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United States Department of Agriculture
Forest Service
Southwestern Region
517 Gold Avenue SW.
Albuquerque, NM 87102-0084

Reply To: 1570 (2850)

Date: AUG 2 0 1990

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AUG 2 3 1990
TWITTY, SIEVWRIGHT & MILLS

Mr. Ralph B. Sievwright
Law Offices of Twitty, Sievwright & Mills
2702 North Third Street, Suite 4007
Phoenix, AZ 85004-1142

CERTIFIED MAIL--RRR

RE: Kaibab NF - Chem-Stone, Inc., David L. Bellaire, Owner
Appeal of Regional Forester's Decision of May 16, 1990
#90-13-00-0198

Dear Mr. Sievwright:

Enclosed per your request is a copy of Mineral Examiner Robin Strathy's Chem-Stone Mineral Material Classification Report. In order to expedite your request, I have photocopied the photographs found in Appendix 4.

Sincerely,

for: DAVID F. JOLLY
Regional Forester

Enclosure

cc:
AZ Zone, R. Strathy
Kaibab
WO, M&GM
Chem-Stone, Inc.

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Southwestern Region
Albuquerque, New Mexico

MINERAL REPORT

2850 Kaibab National Forest
Chem-Stone Pumice

Could not have been written because of info in Draft?

September 25, November 9, 1989
Date of Examination

Robin Strathy
Mineral Examiner

March 30, 1990
Date of Report

Category: Mineral Material Classification

Claim Names: Deadeye #1, 2, 15, 16, 41, 42 PMCs
Sue #1-4, 46, 48 LMCs

BLM State Office and Serial Number: Arizona State Office, AMC 296851, 296852, 296865, 296866, 296891, 296892, 296895 - 98, 296940, and 296942.

Brief of Summary and Conclusions: The material exposed within the mining claims is a common variety that should properly be disposed through a mineral material sale.

ROGER ... NO. 011 USDA FOREST ...

Approved: Roger D. Marion 4/19/90
Regional Minerals Geologist Date

Reviewed: [signature] 4/24/90
Director of Lands and Minerals Date

Approved: Thomas A. [signature] for 5/11/90
Regional Forester Date

TABLE OF CONTENTS

I. INTRODUCTION AND SUMMARY

On July 10, 1989, the Kaibab National Forest received an operating plan, in compliance with surface use regulations at 36 CFR 228 A, from Chem-Stone, Inc. to open-pit mine pumice from a deposit on the east flank of the Bill Williams Mountain, on the Williams Ranger District. At that time, the Forest questioned both the locatability of the pumice material and the propriety of the claimant's desire to begin immediate mining prior to exploring the nature of the deposit. The Forest requested additional information from the proponent and on October 25, 1989 approved a proposal for exploratory trenching on the claims. The claimant was put on notice that an examination and evaluation of the material exposed in the trenches and on the claims would be used to prepare a mineral report to serve as the basis for determining whether the material found in the deposit falls under the purview of the General Mining Law, or is considered common variety and subject to discretionary disposal under the Mineral Material Act of 1947, as amended.

I examined the claims and local geology on September 25 and again on November 9, 1989, at which time several samples were taken from test trenches dug on the claims. The samples were submitted to a number of laboratory facilities for a variety of tests. The pumice exposed in the deposit has been compared with pumices from deposits from a number of other locations to determine whether it exhibited any unique qualities that may give it a distinct and special value. The results of these tests as well as market data indicate that the mineral material of these claims has no known unique property that gives it a distinct and special value as a garment finishing medium or any other commercial uses. Accordingly, it is my opinion that the material is a common variety stone such as was precluded from mining claim location since the Act of July 23, 1955, and that proper disposal, therefore, should be through the mineral material sale provisions of 36 CFR 228, Subpart C, for salable minerals.

II. LANDS INVOLVED

The subject lands are located in sections 15 and 16, T21N, R2E, G&SRM, Arizona, approximately 3 miles south of Williams, Arizona (see Appendix 1). The lands involve six unpatented placer and six overlying unpatented lode claims known as the Deadeye #1, 2, 15, 16, 41, and 42 lodes and the Sue #1-4, 46, and 48 placer claims. Trenching operations were conducted on the Deadeye #1 and Sue #2 mining claims, although the operating plan submitted by Chem-Stone indicates that operations will be conducted on all the above mentioned claims. A map of these claims is included in Appendix 2.

All lands upon which the claims are located are public lands of the Kaibab National Forest and are open to entry under the mining and mineral leasing laws.

III. RECORD DATA

The following information concerning the subject mining claims is from the official files of the Bureau of Land Management, Arizona State Office:

Claim Name	Date Located	BLM Recordation No.
Deadeye #1 placer	4/7/89	A MC 296851
Deadeye #2 placer	4/7/89	A MC 296852
Deadeye #15 placer	4/7/89	A MC 296865
Deadeye #16 placer	4/7/89	A MC 296866
Deadeye #41 placer	4/14/89	A MC 296891
Deadeye #42 placer	4/14/89	A MC 296892
Sue #1 lode	5/18/89	A MC 296895
Sue #2 lode	5/18/89	A MC 296896
Sue #3 lode	5/18/89	A MC 296897
Sue #4 lode	5/18/89	A MC 296898
Sue #46 lode	5/24/89	A MC 296940
Sue #48 lode	5/24/89	A MC 296942

The Sue lode claims overlay the Deadeye placer locations. All of the above claims were located by Mr. David Bellaire, 2215 Mountain View, Phoenix, Arizona.

IV. ACCESS

The lode and placer claims are located about three miles south of Williams, Arizona and are accessed by taking the Perkinsville Road (Forest Road 173) south from Williams (see Appendix 1). An unmarked gravel road intersects this road at about 3 miles. This road is taken heading northwest about 1/3 mile to the junction of another unimproved gravel road to the west. This road is taken about 1/4 mile to the claim block and testing areas.

Trench #1 exposed sand-sized material with cobble-sized pieces of rhyodacite(?) and pumiceous material, and was fairly uniform throughout the exposed depth. It is estimated that about 40+% of the exposed face was sand-sized and smaller, 40% was pebble-sized to 3" material, and about 10% of the exposed material was 3"+ material. In-place pumiceous material appears in the .3" to 3" size fraction. Most of the 3" and 3"+ sized material was rhyodacite(?).

Trench #2 is also fairly uniform throughout its depth. Visually, about 50% of the material appeared to be sand-sized particles consisting of quartz and feldspar fragments with glass and biotite. There appears to be a slightly greater percentage of pumiceous material than in Trench #1; some with in-place dimensions of 2" or greater. Lenses containing the larger fragments appear in the lower 2-3' of the trench. Again, the material is very friable and moist and breaks easily into smaller fragments. Not as much rhyodacite(?) appears in this trench as compared to Trench #1.

Trench #3 contains a predominance of sand-sized particles; visually about 70-80%. Pumiceous fragments from 1/2" to 1" diameter are visible in pit walls.

Trench #4A was dug in red, silty sand with fragments of basalt. It is believed that the contact between what has been mapped by Newhall, et al. as Pliocene or Miocene age basalt and the dacite pyroclastic deposit occurs in the vicinity of Trench #4A. David Bellaire of Chem-Stone indicated that the material found in this trench was not suitable for their use, therefore no sample was taken here. Trench #4B was offset about 30' south of #4A and encountered pumiceous material and ash. Pumice and rhyolite fragments from 1 to 1-1/2" diameter visually comprise about 10-15% of the exposed material; an additional 5% is comprised of larger fragments. The remaining 75-80% is sand-sized ash material.

Trench #5 also encountered the contact between pumiceous material and basalt. A thin layer of air fall material covers basalt on the south end of the trench; the remainder of the trench exposes basalt and basaltic tuff. This trench was not sampled as it was indicated that material from this location was not suitable for Chem-Stone's uses.

Trench #6 was dug in an area that may have served as a material pit in the past, although pine trees 3-4' in height have reestablished on the site (see photo 1). The trench was dug to a depth of 7.2', the upper 3' of which is ash and gravel-sized material (up to 1-1/2" in diameter). Two lenses containing pumice fragments ranging from 1-1/2" to 3" in diameter in a sand-sized groundmass occur about 3 and 4 feet below the surface. They are generally about 6 inches in thickness and comprise about 3% of the total exposed face.

V. AREA GEOLOGY

The area in which Chem-Stone's claims lie is within the San Francisco volcanic field. This volcanic complex covers an area of about 3,000 square miles in north-central Arizona and takes its name from the largest volcano of the group, San Francisco Mountain. The claims lie on the eastern edge of Bill Williams Mountain, the largest volcano in the western portion of the field. The volcanic field has received extensive geologic study, and has been mapped in detail by the U.S. Geological Survey. Appendix 3 contains a geologic map of the subject area (from Newhall, et al., 1987).

Bill Williams Mountain is predominantly a cluster of dacite domes and flows with flanking andesite and benmoreite flows. It represents eruptions over extended periods of time that formed a larger edifice, as compared to the numerous smaller cinder cones in the area which represent short-lived vents (Newhall, 1987). These intrusive and extrusive rocks are age-dated to be of Pliocene (Gauss and Gilbert) age.

VI. CLAIM GEOLOGY AND SAMPLING

The area in which the trenching and sampling took place is described by Newhall as an isolated airfall deposit of pumiceous dacite lapilli (volcanic ejecta ranging from 4-32 millimeters in diameter) and fine ash. Phenocrysts of hornblende, biotite, plagioclase, and quartz occur in a glass-rich hyalophitic (the open spaces of a feldspar network are occupied by glass) to hyalopilitic (numerous minute, needle-like crystals embedded in glass) groundmass. These airfall deposits are K-Ar age dated at 3.49 $\pm$ 0.06 million years.

A total of seven trenches to depths from 6-10 feet, were excavated using a backhoe (see photos 2-21 in Appendix 4). Trenching was conducted on the Deadeye #1 placer and Sue #2 lode. Appendix 2 contains a map showing claim geology and location of sample sites. The geology of each trench was noted and samples taken from those that exhibited pumice considered by the claimant's to be minable. A channel sample was taken the length of the face of each trench to collect about .08 cu. yd. of sample, for a total of about 1/2 cu. yd. of material from all the trenches sampled. A grab sample was also taken from the stockpiled material excavated from each trench. About 50-80 pounds of excavated material was taken from each trench. This was to avoid contentions that channel sampling with a pick may have resulted in size reduction of some of the pumice fragments. The pumice material in-place held quite a bit of moisture and was fairly well compacted. It appeared that once some of the larger fragments were exposed to the air and dried out, they lost much of their cohesiveness and broke down into smaller fragments.

The trench and grab samples were delivered to Arizona Testing Laboratories for sieve analysis and unit weight tests. Trench samples from trenches #1, #3, and #6 and grab samples from stockpiled material from trenches #2 and #4 were dried and screened in order to determine the various size fractions of the material and an estimate of what percentage of the total deposit may have pumice with a dimension of 2" or greater. A unit weight measurement was also taken to determine the weight per cubic foot of the dried material. These results are discussed in section VII and summarized in Appendix 5.

VII. PUMICE USE IN THE GARMENT FINISHING INDUSTRY

Pumice has become a commodity of contention of late, with the fairly recent introduction of the process known as stonewashing and acid-washing, or "frosting", to the garment industry. The following discussion provides some background into the garment-finishing industry and the role of pumice in the finishing process.

Pumice is used either in its raw form to abrade and soften denim material to give it a "lived-in" appearance, or it is impregnated with an oxidizing agent or dye so that when tumbled with the garments results in the streaked or bleached-out look that has become popular in denim-wear. Denim has been the material of choice in the garment industry for these processes because of its durability, although the industry has used other fabrics as well.

The garment industry uses pumices from a wide variety of sources. Pumices from Greece, Turkey, Equador, Indonesia, Mexico, California, Washington, Oregon, Arizona, and New Mexico are among those that have been used in the garment finishing process.

Garment finishing is done on a large scale both on the west and east coasts. El Paso, Texas finishers handle huge volumes of garments for Levi Strauss, who both contracts for finishing and has their own finishing divisions, and many other garment manufacturers as well. Levi uses an average of 50-80,000 pounds of pumice per finishing plant per week in their operations and accounts for 25% of the garment finishing business. Los Angeles, California is another center for the garment-finishing industry, as are locations in Kentucky, Illinois, and Tennessee.

