadsheet, search for your desired element.

10. Use the double sodium lines to align the film, sodium will always appear on the film as it is in the electrodes.

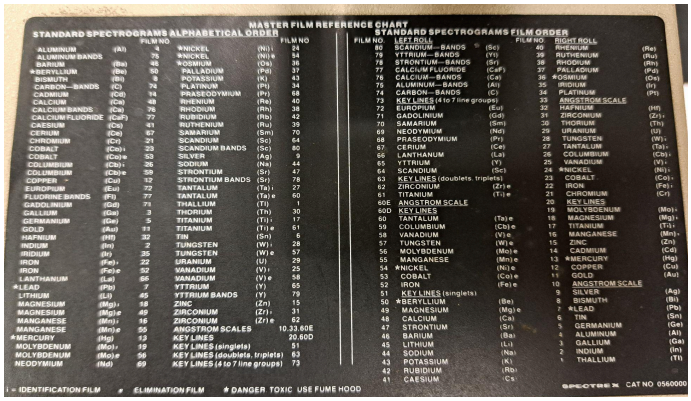
CONTINUE TO PAGE 7 FOR READING & INTERPRETATION



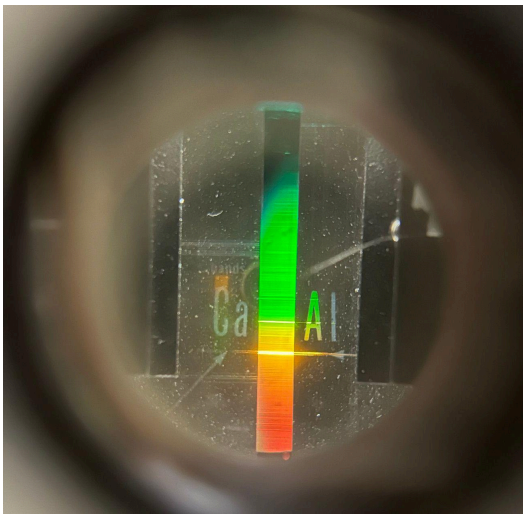
READING AND INTERPRETATION

As you are looking through the spectroscope's film viewer (#41) , use the cranks on the right side of the scope to find the film for the element you are looking for, or the film that has lines that match the lines you see.

To find what element corresponds to what section of film under the eyepiece, there is a plaque with information (Figure 5). Make sure to line up the film with the sodium lines that are on every section of film (Figure 6).



Note that carbon is always present because the rods contain both carbon and sodium. To see if your sample has sodium, there will be the two standard lines as well as other lines that match up to sodium film lines.



Some samples need to be diluted so they do not melt; these samples also need to be heated on the hotter setting, as their melting point is too high. Anything with a melting point above 2000 degrees Celsius must be diluted and heated with the increase heat switch (#50L) , and anything above 3000 degrees cannot be melted or detected by the machine.

Above is an example of the typical Spectrogram of salt.

ADDITIONAL INFORMATION

John Hoyte:

In 2026 John Hoyte, Frederick K Vreeland's nephew, generously donated his remaining model 6 spectroscope to Whatcom Community College.

John Hoyte was born in 1932 to medical missionary parents in Ping Fang Yu, China. He attended a British-run boarding school in the Shantung Provence, which was interned by Japanese forces during WWII. After the war, Hoyte and his family moved to England, where he attended Saint John's College, Cambridge. During his time at college Hoyte put together a team of eight people to recreate Hannibal's famous expedition through the swiss alps with a live elephant named Jumbo. Hoyte moved to the United States at the age of 27, and worked as an engineer in Palo Alto, California. After six years, he founded his own company, Spectrex Corporation which focused on the direct reading spectroscope invented by his uncle, Fred Vreeland. After managing Spectrex for 50 years, Hoyte sold the company to his employees. He now lives in Bellingham, Washington with his wife, Luci Shaw, and enjoys sailing, painting, sketching, and playing the guitar (Hoyte, 2026).

