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Author

Hastorf, Christine A.

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SANTA BARBARA • SANTA CRUZ

DEPARTMENT OF ANTHROPOLOGY
510/642-3391

BERKELEY, CALIFORNIA 94720-3710
FAX: 510/643-8557

A manual for building a mechanized flotation machine

Modified from the SMAP machine first described by Patty Jo Watson, in
1976

Christine A. Hastorf
Associate Professor
Department of Anthropology
University of California, Berkeley

The McKown Archaeobotanical Laboratory Manuscript #42

April 1999

Watson, PJ 1976 In pursuit of prehistoric subsistence: A comparative account of some contemporary flotation techniques. *Mid-Continental Journal of Archaeology* 1(1):77-100.

Archaeobotany Lab Manuscript #42

1) Buy the following before you begin with the welder.

IN US: 1) 1x1.5 m stainless steel wire mesh - .5mm aperture: Howard Wire Cloth Co. 30 mesh. .012" wire dia. Hayward Ca 1800.969.3559

6) medium fish tank siphon (aquarium store)

7) large + medium sharpie pens for all labels

2) a 3.5 - 4.5 hp water pump. Sears

or Briggs + Stratton

a 25' fire hose; a 25' non collapsable hose that goes on the pump into your water source. This also needs a filter / mesh on end to keep things from entering your flat system.

3) chiffon used for the small bucket light fraction catcher (Lafayette Fabrics store) 60 x 60 cm buy enough for 230.

4) Duct tape

5) 2 water sprayers

2) Draw holes etc to be cut / welded on drum before welder begins to make sure it all goes together correctly. Begin welding at the bottom and work up.



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In a delirium in Pernu - boy
1-2 tea strainers $\approx$ 8cm across
used to break

clothes pins.

clothes line in shade

C HASTORF's SNAP modified mechanical flat machine

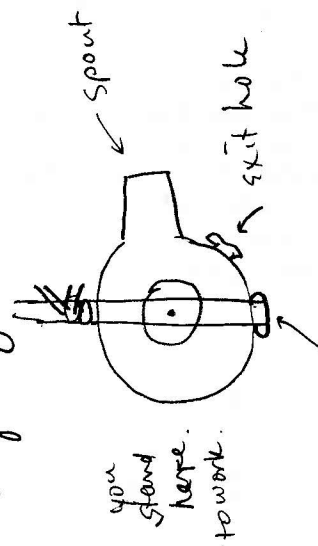
1989

1) Make a tilting base on inside of 55 gallon oil drum you purchase - Make sure it is in good shape, with no holes and little/no rust. This helps silt first.

① Weld tilt at base of drum: ~~Do this~~ first
- Either cut off top or get another round piece of metal that fits the inside. Have this welded on an angle so that the base is where the exit hole is and is not

so that the base is where the exit hole is and is not under the upper spout. Base of drum:

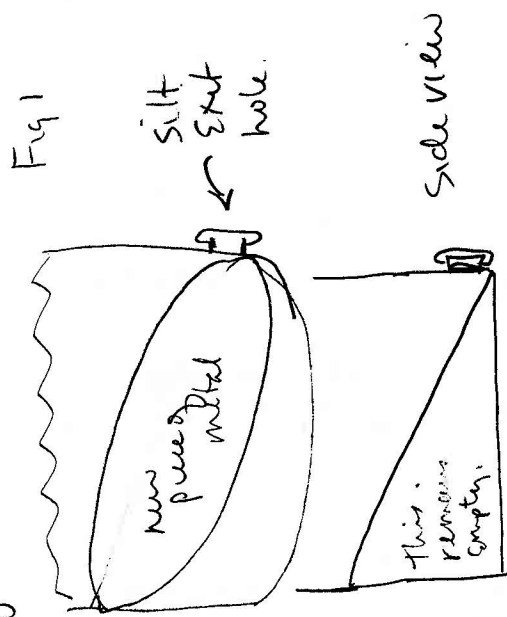
The best way for all of these to go together is: looking down



1/2" tube with inner shower head.

Figure 2

② have welder cut hole at base of the tilt that will fit your threaded exit pipe - sticking out enough for a close cap stopper to be screwed on and off. This is done when drum is full of silt.



Make sure weld is sealed completely or you will have a difficult time.

①



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2) Now you have the base done, the next step is the piping that brings the water to the system. This should be placed between $4\frac{3}{4}$ & $1\frac{1}{2}$ below top rim of drum. It is tricky you need room for the silt but also you want it placed just right for your inner bucket made - or at least - you must have your inner bucket to place the pipe. How its exact height to place the pipe.