A contract finisher does a job for a certain company who requires a certain "look" in their finished product. There is, then, a standard finished garment "look", or narrow range of looks, that must be achieved by the contractor in order to be accepted by the industry. The various contractors are free to achieve this look any way they can, but may follow closely the procedures and raw materials used by the industry in order to ensure an acceptable final product. There are probably well over 50 different "looks" or fashions, each that requires an adjustment in processing, whether it be in the raw materials and chemicals used, tumbling time, or a change in some other part of the process. New "looks" are continually being introduced to satisfy the constant changes in the garment industry. A garment finisher may introduce a "look" to a manufacturer in attempts to capitalize on a technique that they have developed, which may also reflect a combination of chemicals and abrasive medium that they've been able to obtain.

Each new "look" may require a pumice with different physical qualities than the pumice used for the previous "look". In order to achieve a certain finish, the launderer establishes a procedure (after some trial and error), which sets the amount of bleach, the amount of stones, the timing of the run cycle, the size of the machines, and the amount of garments to be loaded into them. Then they can run the same procedure for all their work shifts until that particular contract is completed. Having to change any part of the process "mid-stream", be it the kind of pumice used, the timing, etc., would likely result in lost processing time and the possibility that the proper look may not be achieved. Once a particular contract has been completed, the next contract may require a completely different look, calling for a change in the finishing process, including the type of pumice used.

Naturally, the raw materials used, including pumice, play a major role in ensuring an acceptable final product. Nowhere have I been able to find specifications that a pumice must meet to be suitable for use in the garment industry. Impurities such as iron or magnesium in the pumice must be kept to a minimum to reduce chances of them bleeding out and staining the garments. Excessive clay content may also smear on garments and cause problems in machines. The abrading material must not wear out too rapidly during tumbling or contain material with hard, sharp edges that could tear clothing. Beyond these fairly standard requirements, each finisher has some qualities they look for in a pumice. Some pumices may have qualities that are better suited to one particular garment-finishing process than another, i.e., one pumice may be more suitable for a particular acid-washing technique, but may not be amenable for another. One manufacturer may want a denser, heavier abrading medium; while another may prefer a softer, more absorbent material for acid-washing. And while some finishers have been able to find a pumice they like, and try to use it in most of their processes, to my knowledge, there is no "universal" pumice that is suitable and used for every type of finishing process the garment industry does.

The manufacturers are well aware of the qualities of pumices from various areas; many seem to prefer Greek or Turkish pumice (personal communication with Dr. Dilip Tsad, Levi Strauss - 9/28/89, and Ceaser Guerrero, American Garment Finishers - 10/4/89) for consistency in quality. They are, like any other business, always looking for competitive materials to lower production costs and have found that they must learn to work with certain pumices; in other words, they can adjust their processes to best utilize the character of a particular pumice (Guerrero, pers. comm. 10/4/89). Factors such as consistent and timely availability, cleanliness of the pumice (i.e., void of sticks and dirt upon delivery), method of delivery (whether in bulk or shipped in bags and palletized properly), the amount of detrimental heavy material mixed in with the pumice, how wet the pumice is, and price are very important when a finishing company is considering the use of a particular pumice. It appears that the industry does not absolutely require that a pumice meet stringent specifications. There are pumices that are preferred over others, but with competitive marketing other pumices can be used satisfactorily.

1. Chem-Stone Products

The garment industry is in a perpetual state of flux, following and creating that nebulous idea of "fashion". New approaches or processes are constantly tested to streamline operations and be more cost efficient. Chem-Stone is in the business of marketing a product for the garment finishing industry that can be used in the acid-washing or dying process. They impregnate the pumice with potassium permanganate ($KMnO_4$), a bleaching agent. The impregnated pumice is a finished product that is marketed to the industry. This pumice is tumbled with the garment; as the $KMnO_4$ is released from the pumice, it bleaches out some of the dye in the garment, creating that "frosted" look.

Chem-Stone is also developing methods to fabricate synthetic "stones" from fine pumiceous material by bonding the sand-sized particles into briquette-sized pellets. These "stones" or pellets can then be impregnated with bleach or other chemicals and used in garment finishing. They indicated that this was a use to which the fine fraction of the subject deposit could be put.

Chem-Stone has purchased pumice from a deposit located about 12 miles north of Flagstaff, and about 40 miles northeast of the subject claims. This pit is operated by Arizona Tufflite, from whom Chem-Stone has purchased most of their pumice for $75/yard. Presently, Chem-Stone is removing pumice from a privately-owned pumice pit about 2 miles north of the subject lands (see Appendix 4, photo 22). Chem-Stone reportedly pays the landowner $2.50/yard for this material, which they are blending with Tufflite pumice.

Chem-Stone contends that they have used pumices from various sources worldwide and have found "only one active deposit that meets our standards to produce our product that will satisfy our customers and our requirements. That particular deposit just happens to be in the Flagstaff, AZ area and is being operated by Arizona Tufflite." (Chem-Stone letter dated Sept. 5, 1989, pg. 2, Appendix 6). It is opined that the pumice found on the Deadeye and Sue claims has qualities that make it acceptable for use in the process that Chem-Stone has developed, but it is obvious that other pumices can and are being used for their particular process.

The quality that Chem-Stone indicates to be of primary importance is porosity; they claim that the pore size and pore network of the pumice is that which is necessary for controlled release of the impregnated solution. Should the pore size be too large, the chemical or dye may be released too rapidly, causing spotting or blotting on the garments. As noted on page 7 of Appendix 6, Mr. Bellaire states that, "(t)he claims have a very acceptable porosity, even comparable to portions of the Arizona Tufflite property."

2. Other Materials Used for Similar Purposes

As evidenced by the information provided above and by Chem-Stone's own admission in their September letter, the pumice from the subject claims is not the only material suitable for use in their process. It also appears that there are other materials used by the industry that are equally suitable for use in the acid-washing process.

In discussions with numerous garment-finishing industry representatives, I have found several that are familiar with Chem-Stone's products (Levi Strauss - Dr. Dilip Tsad; American Garment Finishers - Ceasar Guerrero; Desert Industries - Mr. Goldman; East-West Apparel - Mitch Brasington). All of these companies have tried, but are not presently using, Chem-Stone's product for various reasons. One was that many of the companies are now using the synthetic stones as the abrading and porous medium for the acid-washing process. This synthetic material has appeared to give better and more consistent results, and doesn't wear as rapidly as many pumices, even though it costs about twice as much as impregnated pumice ($1.15/pound for chemically-impregnated synthetic material vs. $0.57/pound for Chem-Stone's impregnated pumice).

Totally FALSE

Mr. Goldman with Desert Industries indicated to me that recent tests have linked exposures to $KMnO_4$ with increased incidents of Parkinson's disease. The finishing companies contracted by Levi Strauss have been put on notice that, while these claims have yet to be substantiated, Levi is not requiring that these companies use $KMnO_4$ in their processes. Some of the contract finishers have discontinued its use and are using pumice in conjunction with an enzyme that "eats" the dyes in the fabrics.

Another major concern of the industry is the amount of particulate matter that is generated during the tumbling process which may be flushed into the plant's waste water system and eventually into the city water treatment system. The water company in El Paso, Texas regulates the amount of pumice particulates in the El Paso water supply, and were recently sued by the EPA for exceeding acceptable levels of particulates in their water. The burden to remedy this situation falls on the pumice users and may also be an incentive for using alternate abrading mediums.

3. Market Data

Several garment finishers were contacted to get an idea of prices paid for pumice materials. Prices vary for certain grades of pumice, but from the information I've been able to gather, it seems to be on the order of a few cents per pound. The garment finishers often purchase pumice from a broker or "middle-man" who purchases the pumice from the supplier. Pumice producers, for the most part, prefer to sell their pumice through a broker rather than dealing with the end user directly.

Pumice is probably the biggest cost item for most garment finishers (Bjarne Schmidt, Continental Uniform Rental, pers. comm. 3/23/90). It is usually purchased by volume versus by the pound or ton. Most often a container of bagged or bulk pumice is shipped; containers hold roughly 40,000 pounds. Costs to the end user run between $4,200 - $6,500 per container, which includes shipping. Price paid by the end user can vary greatly, depending on whether the pumice is shipped bagged or bulk, cleaned or mine run. Competition among brokers and suppliers is great. Several years ago, one broker had offered California pumice at $6,850/truckload; another was selling the same material for $5,400; and yet another for $4,680/truckload. (pers. comm. Jim Gauthier-Warriner, USFS R-5).

Table 1 contains a listing of pumice producers and purchasers, pumice sources, and prices paid for pumice materials used in garment finishing. As is apparent, prices can vary, particularily those obtained by the producer; from $2.50/yd. to $50/yd. Reported prices paid by the end users range from $0.09/lb. to $0.18/lb. ($75 - $144/cu. yd., using 800 lbs./cu. yd. as a conversion factor). Market personnel for Arizona Tufflite indicated to me (pers. comm., Linda, 3/30/90) that the somewhat lower prices charged for Mexican and Ecuadorian pumices have created a need for U.S. producers to lower their prices to remain competitive. She indicated that El Paso users are paying $0.10/lb. maximum as retail value for pumice and that AZ Tufflite sells their pumice in bulk for $45/yard delivered to El Paso and California destinations.

There are, to my knowldege, no records of sales of raw material from the subject site for use in garment finishing.

VIII. ANALYSIS OF PROPERTIES OF CHEM-STONE PUMICE

1. Standards for Determining Uniqueness

Deposits of common varieties of pumice and pumicite were removed from location under the General Mining laws by PL 167, the Act of July 23, 1955 (60 USC 611). This act provided for an exception of "deposits of such material which are valuable because the deposit has some property giving it a distinct and special value and does not include so-called "block pumice" which occurs in nature in pieces having one dimension of two inches or more."

TABLE 1 MARKET DATA

Purchaser	Contact	Purchased From	Pumice Source	Price *	Other Information
Various [primarily Dyadic Industries (broker)]	Glenn (Glass Mtn.)	(This is an operator)	Glass Mtn., CA	$30/yd. fob plant for 1"+ size; $22.50/yd. fob plant for 7/8"-1" size	
Various	AZ Tufflite (Linda)	(This is an operator)	Flagstaff, AZ	$50/yd. fob yard (in Phoenix) for 1"-3" size ($0.06/lb.); $18-20/yd. fob yard for 1/8"-3/8" size; $24/yd. fob yard for 1/2" size; $45/yd. delivered bulk, volume sale	+ 1250 per month + mining costs
Chem-Stone	T. Gillett (USFS)	Landowner	Williams, AZ	$2.50/yd. royalty	
Touchstone, Ltd. (broker) Wheeling, IL	Cy Emelfarb	Copar Pumice Co., New Mexico	Jemez Springs, NM	$25/yd. ($0.03/lb.) fob plant at Cuyamunge, NM for 3/4"-2 1/2" size	
		Also from Italy, AZ, CA, Greece, Ecuador		Prices range from $30/yd. to $75/yd.	Sell 1"-3" size generally
Big Chief Stone (broker) Las Cruces, NM	Tyrel Morton	Copar Pumice Co. American Pumice Co.	Jemez Springs, NM	$25/yd. fob plant for 3/4"-2 1/2" size (= $0.03/lb.)	
Levi Strauss El Paso, TX	Dr. Dilip Tsad	Brokers	Greece, Turkey, AZ, CA and others	$0.10/lb. fob Houston ($80/yd.)	Use 1"-2" size generally

* conversion factor of 800 lbs./yard semi-dry pumice to calculate $/yd. to $/lb.