Spectroscope haiku:

Beautiful device
Telling information with
Colorful wavelengths

-Zoe Norman

SOURCES & ACKNOWLEDGEMENTS

Manual Created by Trilian Usinowicz, Gary Redd and Zoe Norman

Special thank you to Alec Hunter and Katja Kraft for editing!

University of Iowa Geology Department. “A Beginners Guide to the Vreeland Spectroscope”. *University of Iowa*. 2026. https://www.spectrex.com/html_files2/technical-notes/vreeland-spectroscope-beginners-guide.pdf

Encyclopedia Britannica. “White Light”. *Encyclopedia Britannica.* 2026. JPEG File.

Hoyte, John. “Biography”. *johnhoyte.com. 2026. https://johnhoyte.com/biography*

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Standard Spectrograms in Alphabetical Order

			Film No.
Aluminum	(A1)		4
Aluminum Bands			75
Barium	(Ba)		46
* Beryllium	(Be)		50
Bismuth	(Bi)		8
Carbon Bands	(C)		74
Cadmium	(Cd)		14
Calcium	(Ca)		48
Calcium Bands	(Ca)		76
Calcium Fluoride	(CaF)		77
Caesium	(Cs)		41
Cerium	(Ce)		67
Chromium	(Cr)		21
Cobalt	(Co)	i	23
Cobalt	(Co)	e	53
Columbium	(Cb)	i	26
Columbium	(Cb)	e	59
Copper	(Cu)		12
Europium	(Eu)		72
Fluorine Bands	(Fl)		77
Gadolinium	(Gd)		71
Gallium	(Ga)		3
Germanium	(Ge)		5
Gold	(Au)		11
Hafnium	(Hf)		32
Indium	(In)		2
Iridium	(Ir)		35
Iron	(Fe)	i	22
Iron	(Fe)	e	52
Lanthanum	(La)		66
* Lead	(Pb)		7
Lithium	(Li)		45
Magnesium	(Mg)	i	18
Magnesium	(Mg)	e	49
Manganese	(Mn)	i	16
Manganese	(Mn)	e	55
* Mercury	(Hg)		13
Molybdenum	(Mo)	i	19
Molybdenum	(Mo)	e	56
Neodynium	(Nd)		69
Nickel	(Ni)	i	25
Nickel	(Ni)	e	54

			Film No.
* Osmium	(Os)		36
Palladium	(Pd)		37
Potassium	(K)		43
Platinum	(Pt)		34
Praseodymium	(Pr)		68
Rhenium	(Re)		40
Rhodium	(Rh)		38
Rubidium	(Rb)		42
Ruthenium	(Ru)		39
Samarium	(Sm)		70
Scandium	(Sc)		64
Scandium Bands	(Sc)		80
Silver	(Ag)		9
Sodium	(Na)		44
Strontium	(Sr)		47
Strontium Bands	(Sr)		78
Tantalum	(Ta)		27
Tantalum	(Ta)	i	60
Thallium	(Tl)	e	1
Thorium	(Th)		30
Titanium	(Ti)	i	17
Titanium	(Ti)	e	61
Tin	(Sn)		6
Tungsten	(W)	i	28
Tungsten	(W)	e	57
Uranium	(U)		29
Vanadium	(V)	i	25
Vanadium	(V)	e	58
Yttrium	(Y)		65
Yttrium Bands	(Y)		79
Zinc	(Zn)		15
Zirconium	(Zr)	i	31
Ziron	(Zr)	e	62