Ideal

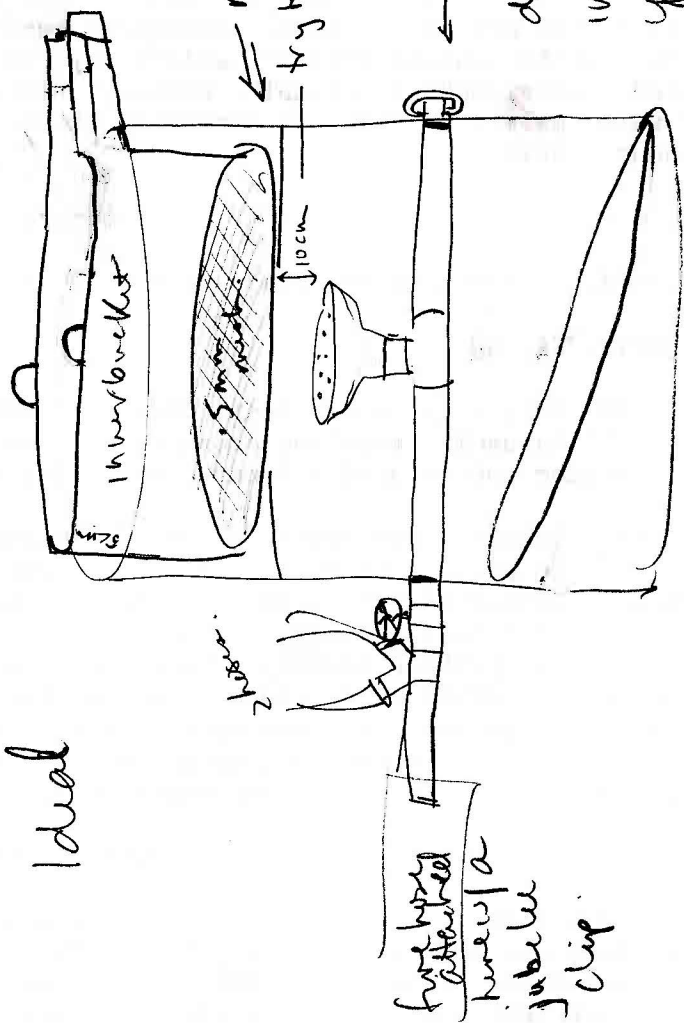
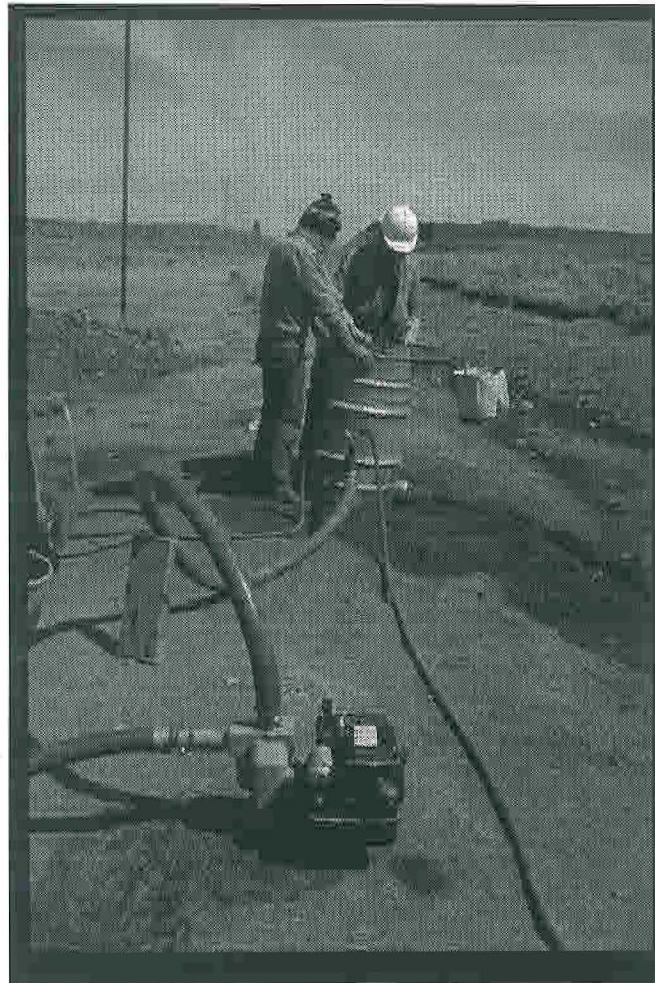


Figure 3

← ∴ The placement of the pipe depends on 1) size/diameter your inner bucket and 2) height your shower (large old fashioned) head.







2) cont. attaching the water piping.
It is important to have all your measurements checked & your

pipes and on your drum.

Purchase metal piping (interior measurement of $\approx 3\text{cm}$) that is weldable. I have always done this at plumbing

stores. You will buy a series of sections that all

screw together. I did this for Bill and sent it to him

I could do this for you if you wish.

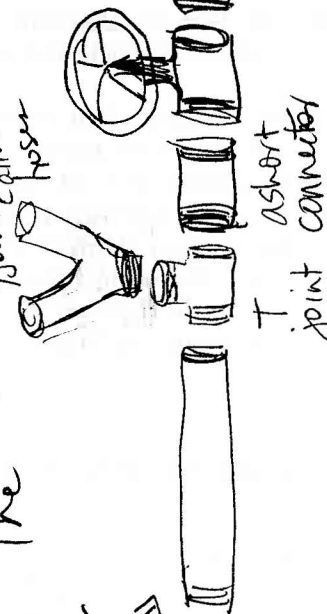
The line needs the following:

the line for
the water
piping

You want lots of
water movement
make sure
the holes are
nice and large.



you might need
an extra piece
here



NB. add silicon tape at every joint as you finally attach all of these.