TABLE 1 MARKET DATA

Purchaser	Contact	Purchased From	Pumice Source	Price *	Other Information
American Garment Finishers El Paso, TX	Ceasar Guerrero	Brokers	Indonesia, Turkey, Mexico, South America, AZ	$0.09/lb. delivered ($75/yd.)	Use 2" size generally
Economy Laundry El Paso, TX	Ceasar Viramontes	Brokers	Mexico, New Mexico	$0.12-$0.14/lb. (= $96-$112/yd.) delivered	Use 2 1/2"-3 1/2" size generally
Desert Industries El Paso, TX	Mr. Goldman	Brokers	Arizona Tufflite Mexico	$0.09/lb. ($75/yd.) delivered $0.09/lb. delivered	Use 1 1/2"-2" generally
East West Apparel El Paso, TX	Mitch Brasington	Brokers	California	$0.17/lb.	Use 1/2"-3" size generally
Continental Uniform Rental Los Angeles, CA	Bjarne Schmidt	Brokers	Ecuador N. California (have used pumice from Turkey, Greece, Indonesia)	$0.13/lb. delivered ($104/yd.) $0.11/lb. delivered ($88/yd.)	

* conversion factor of 800 lbs./yard semi-dry pumice to calculate $/yd. to $/lb.

In McClarty v. Secretary of Interior, 408 F2d 907 (9th Cir 1969), the courts upheld and refined earlier case law and set forth standards to distinguish between common and uncommon varieties of materials. These guidelines are: (1) there must a comparison of the mineral deposit in question with other deposits of such minerals generally; (2) the mineral deposit in question must have a unique property; (3) the unique property must give the deposit a distinct and special value; (4) if the special value is for uses to which ordinary varieties of the mineral are put, the deposit must have some distinct and special value for such use; and (5) the distinct and special value must be reflected by the higher price which the material commands in the market place or by reduced overhead so that the profit to the claimant would be substantially more.

McClarty (at 909) also established that the unique property which gives a deposit a distinct and special value must be inherent in the deposit. Value added by manufacturing or marketing techniques and other external factors not related to the deposit itself are not counted toward giving a deposit a distinct and special value. As pointed out previously, any marketing or price advantage afforded Chem-Stone's impregnated pumice product does not directly reflect a uniquely intrinsic property of the pumice itself.

2. <u>Properties of Subject Pumice</u>

We now turn to a discussion of how each of the guidelines established in the McClarty case are met or not met by the subject deposit. Chem-Stone has indicated in their September 5, 1989 letter (pg. 1, Appendix 6) that "size...is of lesser importance than the chemical composition of the pumice, and that the most important property of this deposit is the physical characteristics of this particular deposit when compared to other pumice deposits around the world."

Samples of material from the deposit were sent to several laboratories for testing to determine whether the pumice did, in fact, exhibit a unique property.

Appendix 7 contains a study conducted by Robert M. Hutchinson for Chem-Stone entitled "Microscopic Analysis of Ten Rock Pumice Samples" which compares microscopic and physical features of pumices from locations in Arizona, New Mexico, Greece, Equador, and Mexico. Appendix 8 contains the results of analytical tests conducted on the subject pumice and pumice samples from other deposits in New Mexico, Arizona, and Mexico. There is minimal variance between samples in the unit % measurements of the elements tested. From this information it can be determined that there exists nothing "unique" about the chemical content of the subject deposit. Appendix 10 contains the results of testing conducted by Dr. Jerry Hoffer on representative samples of material from these claims. The samples from the subject claims (labeled as BWM in Dr. Hoffer's report; samples labeled BWM-MP are from the pumice pit on private property from which Chem-Stone also acquires pumice) have been compared with other pumice deposits, in general, from the U.S. and elsewhere. The tests attempt to quantify those characteristics most often considered in a pumice for use in the garment-washing industry.

An index of refraction test was conducted (Appendix 7) which is designed to determine from what kind of a parent material the tested material may have been derived. As indicated in Mr. Hutchinson's report at page 3, "(t)he silica content for the volcanic glass of the ten rock samples ranges from 69 wt. % up to 71.5 wt. %. This is visibly a very narrow and restricted range indicating that all ten rock types are derived from similar lava type or types."

Discussion of the various samples on pages 19-20 of Hutchinson's report reveals that there is "a large amount of fragmented crystal fragments that are suspended in volcanic glass" in samples #1 and 2 (Williams Site B and A) taken from the subject claims. The author attempts to name the rock type of these samples and classifies them as "crystal vitric (tuffaceous) pumice or tuffaceous crystal vitric pumice", because of the "many suspended broken crystal fragments engulfed in the siliceous lava." Like the other samples tested, the fragments are composed of plagioclase, hornblende, biotite, and/or magnetite; just in varying percentages.

Arguably, the term "pumice" has been used to incorporate a wide range of material types. The Bureau of Mines' A Dictionary of Mining, Mineral, and Related Terms, 1968 simply terms pumice as "(a) highly porous igneous rock, usually containing 65-70 percent SiO_2 and 10 to 20 percent Al_2O_3; with a glassy texture." Pumicite is defined as "(a) finely divided volcanic ash or volcanic dust." As seen by the chemical analysis done by the U.S. Bureau of Mines on samples * representitive of this deposit (Appendix 9), it is on the low end of the scale for total SiO_2 content and fairly high in Al_2O_3 and other oxides. As such it has been termed a dacite pyroclastic deposit by Newhall, et al. Dacite is defined by U.S. Bureau of Mines (1968) as "(t)he extrusive equivalent of diorite (tonalite). The principal minerals are plagioclase (andesine and oligoclase), quartz, phroxene [sic, = pyroxene] or hornblende or both, minor biotite, and minor sanidine. All these minerals may occur as phenocrysts in a glassy or finely crystalline groundmass of alkali feldspar and silica minerals. Biotite, sanidine, and hornblende are more prominent in rocks transitional into quartz latite and rhyodacite." This becomes somewhat a matter of semantics, but reflects on the subtle differences in the mineralogy of the parent magma. As noted by the complexity of the geologic mapping conducted by Newhall, et al., (Appendix 3), and as is typical around volcanic centers, there exists a wide range of rock compositions.

Appendix 5 contains results of a unit weight measurement conducted by Arizona Testing Laboratories (ATL) on material collected from the Deadeye and Sue claims. Page 1 of the appendix shows that the dry unit weight of this material is 95.1 pounds per cubic foot. This weight measurement was taken on bulk material from the sampling program and not on screened or sized pumice fragments. Other density measurements were taken by Mr. Hutchinson and are reported in Table 5 of his supplement in Appendix 7. Densities of pebble-form pumice varied from 36 - 84 lbs/ft^3. He reported in-place density of Williams Site samples as approximately 62 lbs/ft^3. Values reported in Appendix 10 on samples analyzed by Dr. Hoffer substantiate this; he reports an average of .92 g/cm^3 (x 62.4 lbs/ft^3 = 57.4 lbs/ft^3). It is apparent that there can be any range of densities for a particular deposit and that, while pumice is obviously less dense than many other rock types, density of a particular pumice is not unique. It is likely that the higher density of the subject material is related to the relatively large amount of crystal fragments.

Porosity is mentioned by both Mr. Bellaire in his September letter (Appendix 6) and Mr. Harvey Smith, as a Chem-Stone representative, in his cover letter to Appendix 7, as being the most "important" physical characteristic of the subject pumice.

Porosity percent was estimated visually by Mr. Hutchinson. The results of his study is displayed in Table 2, pg. 6 of Appendix 7. A thin section of the sample was dyed with a blue-green dye to emphasize pore spaces. It is not discussed in the report how the quantitative porosity percentages were arrived at. In a supplemental report submitted by Mr. Hutchinson (also in Appendix 7), he used another method to calculate volume percentage of pumice samples. Percent by volume of void spaces was calculated by determining the ratio of apparent specific gravity to true specific gravity of the pumice sample. Calculated void volumes for the samples tested ranged from 43% to 75%, with the Williams samples testing in the 59% range.

As noted above, however, there exists a wide range of rock types and compositions in any volcanic field. These compositional differences can have a marked effect on such characteristics such as porosity. The presence of an abundance of mineral fragments in a rock with a frothy groundmass would have the effect of reducing porosity.

Table 5 of Appendix 10 shows how samples from the subject deposit compare with 58 other pumice samples with respect to vesicle density or pore space. In conducting his tests for porosity, Dr. Hoffer measured pore size and number of open pores in a 1 mm-thick thin section. The range of porosities for the subject pumice was 9-18%, which falls within the range of porosities obtained from 31 of the other pumice samples from Mexico, California, Turkey, Guatemala, and Ecuador. One would be hard pressed to say that the porosity of the subject pumice was unique, unless willing to concede that porosity for all other pumices was also unique. I doubt that such is the case.

The vesicle size (in millimeters, shown also in Table 5, Appendix 10) for the subject material was measured at 0.30 mm. This is in the midrange for all other pumice samples tested which ranged in vesicle size from 0.15 to 0.50 mm, and is the same as or very similar to vesicle sizes found in other pumices from Guatemala (0.30 mm), California (0.22 and 0.23 mm), Ecuador (0.35 mm), and Mexico (0.27 mm). Vesicle size is related to the rate at which a pumice would release impregnated chemicals. It is evident that the subject pumice exhibits a range of vesicle sizes very similar to other pumices. One can conclude that there is nothing "unique" about the subject pumice with respect to porosity or vesicle size.

Table 4 of Appendix 10 displays the results of tests designed to measure the effective porosity or the ability of the pore spaces in the pumice to absorb fluids. It is measured as a weight % increase of the pumice after being submerged in water for 5 minutes. This test method closely approximates what is actually done in practice in the industry. When finishers do their own impregnating, they simply pile the pumice on the ground and sprinkle the chemicals over it, allowing it to soak for five minutes or so (Bjarne Schmidt, pers. comm.). The subject material showed a range of effective porosity (8-17%) consistent with those of the other samples tested. Twenty-seven samples from one California deposit exhibited a range of effective porosity from 1%-50%. It becomes quite evident that even in a single deposit, particular characteristics of a pumice can vary greatly; quantifying a particular pumice as unique because of a certain trait becomes nearly meaningless.

The pumice samples were also tested to determine the rate at which the pumice would absorb fluids. This is measured in % weight increase per minute. Once again a wide range of rates (from 0.6-11.3 % wt. increase/min.) is displayed for all the samples tested (see Appendix 10, Table 6) and the results for the subject pumice exhibit ranges from 1.6 to 3.5; very consistent with numerous other pumice materials tested. The subject pumice averaged 2.3 % wt./min., one of the lowest averages for the pumices tested, but this is only one standard deviation from the mean value of 3.9 % wt./min. for all samples tested:

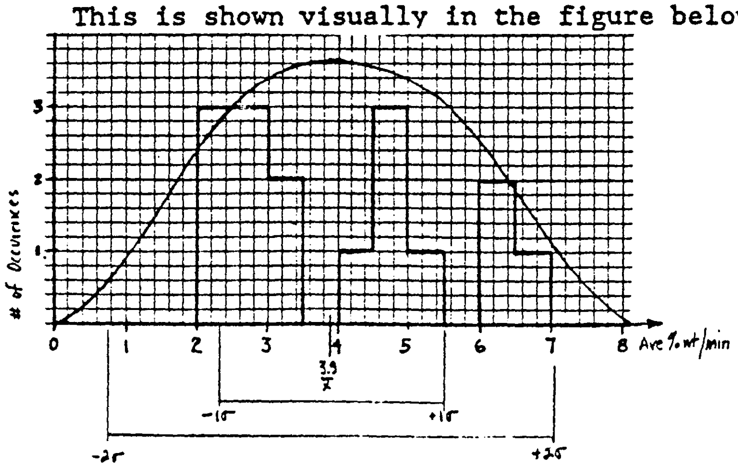
$$\frac{2.3 - 3.9}{[\sigma](-1.57)} = -1.02 \text{ standard deviations}$$

:where [σ] is the standard deviation of the distribution.

The average impregnation rate for 138 of 188 samples tested, or 73% of all samples, falls within one standard deviation of the mean:

$$3.9 \pm 1.57 = 2.3 \text{ to } 5.5 \text{ \% wt./min.}$$

This is shown visually in the figure below:



This shows the range of <u>averages</u> of effective porosity values--actual values ranged from 0.6 to 11.3--and would represent the high and low values of a bell-shaped curve.

The Statute on pumice places Common Varitity as that witch the product is used Commonly ~~an~~ the Common ~~for~~ Varitity pumice mined in the US AS per USDA pufflications is light weight aggrate and buildin material ~~Stone for raid iseas~~

Garnet processing is abviously an uncommon use for this material and deposit and is agreed to by this Report and therefor ~~has~~ on an Common Varitity use and is an Common Varitity pumice deposit

Again, evidence points to the fact that impregnation rate is not a unique property of the subject pumice.