Angstrom Scales	10, 33, 60E
Key Lines	20, 60D
Key Lines (singlet)	51
Key Lines (doublets)	
Key Lines (triplets)	63
Key Lines (4 to 7 line groups)	73

i = Identification film
e = Elimination film
* = Danger Toxic. Use fume hood

SPECTREX CORPORATION

Melting Points of Elements on Films

	Melting Point °C	Boiling Point °C
Aluminum	659.7	2057
Barium	725	1140
Beryllium	1278	2970
Bismuth	271.3	1560
Carbon	>3550	4200
Cadmium	321	767
Calcium	842	1240
Cesium	28.5	670
Cerium	804	1400
Chromium	1890	2480
Cobalt	1495	2900
Columbium	2500	3700
Copper	1083	2336
Europium	1150	---
Gadolinium	---	---
Gallium	29.78	1983
Germanium	958.5	2700
Gold	1063	2600
Hafnium	1700	>3200
Indium	156.4	2000
Iridium	2454	>4800
Iron	1535	3000
Lanthanum	826	1620
Lead	327.43	1336
Lithium	186	1107
Magnesium	651	1900
Manganese	1260	356.58
Mercury	-38.37	4800
Molybdenum	2620	2900
Neodynium	840	>5300
Nickel	1455	2200
Osmium	2700	760
Palladium	1549.4	4300
Potassium	62.3	2500
Platinum	1773.5	700
Praseodymium	940	2700
Rhenium	3167	
Rodium	1966	2400
Rubidium	38.5	1950
Ruthenium	2450	880
Samarium	1300	1150
Scandium	1200	4100
Silver	960.8	1457
Sodium	97.5	4500
Strontium	774	
Tantalum	2996	
Thallium	302	
Thorium	1845	

Melting Points of Elements on Films

	Melting Point (°C)	Boiling Point (°C)
Titanium	1800	3000
Tin	231.89	2270
Tungsten	3370	5900
Uranium	1130	---
Vanadium	1710	3000
Yttrium	1490	2500
Zinc	419.47	907
Zirconium	1857	2900

Elements without Master Films Which Have Visible Lines
(Use Angstrom Scale For Identification)

Element	Wave Length	
Dysprosium	4000.4Å	4211.7 Å
Erbium	5414.6 Å	
Holmium	4882.9 Å.	
Lutecium	5476.6 Å	
Ruthenium	4554.51 Å	6923.2 Å
Terbium	4276.71 Å	4278.5 Å
Thulium	4242.1 Å	4359.9 Å
Ytterbium	6667.8 Å	6799.6 Å

Elements Identified With UV/IR Modification

Elements	Wave Length	
Antimony	2528.5 Å	
Arsenic	2860.5 Å	
Boron	2496.7 Å	2497.7 Å
Silicon	2881.5 Å	
Tellurium	2383.2 Å	2385.7 Å

Minimum Detection Limits of Elements identified on the Vreeland Spectroscope

These figures have to be used with some reservation due to the variability of matrix effects.

	%		%
Aluminum	.003	Molybdenum	.001
Barium	.003	Neodymium	.1
Beryllium	.2	Nickel	.01
Bismuth	.01	Osmium	.1
Carbon	No Standards	Palladium	.01 -.05
Cadmium	.05	Platinum	.1
Calcium	.005	Potassium	.05
Calcium Fluoride	.5	Praseodymium	.5
Cesium	.5	Rhenium	.1
Cerium	.05	Rhodium	.1
Chromium	.002	Rubidium	.1
Cobalt	.02	Ruthenium	.1
Columbium	.2	Samarium	.1
Copper	.001	Scandium	.01
Europium	.5	Silver	.003
Gadolinium	.05	Sodium	.0005
Gallium	.01	Strontium	.005
Germanium	.05	Tantalum	.1
Gold	.05	Thallium	.001 -.01
Hafnium	No Standards	Thorium	.5
Indium	.01	Tin	.005
Iridium	.1	Titanium	.002
Iron	.0015	Tungsten	.05
Lanthanum	.05	Uranium	.1
Lead	.0015	Vanadium	.002
Lithium	.002	Ytrium	.01
Magnesium	.003	Zinc	.003
Manganese	.005	Zirconium	.01
Mercury	.1		

Note: 1 part per million = 0.0001%
100 parts per million = 0.01%