The threaded
must go outside
the drum

T joint
that
screw on
3 sides

threaded at
both ends
 $\approx 35\text{cm}$ long

NB must be
long enough
so outer
threads are
outside of drum

cap to
screw
on
outside
of
drum

Figure 4

2) cont.: Welder must cut holes at either end of drum at correct height to the size that fits the pipes.

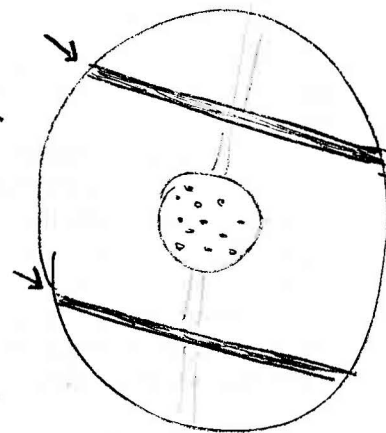
as in Figures 2+3.

3) After cross pipe is welded in permanently; now you are welding 2 lags for your inner bucket

to sit upon. As in Figure 3.

middle of drum

You must make sure you have measured the height of your inner bucket as it really will be.



looking down.
Figure 6

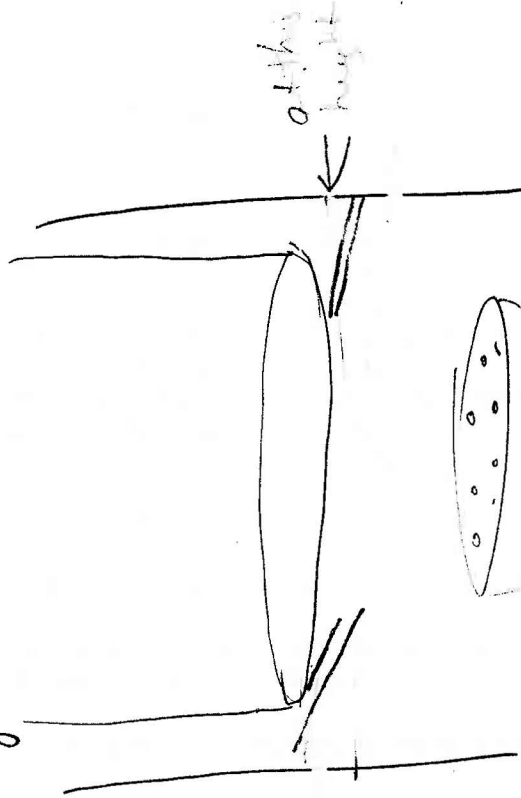
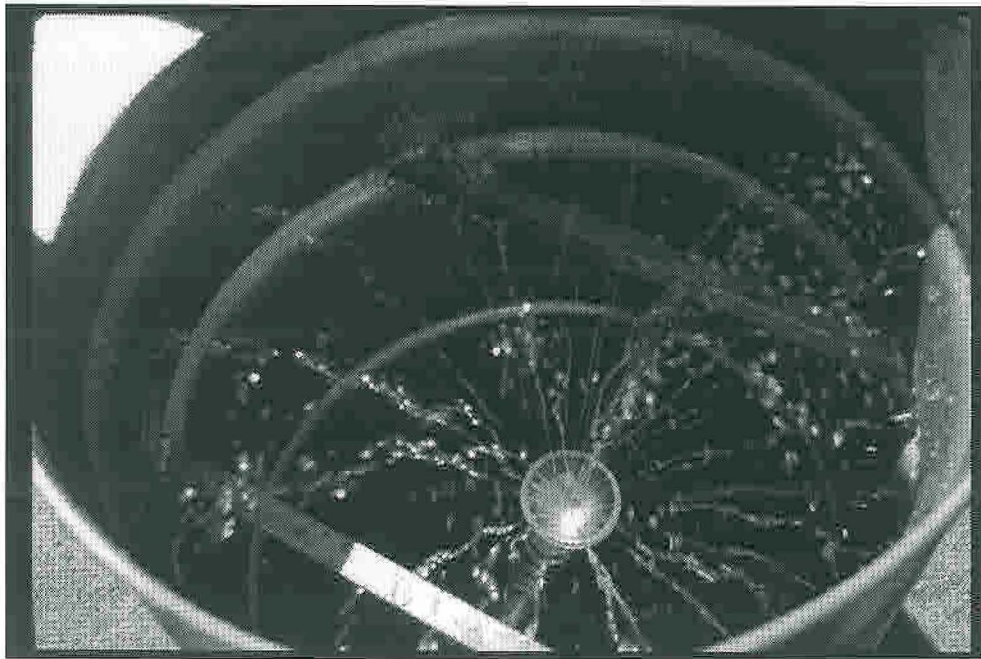
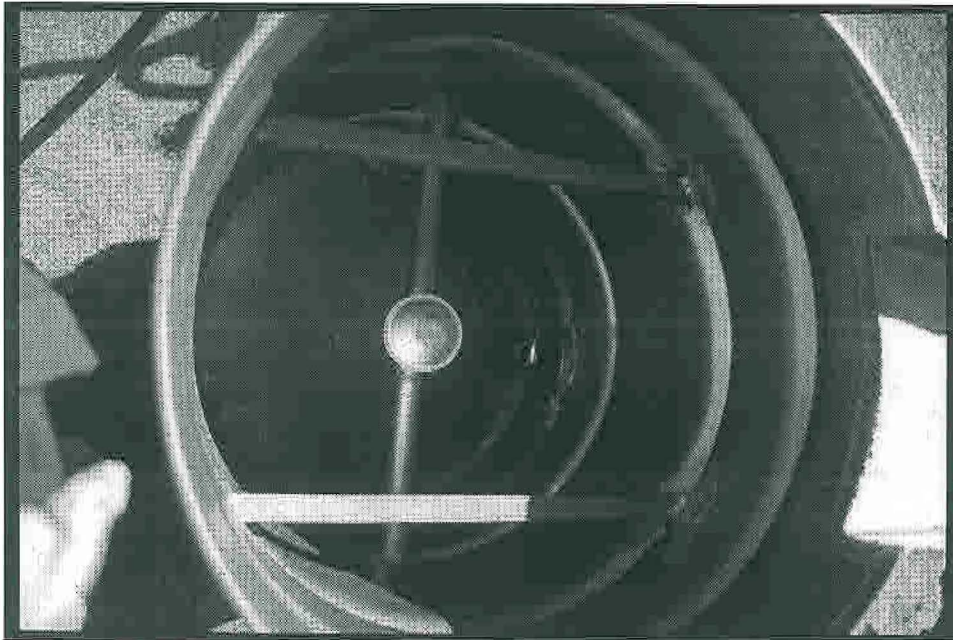