Based on his knowledge of physical properties desirable of a pumice for use in garment-washing, Dr. Hoffer has ranked the pumices he has tested according to density, hardness, abrasion loss, effective porosity, and impregnation rate values (Table 7, Appendix 10). Although this could be considered somewhat subjective, as far as desirability for garment-washing, the subject material was rated as least desirable; due in large part to its high density and hardness, and, Dr. Hoffer points out, low porosity. For another professional opinion I consulted Mark Emelfarb, president of Dyadic Industries of Riverwoods, Illinois; a major broker for pumice from deposits worldwide. He stated that he has visited and tested pumices from deposits flanking Bill Williams Mountain and rejected them because of what he felt was poor quality. He opined that the subject material was neither unique, nor even considered "good" by industry accounts.

The pumice from the private pit (noted as BWM-MP in Dr. Hoffer's report) which Chem-Stone is presently using, ranked fairly high. But, as noted on page 9 of the report, it is not considered unique among pumices; it simply exhibits physical characteristics that could classify a pumice as suitable for garment-washing.

Based on all tests conducted on the subject material, I do not believe that porosity, or any other physical or chemical property of the subject material can be termed unique. As noted earlier, there may be certain qualities that are desirable in a pumice for use in garment finishing, but it is obvious that there exists other pumices that can be used.

There is no known market data from sales of material from the subject site for use in garment finishing, but it has not been shown that the unprocessed pumice would be able to commmand a higher price in the market because of an inherent distinct and special value.

1. So-called "Block Pumice"

So-called "block pumice", or pumice having one dimension of 2 inches or greater, was determined to be locatable by statute. A sieve analysis test was conducted by ATL on five samples of the material on the Deadeye #1 and Sue #2 claims in order to get an idea of the size distribution of material in the deposit. Appendix 4 contains the results of those tests. The tests were conducted on two grab samples (denoted as Grab #2 and Grab #4-B) and three trench samples (denoted as Trench #1, Trench #3, and Trench #6 in Appendix 4). From the test results it can be seen that only from one sample (Grab #2) was any material retained in the 2"+ range. In that case, only 3% of the material passed over the screen column was 2" or greater in diameter.

A Competitor And An Enemy

Crushed By Back Hoe

As previously noted, a portion of the subject claims has been mined in the past. Claims covering these lands in sections 9, 15, and 16, T21N, R2E, on the Kaibab Forest were the subject of litigation in U.S. v. Paul Thomas, et al., 78 ID 5, January 12, 1971 (see Appendix 11) which affirmed previous decisions declaring the claims null and void for lack of discovery of a valuable mineral. Evidence in the case raised the question of the appropriate geologic classification of the material found on the claims. Both the contestant's and the contestee's expert witnesses described the material as "pumiceous material" (IBLA 70-46 at 211). The hearing examiner and Office of Appeals and Hearings found that this was not a true pumice and, therefore, could not be classified as "block pumice" expressly excepted by section 3 of the Act of July 23, 1955, as amended (30 USC 611, (1964). Although the IBLA did not find it necessary to determine whether "pumiceous material is not a true pumice" as previously ruled, they did find that "on the absence of competent evidence to that effect, we cannot conclude that "block pumice" has been shown to exist anywhere on appellants' claims" (supra at 216). There has been no further development of the pumiceous deposits on these lands since this ruling was effected and I have seen no evidence as to the presence of what could be determined to be minable quantities of so-called "block pumice" in any exposures on the claims.

IX. CONCLUSIONS

Based on my field examination of the material exposed on the Deadeye and Sue mining claims, review of market data, and analysis of the results of the sampling and testing, I offer the following conclusions:

1. The pumiceous material found on the mining claims has no known unique property that gives it distinct and special value, and is accordingly a non-locatable common variety of stone such as was removed from location under the mining law by the Act of July 23, 1955, Public Law 167 (69 Stat. 368; 30 USC 611).

2. Any disposal of the mineral material should be as provided for by 36 CFR 228, Subpart C, for salable minerals.

Robin Strathy

ROBIN STRATHY
Geologist

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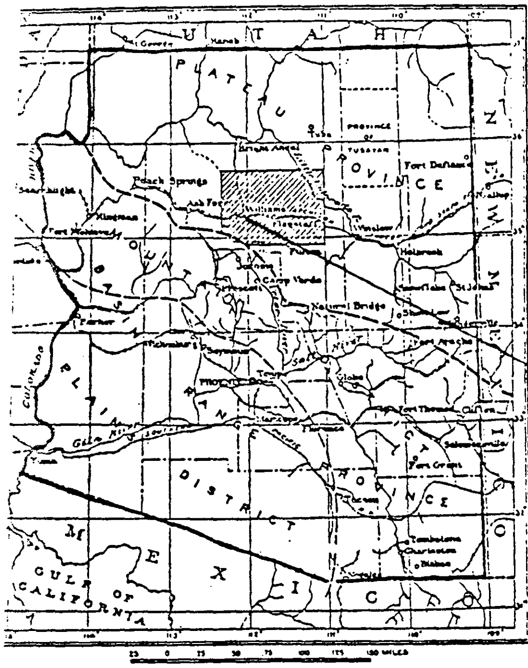
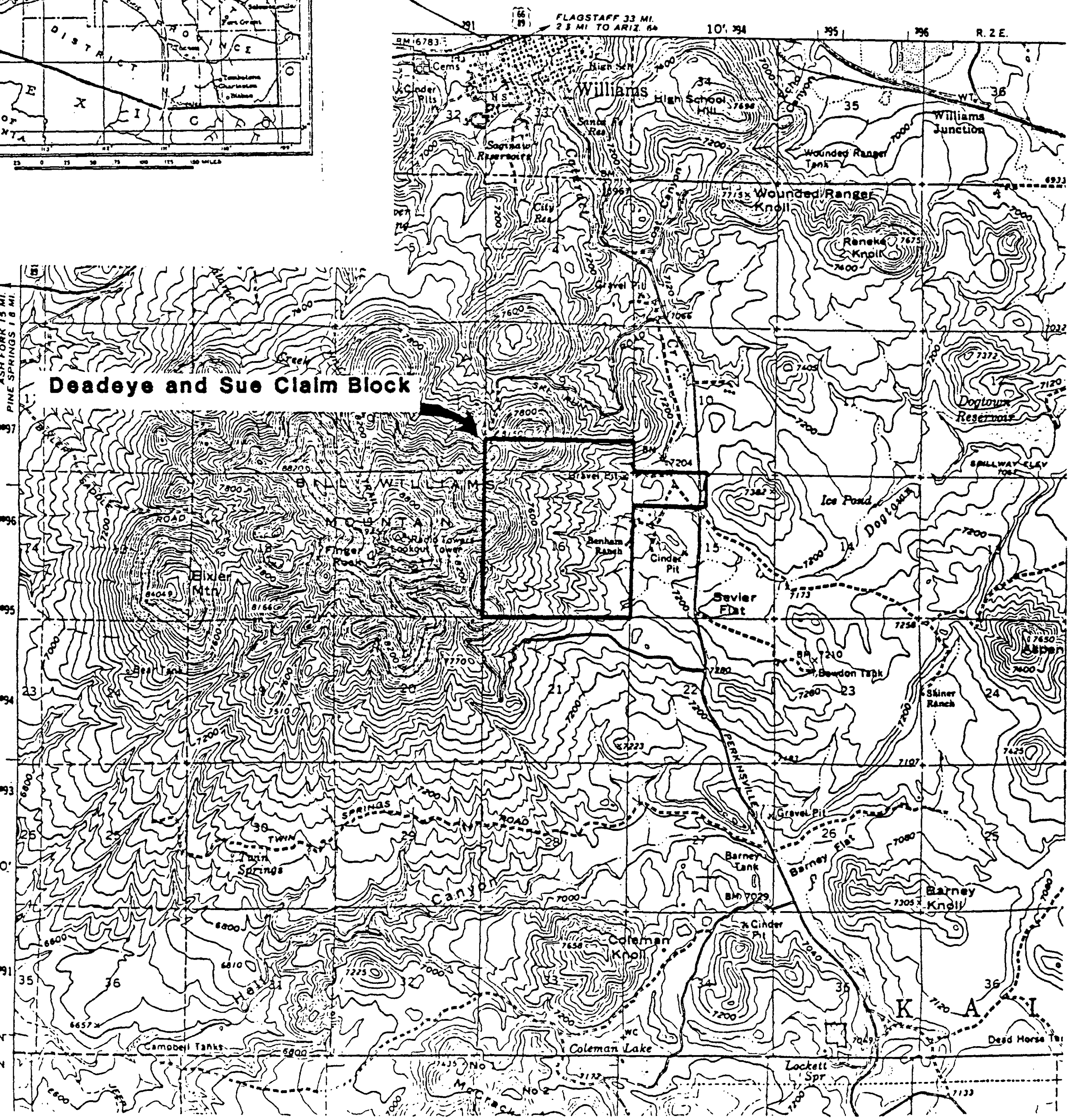
Wilson, Robert E., 1966, Mineral Patent Application Report for Aluminum Oxides No. 1, 2, 4, 7 and Bill Williams No. 4 Placer Mining Claims: U.S.D.A. Forest Service.

APPENDIX 1

Claim Block Location and Access

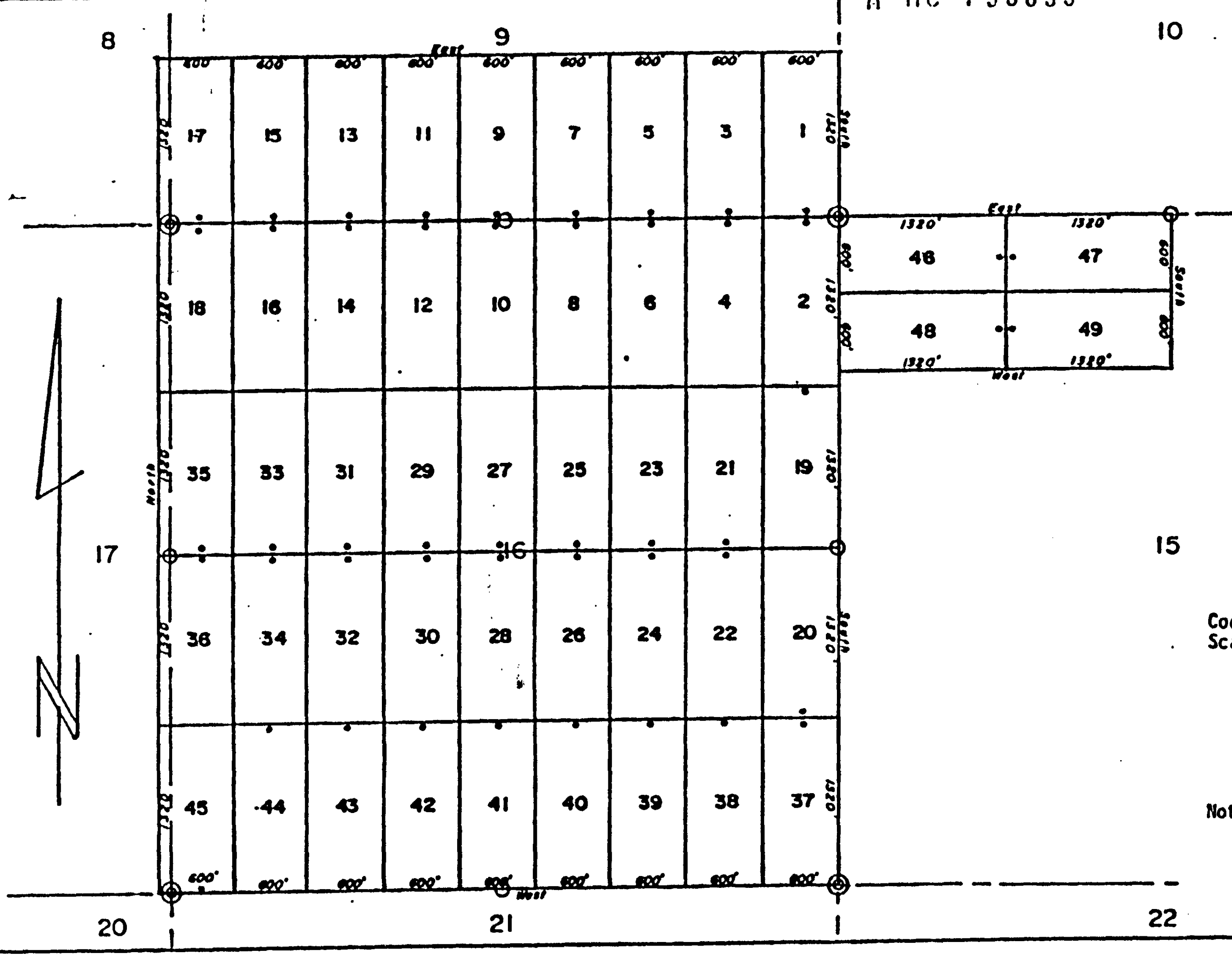




Appendix 1

APPENDIX 2

A MC 296895



RECEIVED
B.L.M. AZ STATE OFFICE
1989 JUL 5 PM 2:58
PHOENIX, ARIZONA

MINING CLAIMS
of
DAVID BELLAIRE
Chem-Stone, Inc.
2215 W. Mountain View
Phoenix, AZ 85021

known as

SUE #s 1-49 lodes

situate in

Secs. 9, 15 & 16,
T.21 N., R.2 E., G.& S.R.M.

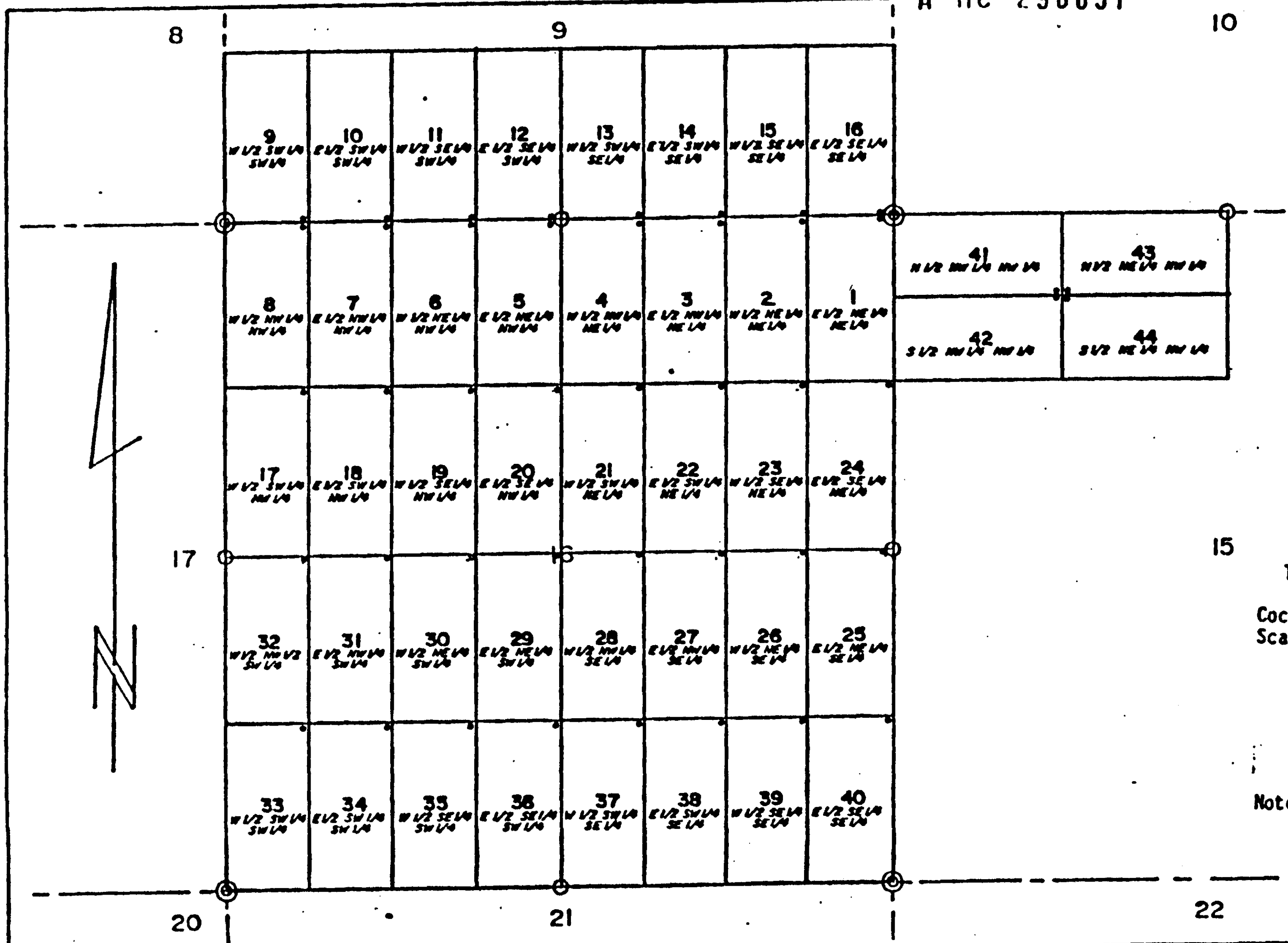
Coconino County Arizona
Scale 1" = 1000' Jun. 8, 1989

Surveyed by:
Harvey W. Smith, E.M.
Del Tierra Engineering
& Mining Corporation

Note: o - denotes location mon.
All mons. are 2" x 2" x 4'6"
wood posts.

Appendix 2

A MC 296051



MINING CLAIMS
of
DAVID BELLAIRE
Chem-Stone, Inc.
2215 W. Mountain View
Phoenix, AZ 85021

known as

DEADEYE #s 1-44 placers

situate in

Secs. 9, 15 & 16,
T.21 N., R.2 E., G.& S.R.M.

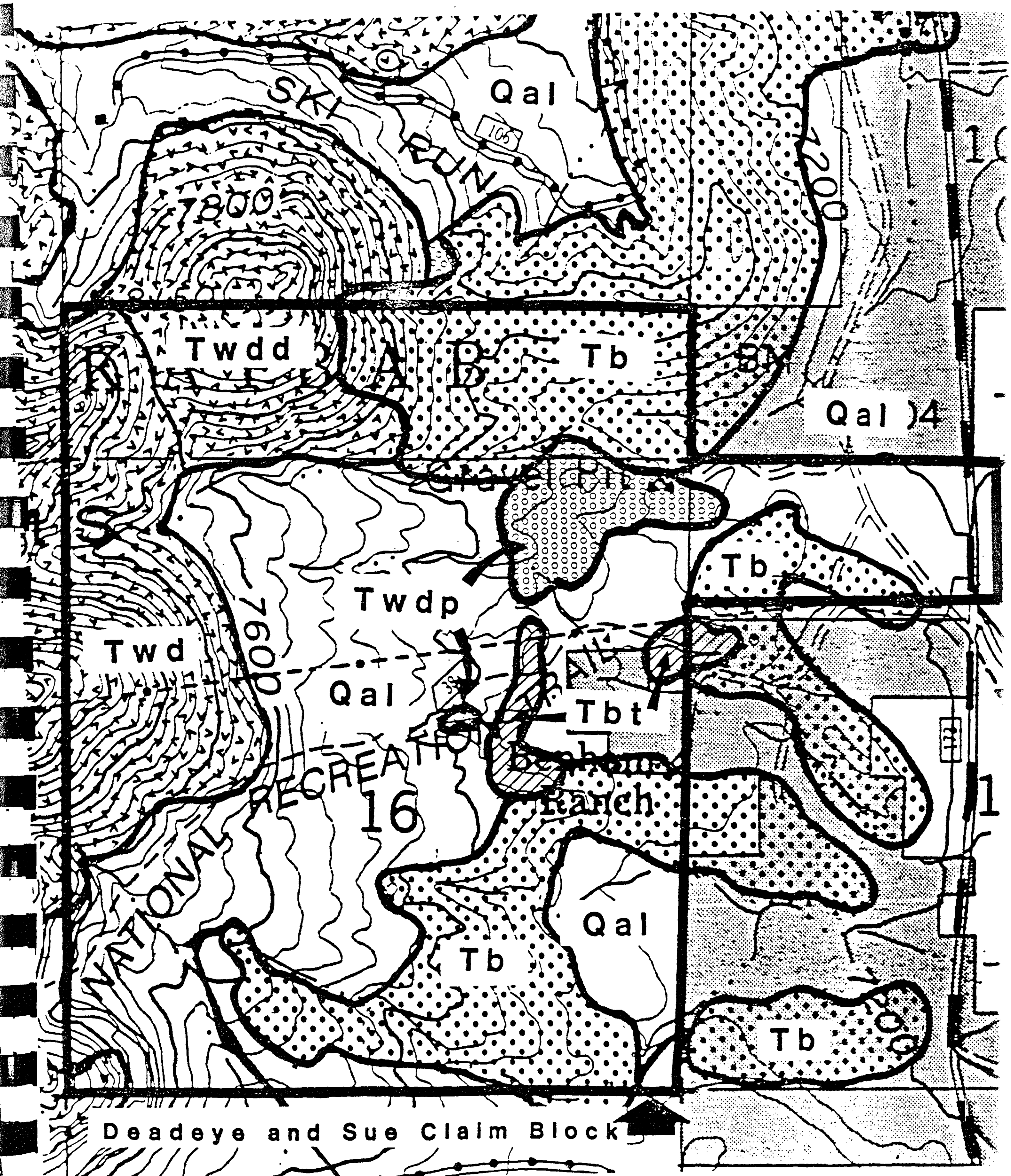
Coconino County Arizona
Scale 1" = 1000' Jun. 8, 1989

Surveyed by:
Harvey W. Smith, E.M.
Del Tierra Engineering
& Mining Corporation

Note: o - denotes location mon.
All mons. are 2" x 2" x 4'6"
wood posts.

Geology of Claim Area

tr Newhall et. al.,(19

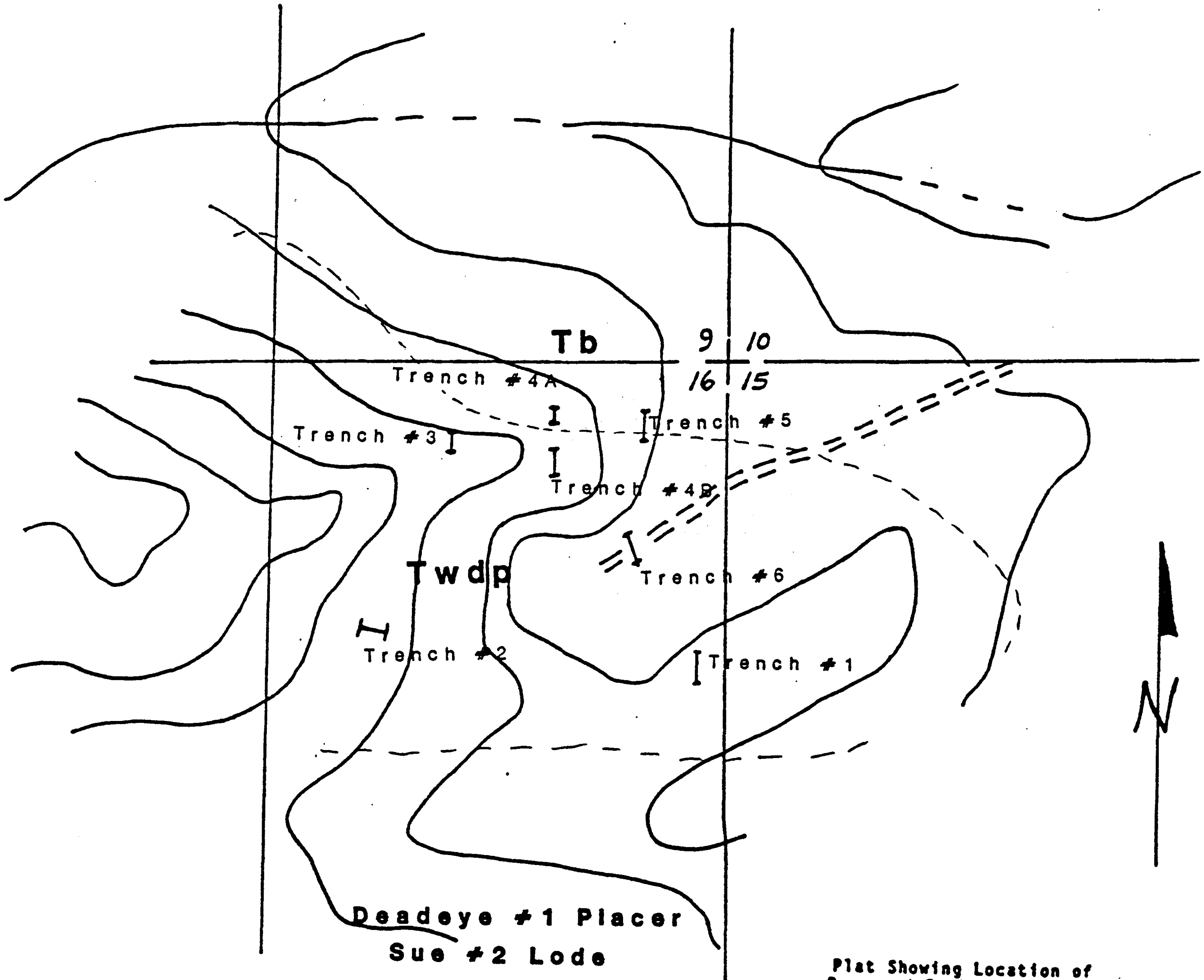


Deadeye and Sue Claim Block

Scale 1" 1320'