Figure 5





Outer drum- Purchase a 55 gallon drum in good shape, no dents or rust.

4) Add spout to drum: do this last.
looking down on drum

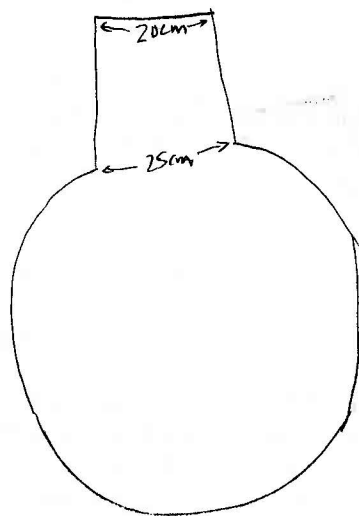


Figure 7

Have welder cut a  out at one point along top rim. This should be 10" cut and weld a  shaped piece of metal that sticks up. It should be about 25cm wide at drum; tapering to 20cm where hooks will be welded.

Side ridges vertical with upturned hooks welded on bucket.

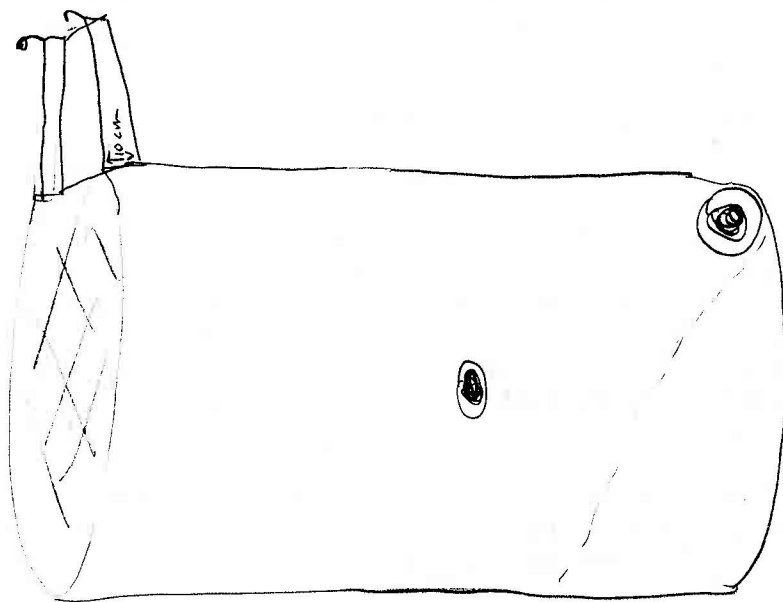
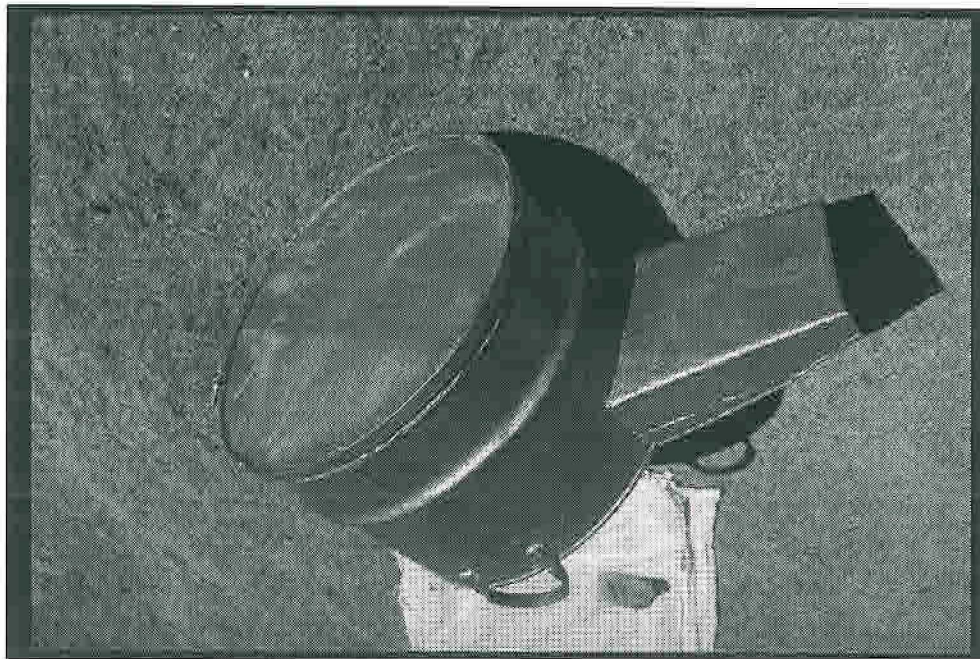