(see Appendix 3 for legend)

Sample Sites



Plat Showing Location of
Proposed Exploration Cuts

Chem-Stone, Inc.
2215 W. Mountain View
Phoenix, AZ 85021

Deadeye #1 Placer Claim
Sue #2 Lode Claim

Sec. 16, T.21 N., R.2 E., G.& S.R.M.
Kaibab National Forest

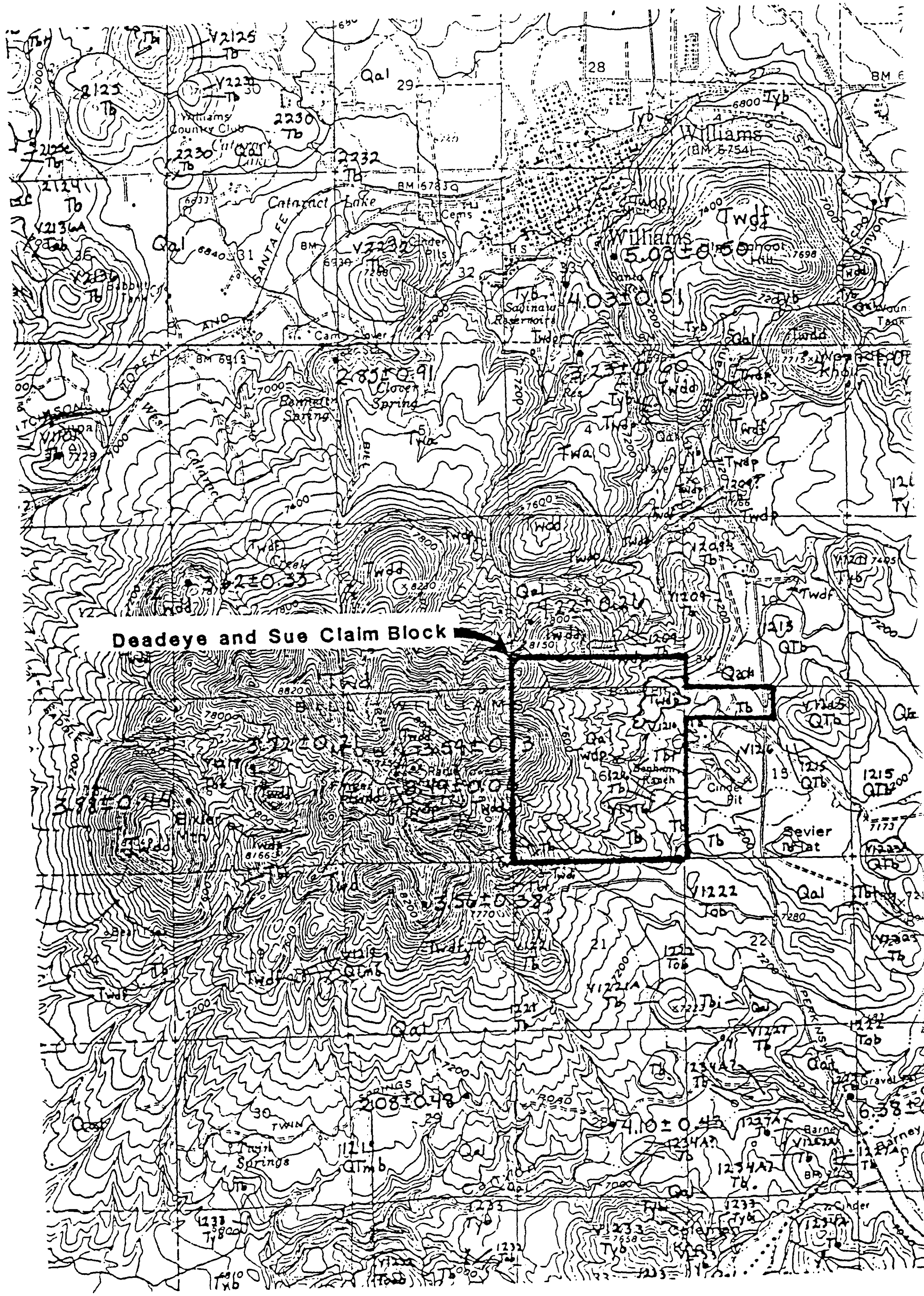
Coconino County Arizona
Scale 1" = 200' Sept. 28, 1989

Surveyed by:
Del Tierra Engineering
& Mining Corp.

APPENDIX 3

Geology of the Bill Williams Mtn. Area

From Newhall et. al., (198



LIST OF MAP UN

SURFICIAL DEPOSITS OF QUA... ...ARY ...

Qal ALLUVIAL AND COLLUVIAL DEPOSITS (HOLOCENE AND PLEISTOCENE)
Ql LANDSLIDE DEPOSITS (PLEISTOCENE)

EXTRUSIVE AND INTRUSIVE ROCKS OF QUATERNARY AND TERTIARY AGE EXCLUSIVE OF MAJOR ERUPTIVE CENTERS

BASALT OF YOUNGER PLEISTOCENE (OLDER BRUNHES) AGE
Qbb Basalt flow
BASALT OF PLEISTOCENE (OLDER BRUNHES OR MATUYAMA) AGE
Qbmb Basalt flows and cinder cones
BASALT OF PLEISTOCENE (MATUYAMA) AGE
Qmb Basalt flows and cinder cones
EXTRUSIVE AND INTRUSIVE ROCKS OF PLEISTOCENE OR LATEST PLIOCENE (MATUYAMA) AGE
QTmb Basalt flows and cinder cones
QTmbt Basaltic tuff of vent 3229
QTmbp Basalt pyroclastic sheet
QTmbi Composite basalt dike of Little Squaw Mountain
QTmab Basaltic andesite flows and cinder cones
QTmai Basaltic andesite dike of Buck Mountain
QTmbn Benmoreite flow and vent deposits of Horse Hill
QTmba Basalt and andesite flow of vent 1419
QTma Andesite of vent 4418
EXTRUSIVE ROCKS OF PLEISTOCENE OR PLIOCENE (MATUYAMA OR OLDER) AGE
QTb Basalt flows and cinder cones
QTsb Basalt dome of Squaw Mountain
QTab Basaltic andesite flow and cinder cone
Basalt, andesite, and dacite of Davenport Hill
QTdba Basalt and andesite flow
QTda Andesite cone of vent 1305
QTdd Dacite dome
ANDESITE OF LATEST PLIOCENE (MATUYAMA) AGE
Tmha Andesite flow of Howard Mesa
BASALT OF PLIOCENE (GAUSS OR GILBERT) AGE
Tyb Basalt flows and cinder cones
Tybp Pyroclastic sheet of Cedar Mountain
Tybff Fissure-fed flows
Tybt Basaltic tuff
Tybi Dikes and pluton
EXTRUSIVE AND INTRUSIVE ROCKS OF PLIOCENE OR MIOCENE AGE
Tb Basalt flows and cinder cones
Tbu Basalt flows, undivided
Tbp Basalt pyroclastic sheet deposit
Tbt Basaltic tuff
Tbi Basalt dikes
Tab Basaltic andesite flows and cinder cone
EXTRUSIVE AND INTRUSIVE ROCKS OF MIOCENE AGE
Tob Basalt flows and vent deposits
Toab Basaltic andesite flows and cinder cones
Thcd Dacite dome of Hell Canyon

EXTRUSIVE AND INTRUSIVE ROCKS OF QUATERNARY AND TERTIARY AGE OF MAJOR ERUPTIVE CENTERS

Bill Williams Mountain

EXTRUSIVE AND INTRUSIVE ROCKS OF PLIOCENE (GAUSS AND GILBERT) AGE
Twa Andesite flows and domes
Twbn Benmoreite flow
Twd Dacite flows and intrusive rocks of central complex
Twdd Dacite domes
Twdf Dacite flows
Twdp Dacite pyroclastic deposits
Twdi Dacite dike

DESCRIPTION OF MAP UNITS

Bill Williams Mountain

EXTRUSIVE AND INTRUSIVE ROCKS OF PLIOCENE (GAUSS AND GILBERT) AGE

Twa Andesite flows and domes—Flows extruded from bases of dacite domes on north side of Bill Williams Mountain and two small domes (the Railroad domes) north of Williams. Maximum thickness of flows is about 110 m and of domes about 50 m. Unit typically contains abundant phenocrysts of plagioclase (≤1 cm), which is corroded and sieved, and hornblende. Hornblende prisms in the flows are ≤1 mm long and are usually altered to opaque oxide or biotite, whereas in the domes they are ≤1 cm long and are unaltered. Sparse corroded quartz grains (≤5 mm) enclosed by pyroxene reaction rims occur consistently. Groundmass is fine grained and pilotaxitic to glassy and hyalopilitic; it normally contains tabular or microlitic plagioclase, pyroxene, opaque oxide, and glass and is generally more crystalline than that of the dacites (Twd, Twdd, and Twdf). For composition see analyses 1204, 1206 (flows) and 2221, 2222A (domes). K-Ar ages 2.85±0.91, 3.23±0.60, and 3.48±0.05 Ma. Polarity normal

Twbn Benmoreite flow—Flow, characteristically shows sheetlike jointing, ≥60 m thick, extruded from west base of dacite dome (Twdd) that forms Bixler Mountain. Benmoreite contains scattered phenocrysts of corroded and sieved plagioclase (≤5 mm), altered hornblende (≤3 mm), and corroded quartz (≤4 mm). It also contains microphenocrysts of plagioclase that are gradational in size to plagioclase in the groundmass, which, in addition, contains olivine (altered to iddingsite), apatite, opaque oxide, and glass. Groundmass texture ranges from hyalopilitic where flow is glassy to pilotaxitic where i[t] is more crystalline. For composition see analysis 1122. Uni[t] is both overlain and underlain by basalt flows (Tyb). K-Ar age 2.94±0.57 Ma. Polarity reversed

Twd Dacite flows and intrusive rocks of central complex—Thick undivided flows and intrusive rocks of largely homogeneous, porphyritic dacite that forms the central and major part of Bill Williams Mountain. Unit includes spinelike ridges of dacite that are approximately radial to the mountain center, commonly contain vertical vesicle trains, and in which the dacite has a chalky altered appearance; the ridges may represent the upper part of a radial feeder-dike system. Dacite is generally similar in lithology to dacite domes (Twdd) and flows (Twdf) of Bill Williams Mountain. It contains abundant large (≤2 cm) phenocrysts of plagioclase that are moderately corroded and sieved and smaller (≤3 mm) phenocrysts of hornblende and biotite that are altered to opaque oxide; additional phenocrysts of quartz, unaltered biotite, and clinopyroxene occur locally. Groundmass consis[ts] of the same minerals plus hypersthene. For composition see analyses 1217, 1217C, 1218D, 1220. Microdiorite xenoliths similar to those in dacite domes (Twdd) are common. K-Ar ag[e] 3.56±0.38 Ma. Polarity, measured at one locality, normal

Twdd Dacite domes—Domes, light- to medium-gray, circular to irregularly shaped, 0.25-1.9 km in diameter, 75-305 m high. Most are peripheral to central complex of Bill Williams Mountain (Twd), but two occur in the summit area, and severa[l] occur to the northeast in the vicinity of Reneke Knoll and High School Hill. Dacite contains abundant large (usually 0.5-1 cm long, but locally ≤3 cm) phenocrysts of corroded an[d] sieved plagioclase. Smaller (≤3 mm) phenocrysts of hornblende, biotite, and opaque oxide (mainly magnetite) are common. Phenocrysts and glomerocrysts of clinopyroxene (≤3 mm) and phenocrysts of quartz (≤1 cm) are abundant in the domes at the summit of Bill Williams Mountain but are sparse in the other domes. Phenocrysts of biotite are abundant onl[y] in the Reneke Knoll dome. For representative compositions s[ee] analyses 1221 (typical dome peripheral to Bill Williams Mountain), 1202 (outlying biotite-rich dacite of Reneke Knol[l] dome), and 1217B (pyroxene- and quartz-rich dacite of summit dome). K-Ar ages 3.59±0.13, 3.62±0.33, 3.72±0.21, 3.88±0.44, 4.17±1.06, 4.22±0.26 Ma. Polarity normal and reversed.

Microdiorite xenoliths are widely scattered in this unit. Xenoliths are medium to dark gray, commonly vesicular, spherical to irregularly shaped, 1-10 cm in diameter. They consist of a fine- to medium-grained, pilotaxitic matrix of hornblende and plagioclase that contains sparse phenocrysts [of] corroded plagioclase, hornblende, or quartz. For compositio[n] see analyses 1207 and 2235

Twdf Dacite flows—Flows, light-gray, broad or elongate bodies of porphyritic dacite distinguished from dacite domes (Twdd) by their greater ratio of surface area to thickness and from th[e] central complex (Twd) by their isolation from it. Unit includes flow of High School Hill, which may have buried its own vent, a flow extruded from the southwest flank of Wounde[d] Ranger Knoll, and several flow outcrops separated from Bill Williams Mountain by Quaternary alluvial and colluvial deposits (Qal). Dacite contains abundant large (typically ≤[1] cm long, but locally ≤4 cm) phenocrysts of corroded and siev[ed] plagioclase. Smaller phenocrysts (≤4 mm) include hornblende, which is common, and subordinate biotite. Phenocrysts of quartz (≤4 mm) are locally abundant. For typical compositio[n] see analyses 1203A, 2233B. One sample from the flow of High School Hill (analysis 2233) is transitional between andesite and dacite. K-Ar age, flow of High School Hill, 5.03±0.50 M[a] but the flow overlies a basalt flow (Tyb) with a K-Ar age of 4.03±0.51 Ma. Polarity, flow of High School Hill, normal

Twdp Dacite pyroclastic deposits—Airfall deposits of pumiceous dacite lapilli and fine ash distributed around Bill William[s] Mountain as isolated outcrops, as pyroclastic collars around dacite domes (Twdd), and beneath parts of the dacite flow (Twdf) of High School Hill and andesite flows (Twa) south of Williams. Phenocrysts of the same minerals as in other daci[te] units related to Bill Williams Mountain occur in a glass-ric[h] hyalophitic to hyalopilitic groundmass. Accidental clasts o[f] Precambrian basement rocks including gneiss, schist, mylonit[e] and orthoquartzite are locally common. For composition see analyses 1203 and 1217A. K-Ar age of dacite clast from summ[it] deposit is 3.49±0.06 Ma

Twdi Dacite dike—Dike, porphyritic, 180 m long, 5-10 m wide, feed[er] for small dacite dome (Twdd) on southeast flank of Bill Williams Mountain. Dacite contains abundant large (≤3 cm long) phenocrysts of sieved plagioclase and smaller (≤3 mm) phenocrysts of hornblende and quartz as well as scattered phenocrysts of biotite, hypersthene, and opaque oxide set i[n] glassy groundmass

Appendix

APPENDIX 4

Photo 1: Overview of proposed mining area on Deadeye #1 PMC (Sue #2 LMC). View looking SE towards access road. This area was previously mined in the 1960's. Note relatively new conifer growth. Trench (test pit#6) taken in this vicinity.

Appendix 4
Robin Strathy

Photo 2: View of Trench #1.

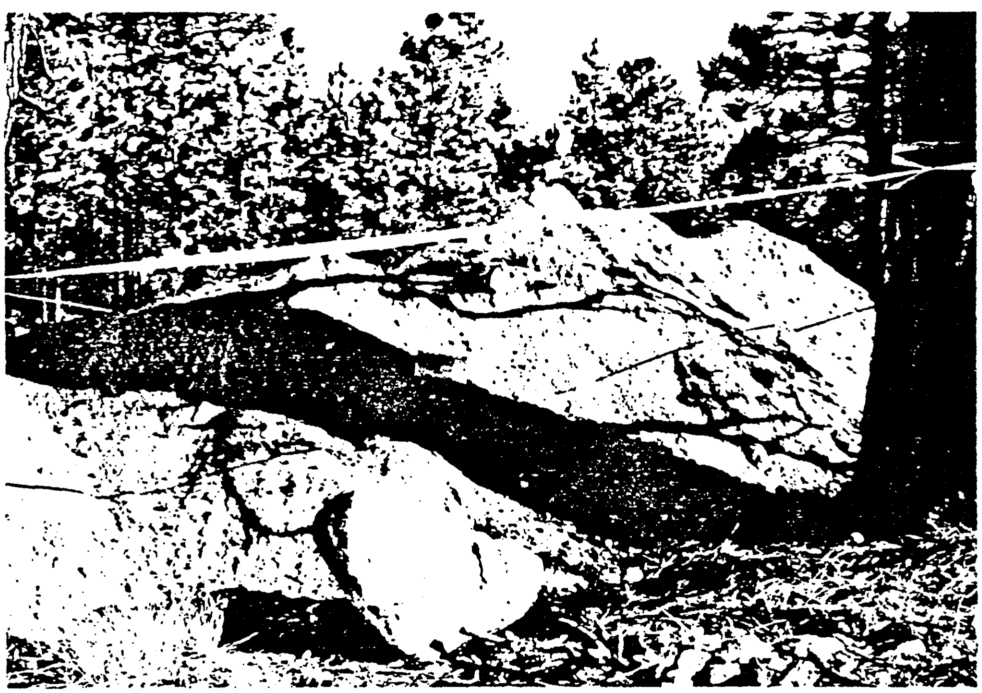


Photo 3: Excavated material from trench #1.

Photo 4: Material in-place; pit wall of test pit #1. Note mix of sand to gravel sized material and fragments of reddish rhyodacite material.

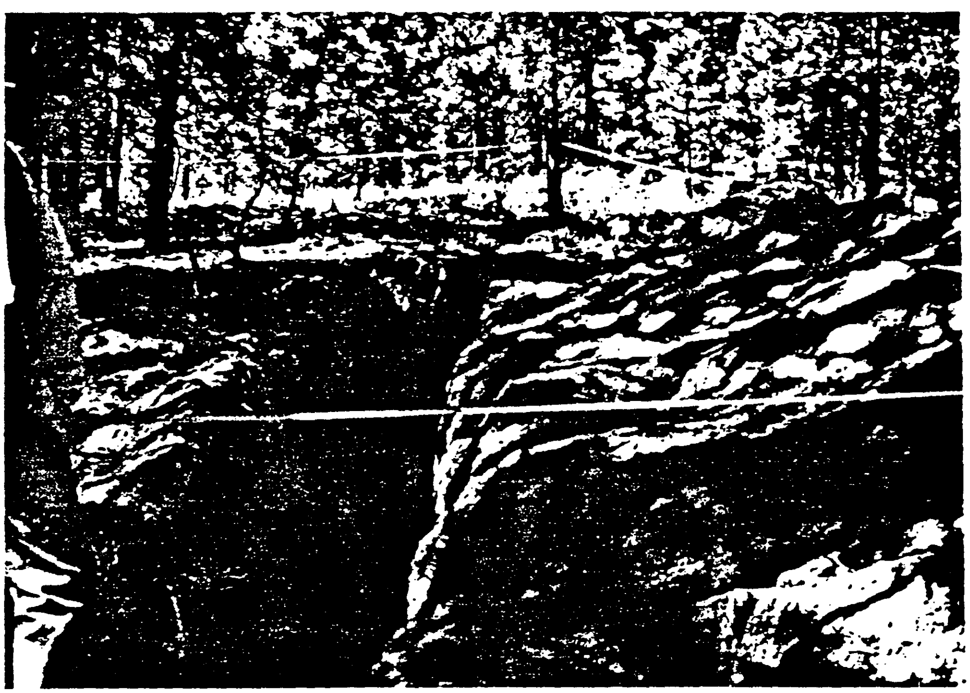


Photo 5: Test pit #2.

Photo 6: View of channel sample and in-place material of test pit #2.

Photo 7: Close up of material in pit walls. Note predominance of sand to gravel sized ash and pumiceous fragments.

Photo 8: Excavated material from test pit #2.

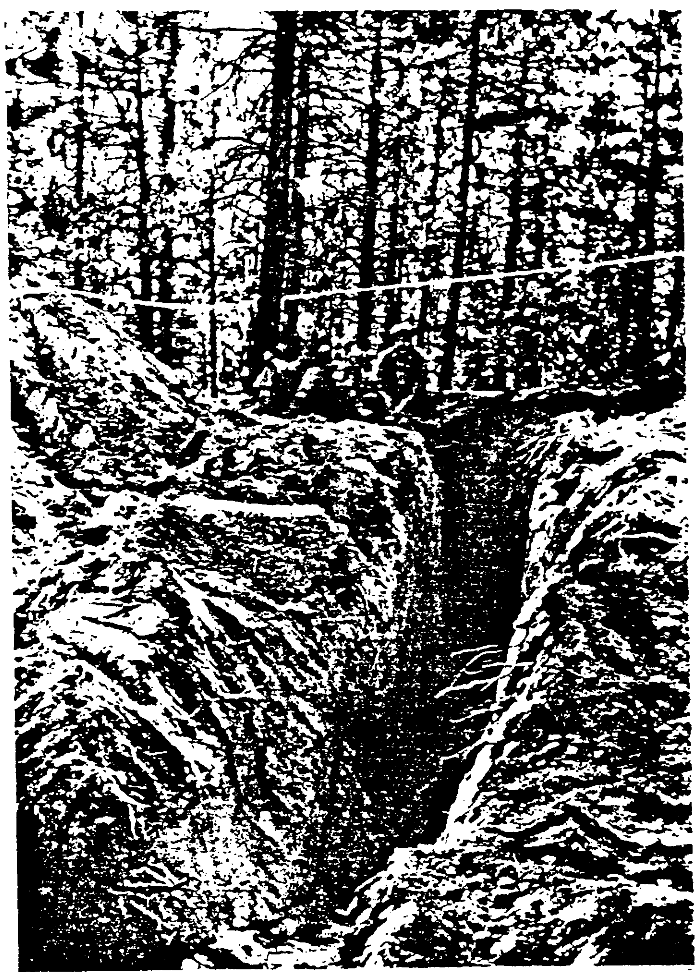


Photo 9: Test pit #3. Note abundance of sand-sized material.

Photo 10: Channel sample site
in test pit #3.

Photo 11: Close up of material
in pit wall; test pit #3.