Figure 8

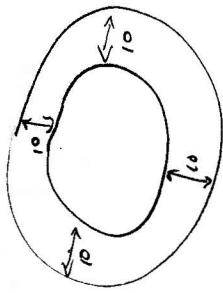




C. HASTORF'S SNAP modified mechanized flat machine

5) The inner bucket:

As mentioned above; the inner bucket should be smaller than the 55 gallon drum, about 10-12 cm on each side of it while in the drum.



Sitting on the lugs inside the drum - The top of the inner bucket should be above the solids

The inner bucket's spout is longer & taller than the drums but should be snug. [This is tricky] so it looks like Fig 7 but w/ a longer spout.

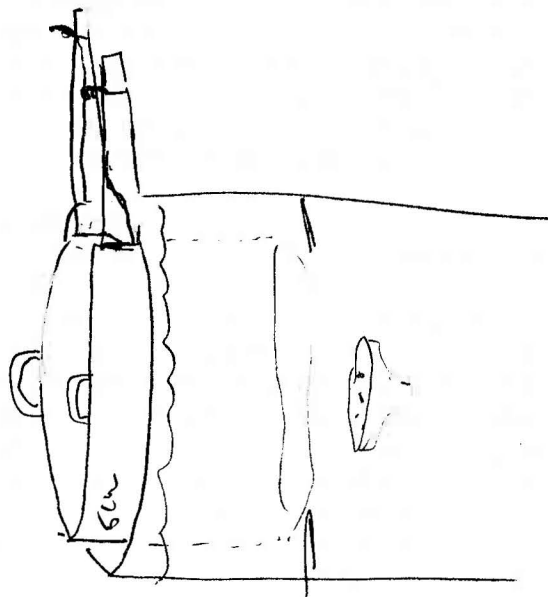
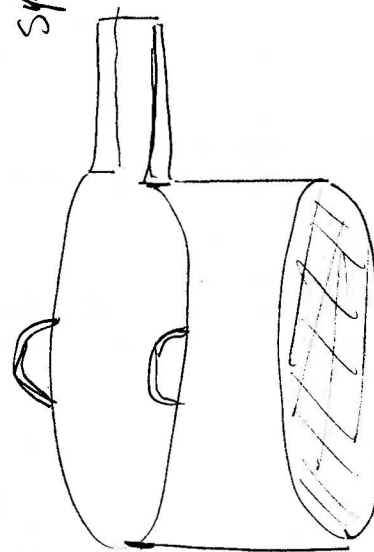


Fig 9.



The inner bucket's spout should be bent and welded at the drums, so they are snug - but not too snug.

(6)



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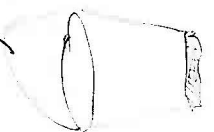
C. HASTORF's SNAP modified mechanized flat machine

5) cont.

Besides the spout the base of the bucket must be cut off and then a .5mm stainless steel mesh attached in a snug smooth manner, so as not to have the mesh hitting the bars in the drum and ripping them. Every welder has done this differently. you also want to be able to replace the mesh after wear and tear (usually after one full season of fishing). One of my favorite clips. This makes a band with a small jubilee clip. But it's very it easier to remove it. That way. and firm with to return to the welder that is tight and firm with important that the mesh is tight and firm with important to both sides so a person

can
two rips.
weld handles on to both sides so a person
can lift inner bucket in and out of machine.

6) The little bucket; a normal metal bucket, with handle. Also get your welder to cut the bottom out and also weld snug a piece of your .5mm metal mesh on to this bucket. This hangs on the 2 hooks and catches all water out the spout (7)



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Modified SMAP flotation sample processing.

C. Hastorf 1999

At the flotation machine:

Samples for this sized machine tend to be about 10-15 liters (more than one bucket of matrix). First a flotation number is recorded on the tags and in the log (FL #). This number should always be placed on the back of all tags. The chosen bags of soil are poured into the calibrated buckets. After rocking it back and forth to be systematic in measuring all volumes, the volume is recorded in the float log that also includes the full provenience as well as date of floating, who are the floaters and if modern seeds are added to test the machine. 50 charred seeds (we have been using charred poppy seeds) (seeds wrapped in aluminum foil can be charred in an oven) are added blind in one sample's soil per day per machine. These seeds are counted and placed in gel caps for easy use.

- have the tank totally full of water.

- prime the intake hose with water

- adjust the throttle and start the motor, making sure the water is strongly flowing with no obstructions.

- Place the inner bucket into the drum, with the two noses snug against each other and the upper one sticking out as much as possible (see photos). The thin sponge clipped across the spouts beginning area helps to keep the flow all into the upper inner bucket. This sponge should be replaced regularly.

- the chiffon must be moistened and pegged in place on the little light fraction bucket.

- Place the small light fraction bucket on the two hooks making sure **all** of the water lands in the center of the chiffon "cup" formed by the clipping it on the bucket.

- One must check that the pouring spout is snug with the main float tank. All of the pouring off water from inside the inner bucket should go into the chiffon. Adjust the flow, the two spouts etc. to make sure this is so.

- Once recorded and the float machine is clean and prepared with the chiffon, the measured matrix in the bucket, is poured slowly into the machine. The water pressure should be moderate at this point. While this happens, one of the hose sprayer sprays water on the soil gently as it lands in the water, to keep it from floating away. This wets the soil and gets it to separate from the charred plant remains.

- After all soil is in the inner bucket, allow a few minutes to go by for the soil to moisten. Once done, we begin to jiggle the inner bucket pulling the handles up and down as well as twisting it back and forth horizontally. This phase is also called agitation, where the inner bucket is held in both hands and jerked back and forth to get the silt and clay to go through the bottom mesh. You can gently use your hands to check what is there and help the process. I tend to do that at least 2 times but if a dirty sample more like 4 times.

- It is important to keep the light fraction chiffon fabric clean of silt and clay. This is done by regularly spraying the chiffon on its sides, not to directly "hit" the charred plant remains. this is done with the hose and sprayer.

- After a few minutes, the flow of water is slowed down and cut off so allow the water to stop movement and for plant remains that are hovering in the water to quietly surface.

- Then after about 2-3 minutes, the water gate is opened again to a steady force and, using the tea strainer, one helps the newly floated material into the chiffon mesh.

- Continually one uses the tea strainer to check how clean the water is for that sample. It normally takes at least 20 minutes to get a sample clean. For some samples, this jiggling and shutting the water off must occur several times.

- This running the water and cleaning/checking with the tea strainer is kept up until the water is fairly empty.

- Then the water is shut down and the water siphon is used to also catch the hidden charred remains that are circulating in the inner bucket water but are not willing to float to the surface (those bums). To get this flow going, one must suck on the small end of the tube to get the water flowing and then once going it is poured into the chiffon, keeping the

chiffon bucket lower than the siphon in the inner bucket. Once done for 2-3 minutes, as the siphon is kept 3 inches above the bottom material and moved gently around, it is removed and clean water from one of the sprayers is run through it to make sure no plant remains are lodged in it. It is put aside and kept for the next sample.

-When the water in the inner bucket has no more charred floating material and the matrix sitting on the bottom of the inner bucket mesh is clean of fine soil, one can take the sample out of the machine.

-Once the water is clear of charred matter and the mesh at the bottom of the inner bucket is filled with clean items and not more muddy surround exists on the items, one can put the two residue fractions away. The light fraction in the chiffon is unclipped and tied up with the original tag and string that had been around the bag that carried the matrix from the excavations. This tied dumpling (of one or more chiffons with material within, is hung up in the shade using a clothes pin in a shaded quite spot. If there is more than one bag, make sure that each chiffon dumpling has its own tag. This is usually done by the archaeobotanist on duty. The inner bucket is then slowly lifted up out of the water, (making sure that the spout is raised up so that no water or matrix spills out with a moderate flow of the motor at this phase. Only remove this inner bucket when you think the sample truly is done and not before, it will contaminate the sample otherwise should you want to put it back.

-This then is carried over to one of the large, laid out plastic bags (flour sacks) that already has received one of the inner tags sitting under a stone as well as the float number of the sample written with a large perm ink pen on duct tape, visible to those with the inner bucket. The inner tag stays with the heavy fraction and eventually ends up with the botanical matter. The emptying of the inner bucket requires care. One holds the inner bucket at an angle while using the hose to gently and carefully channel the material to flow onto the middle of the plastic bag (flour sack). Once all of the matrix is on the bag, this bucket is taken away from the samples and given a quick blasting clean with the hose, making sure all charred material is removed from the inside of the bucket and mesh. This is now ready to be replaced in the drum for the next sample.

Mini float procedures: When the samples are very small, one liter or so, we simply place the soil into a little bucket with a chiffon mesh piece clipped to the edges of the bucket. We **GENTLY** spray the sample to help the silts move through, and once the water has reached the level of the chiffon we use the chiffon square itself to move the materials around by pulling at the edges. Once the silts are gone what is left is a sample with both the botanicals and the all of the heavy fraction. The chiffon's are tied up with string and dried like normal flot. samples. Once they are dry, they are transferred to plastic bags in the lab. These samples are then sent through the heavy fraction process, but instead of having the sorters pull out the Boots, they only pull out the other materials, and the rest is left to be sorted in the botanical laboratory with normal sorting procedures. Such mini-samples should be recorded in the flot log and receive a flot. number like the larger ones. A flotation number is recorded on the tags and in the log when it is being recorded. This number should always be placed on all tags. A comment indicating that the sample was floated in this manner should be recorded in the flot. log.

Odds and Ends regarding floating:

-Make at least 2 calibrated buckets, two for the machine at the beginning of the season.

-Always have two tags per sample, if one is lost, make another on the spot (keep blank ones in your pocket), add flot number to all tags. This number is assigned out by the machine.

-Someone should watch the float assistants at all times (if you have them), also to record the data in the flot log as well as keep the recovery rate systematic and perfect!!

- While watching over the floaters, make sure they are slow-fast enough, do not empty water before clean of charred items.
- Only use sharpies- perm ink and tyvek tags on all float items.
- Check valves, all meshes, sprayer regularly for leaks.
- Change oil in machine of the little machine two times a week if the machine is used all day every day (6 days). Record when you do this in the flot log.
- The flot log should be regularly entered into an excel file. This helps to locate flotation samples during the season.

The On -Site Laboratory Procedures:

Processing the light and heavy fractions:

1) Light fraction processing:

- a) Samples in chiffon bags are transferred to plastic bags once they are completely dry.
 - if a sample is found to be wet place it in an open box or tray to dry. Keep it out of the way of breezes and cats!
- b) Labels from chiffon ties put into the light fraction zip lock bag and unit, sample, flot number along with area and year written on outside of bag with sharpie (permanent ink pen).
- c) Flot log book is updated- a check is placed in the column marked "sample bagged"
- d) Samples are moved into storage boxes which are ordered according to unit number.
 - boxes should remain accessible so the heavy fraction can be attached.
- e) Attach heavy fraction plant remains as soon as they are available (this can wait until later, but the longer it goes, the more of a pain it becomes)

2) Heavy Fraction processing:

- 1) Dried samples bagged in large zip lock plastic bags, with tags and provenience written on the outside. These are collected from the flot area and brought to the sorting area in plastic bags. This is the long table where the local women work.
 - a) a tag should already be in the bag at this point
 - b) the label information should be written in permanent pen on the outside of the bag
 - c) if a sample is still wet (and perspiration is noticed on the inside of the bag) it should be opened and sorted carefully in an upright position until it has dried.
 - d) a temporary storage area for samples that are waiting to be sorted should be created in a protected area.

2) Organization of Heavy Fraction sorting One person should be overseeing this every work day. Your job will be to make sure they are there and to maintain quality control. You should be overseeing these steps not necessarily doing them.

- a) Supplies needed every day
 - 1) Large Trays
 - 2) Forceps - there should be one per women sorting.
 - 3) Fine sharpies
 - 4) Labels for various areas
 - 5) Small plastic bags for artifacts
 - 6) Medium bags for remaining fraction
 - 7) Big geological sieves
 - 8) Heavy fraction recording sheets
 - 9) Paint brushes- for cleaning trays

10) <1mm silt bucket- this portion is discarded but it should be discarded well away from the sorting area and out of the way in general.

b) Preparing a heavy fraction sample for sorting. Make a form for this so that the results can be regularly recorded.

1) Pour the sample through the big geological screens (>4 mm, >2 mm, >1mm, and the base). Shake well- but be careful if there are very large artifacts or mud brick bits in the >4mm. Reshake once each screen has been removed and the contents placed in a sorting tray. Once a particular portion of the sample is in a tray it should have some tags attached to it. Never leave a tray out without a tag. Big samples should go in the bigger trays (1mm or greater size fractions almost always need a big tray). Less than 1mm fractions of the samples are thrown away to conserve space (and none of the specialists are willing to commit the time to sorting the materials from this portion)

2) fill out a form for the sample

a) write the unit information and the flot number on the form.

b) fill in date and sorter

c) place the form under the mother bag on the table

3) create tags for the sample - fill out as much as you can

WRITE CLEARLY

a) write the unit, sample, area, flot number, size (and percentage for 4mm- always 100%) can be filled in.

b) make the remaining fraction tags for the 3 sizes

c) make tags for unsorted portions for 2 and 1mm sizes

d) make at least 4 other tags for each of the sizes with as much information as possible

c) Sorting a sample

1) Generally, everything from the 4mm, 2mm, and 1mm portion is sorted at 100%.

a) in the case of large samples the samples are sorted at < than 100% for each size. depending on what is coming out, They still should be put through the nested sieves to keep things the same for the specialists records.

b) Once the samples are poured into the trays and the labels are clipped to the sides, the sorters should go through the matrix very systematically and pull all artifacts.

2) As the women/men sorters finish each tray, the sample should be checked over quickly to make sure that everything has been pulled out.

3) Tags are then completed and given to the women/men to put in the appropriate artefact bag.

4) Check marks should be placed next to artifact types on the form if they have been recovered from the sample, noting presence/absence information.

d) When a sample is finished:

1) Gather all bags - small artifacts and remaining fraction in bags - and put them inside the "mother bag" sealed.

2) Take form with the mother bag and store in a safe place in the heavy fraction area of the laboratory, until they all can be weighed.

e) Weighing samples:

1) One person can do this, but often two make the job faster and more accurate.

2) Pull out all artifact bags from the mother bag.

3) Group the bags into like sizes (making sure the tags are also like sizes).

4) Have one example of each sized bag and tag so that you can “tare” the scale before the weighing begins.

5) Weigh the each bag of artifacts and enter the weights (making sure that the weight of the bag and tag are accounted for) on the forms.

6) Certain remains need to be grouped together. The same happens for the obsidian. The like remains but of different sizes can be stapled by groups of all 3 sizes.

Lot No	Site Division	Provenience	Bury No.	Bury Site	Date Excavated	Date Flayed	Wt Left Foot	Wt Left Foot	Comments, Quality	Weather	Flatter	Flot System	Happy Scale
365	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	30.2		200 Bury	Cloudy	High	A	
366	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	18.5		apparent	Cloudy	High	A	
367	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	25.7	3.3	apparent	Cloudy	High	A	
368	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	121.3	89.3	apparent	Cloudy	High	A	
369	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	16.8	28.0	apparent	Cloudy	High	A	
370	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	70.1		apparent	Cloudy	High	A	
371	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	13.5		apparent	Cloudy	High	A	
372	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	15.2	0.2	apparent	Cloudy	High	A	
373	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	18.9	2.7	apparent	Cloudy	High	A	
374	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	9.3		apparent	Cloudy	High	A	
375	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	33.5		apparent	Cloudy	High	A	
376	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	6.7		apparent	Cloudy	High	A	
377	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	9.9		apparent	Cloudy	High	A	
378	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	7.1		apparent	Cloudy	High	A	
379	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	4.9	1.0	apparent	Cloudy	High	A	
380	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	14.9	2.3	apparent	Cloudy	High	A	
381	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	46.8		apparent	Cloudy	High	A	
382	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	8.1	0.4	apparent	Cloudy	High	A	
383	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	6.6	0.7	apparent	Cloudy	High	A	
384	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	49.6		apparent	Cloudy	High	A	
385	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	19.1	0.4	apparent	Cloudy	High	A	
386	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	18.6		apparent	Cloudy	High	A	
387	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	3.4		apparent	Cloudy	High	A	
388	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	8.9		apparent	Cloudy	High	A	
389	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	10.8		apparent	Cloudy	High	A	
390	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	30.0	0.5	apparent	Cloudy	High	A	
391	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	78.4		apparent	Cloudy	High	A	
392	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	13.2		apparent	Cloudy	High	A	
393	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	87.6		apparent	Cloudy	High	A	
394	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	69.4		apparent	Cloudy	High	A	
395	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	32.3		apparent	Cloudy	High	A	
396	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	11.8		apparent	Cloudy	High	A	
397	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	4.9	0.3	apparent	Cloudy	High	A	
398	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	17.4		apparent	Cloudy	High	A	
399	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	22.7		apparent	Cloudy	High	A	
400	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	9.2	0.4	apparent	Cloudy	High	A	
401	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	16.6	0.2	apparent	Cloudy	High	A	
402	Peruvia	Peruvia	1	7/8	10-27-87	10-26-82	12.5		apparent	Cloudy	High	A	

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Capa 4 ↓

2 pages of flat loc examples: Always use unique flat numbers

#	S	U	L	Loc	SL	EXCAV. DATE	FLUT DATE	BAG SIZE	WEATHER	CONTEXT	COMMENT	PESO	P	CREW	ITEMS
2371	1	D3	2	350	1	18 JUL 86	19 JUL 86	1.0	SUNNY			7.7		DAVID	✓
2872	1	D3	2	347	1	18 "		1.0	✓			9.4		HEIDI	✓
2373	1	B3	1	357	1	18 "		1.0	NICE			5.4			✓
2374	1	C3	2	344	5	17 "		1.0				5.5			✓
2375	1	D3	2	359	4	18 "		1.0				8.0			✓
2376	1	C3	2	356	1	18 "		1.0				3.8			✓
2377	1	C1	2	348	5	18 "		1.0				-			MISLABELED ✓ NOT INFO
2378	1	B3	1	357	5	18 "	11 "	1.0	"			13.2		"	✓
5945					11 "		20 JUL 84		Beautiful		Oil changed			LYNN MARKUS	
60-15					11 "										
61-15					11 "										
62-15					14 "										
63-15					14 "										
64-15					14 "										
65-15					14 "										
66-15					14 "										
67-15					14 "										
68-15					14 "										
69-15					15 "										
70-15					15 "										
71-15					15 "										
72-15					15 "										