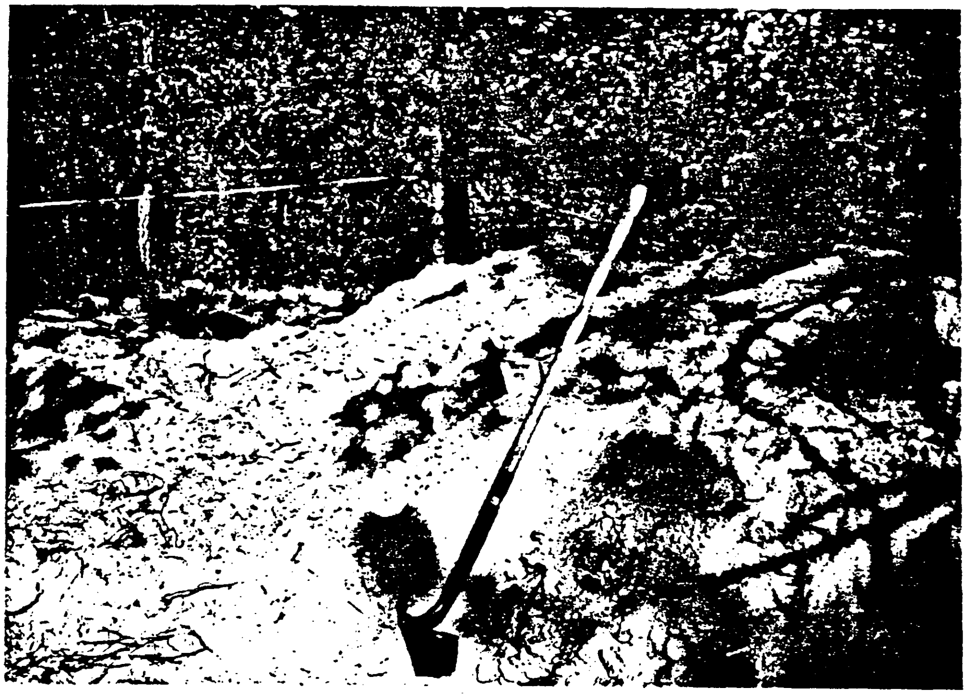
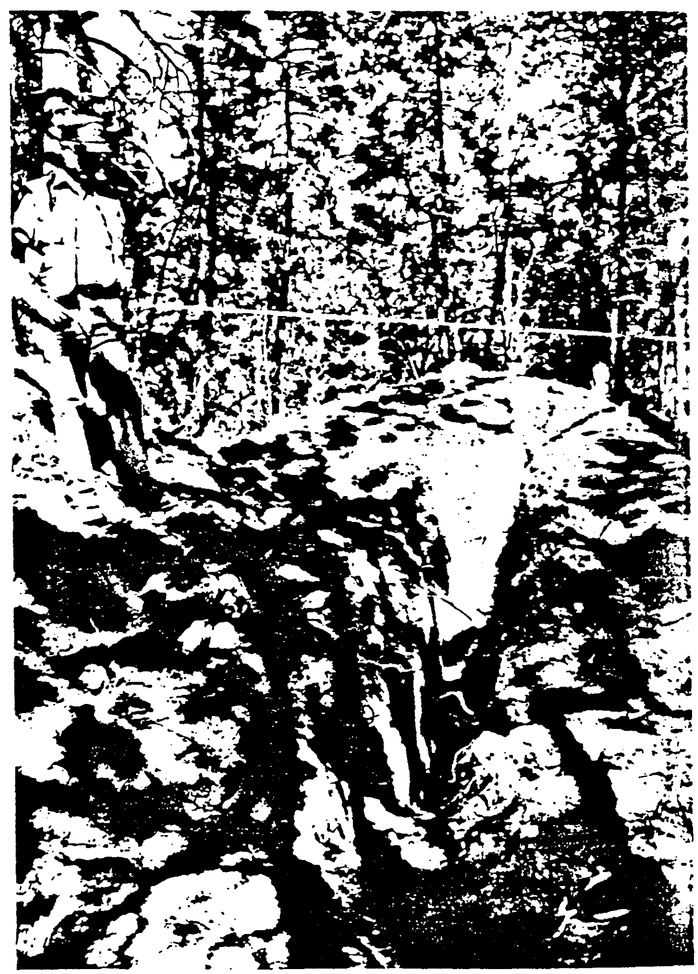


Photo 12: Trench material from test pit #3.
Grab sample taken.

Photo 13: Test pit 4A in red soils and basalt; near contact of dacite pyroclastic deposit and basalt.
No sample taken.



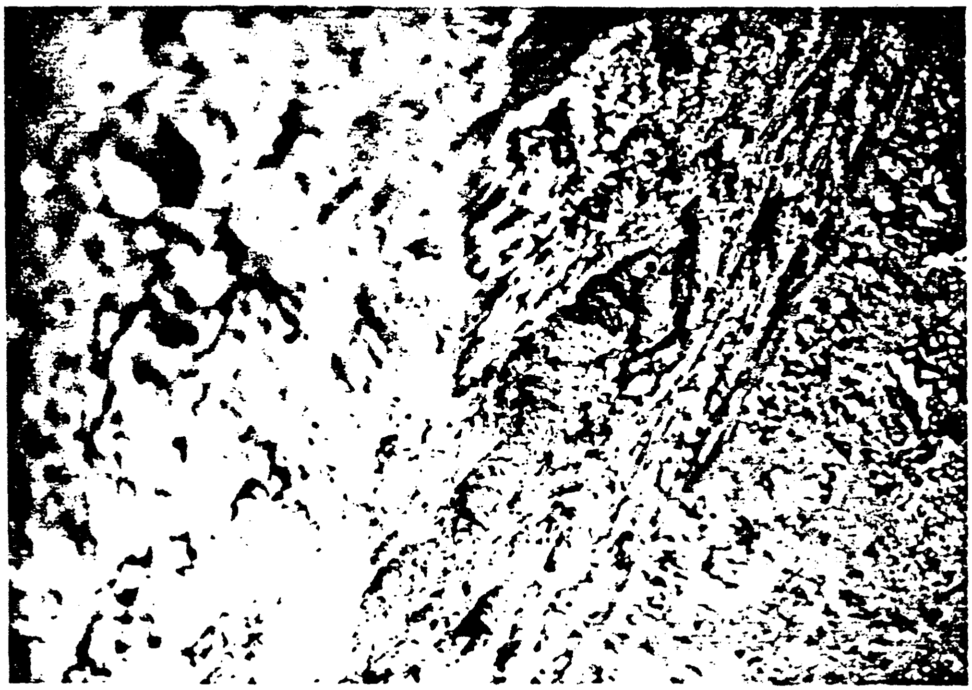


Photo 14: Close up of basalt fragments in test pit 4A.

Photo 15: Channel sample area in test pit 4B. John Gutierrez and Tom Gillett pictured here.

Photo 16: Close up of pit wall from test pit 4B. Note rhyodacite fragments and large amount of sand to gravel sized material.

Photo 17: Channel sample in test pit 4B. Note that material is fairly moist and there are scattered fragments of cobble-sized pumiceous and rhyodacite fragments.

Photo 18: Test pit #5 exposed contact between thin layer of overlying rhyolitic material (upper left hand corner of photo) and basalt.
No sample taken.

Photo 19: Test pit #6.

Photo 20: Channel sample in test pit #6. Note thin lenses of larger sized pumiceous fragments within predominently sand-sized particles.

Photo 21: Trenched material from test pit #6. Grab sample taken.

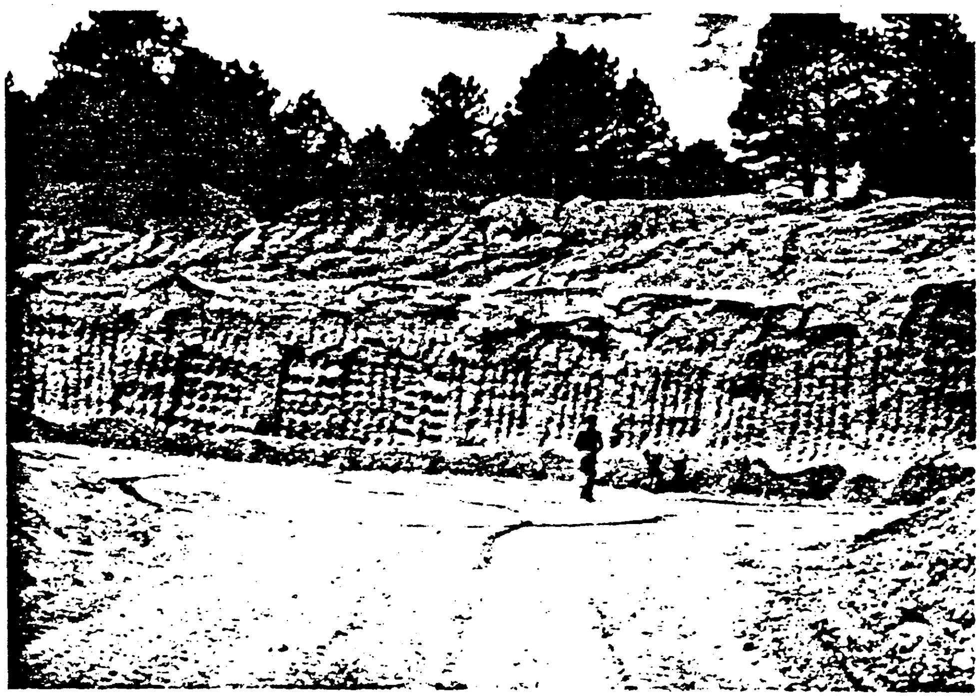


Photo 22: Pit on private land approximately 2 miles north of subject claims from which proponent presently removes material. Note greater amount of larger-sized pumice fragments here than on subject claims. Mining method is front end loader w/ripper teeth (note marks in pit walls).

APPENDIX 5

ATL TESTING LABORATORIES
GEOTECHNICAL AND MATERIALS CONSULTANTS

RECEIVED USFS R-3
FISCAL & ACCTG. MGMT.
1990 JAN 11 AM 8 53

December 26, 1989

USDA Forest Service
2324 E. McDowell Road
Phoenix, Arizona 85006
Attention: Robin Strathy

SUBJECT: Particle Size Analysis and Unit Weight
Chem Stone PO #8371-0-0148
ATL JOB NO.: 289189

Gentlemen:

Enclosed are the results of sieve analysis and unit weight of the samples provided to the laboratory.

The sieve analysis were performed in accordance with ASTM D-422. The unit weight was done as per AASHTO t-19.

If you have any questions, please do not hesitate to contact us.

Very truly yours,
ATL TESTING LABORATORIES

for Masood Mirza
Materials Engineer

MM/mmi

RECEIVED U.S.F.S.-R3
JAN 11 1990
ADMINISTRATIVE
SERVICES

2922 WEST CLARENDON • PHOENIX, ARIZONA 85017 • TELEPHONE (602) 241-1097
A DIVISION OF R & D ENGINEERING ASSOCIATES, AN ARIZONA CORPORATION

ATL TESTING LABORATORIES
GEOTECHNICAL AND MATERIALS CONSULTANTS

CLIENT: USDA FOREST SERVICE
2324 E McDOWELL RD
PHOENIX. AZ. 85006
ATTN: ROBIN STRATHY

DATE: 12/07/89

LAB NO: 89-2023

PROJECT: CHEM STONE P.O.# 8371-0-0148
MATERIAL: SANDY GRAVEL
SOURCE: TRENCH # 1

PROJECT NO: 289189
DATE RCVD: 11/15/89
SAMPLED BY: CLIENT
TESTED BY: WP

PARTICLE SIZE ANALYSIS OF SOILS

METHOD: ASTM D 422

SIEVE SIZE	% RETAINED	% PASSING
4 "	0	100
3 1/2 "	0	100
3 "	0	100
2 1/2 "	0	100
2 "	0	100
1 1/2 "	1	99
1 "	3	96
3/4 "	3	93
1/2 "	5	88
3/8 "	4	85
1/4 "	7	77
# 4	5	72
# 8	10	63
# 10	3	60
# 16	8	52
# 30	11	40
# 40	6	34
# 50	5	30
# 100	11	19
# 200	8	11
Pass # 200		11.0

Moisture Content (%) 3.08

Respectfully Submitted,
ATL Testing Laboratories

William D. Pierce
Laboratory Supervisor

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ATL Testing Laboratories
GEOTECHNICAL AND MATERIALS CONSULTANTS

CLIENT: USDA FOREST SERVICE
2324 E McDOWELL RD
PHOENIX, AZ. 85006
ATTN: ROBIN STRATHY

DATE: 12/07/89
LAB NO: 89-2026

PROJECT: CHEM STONE P.O.# 8371-0-0148
MATERIAL: SANDY GRAVEL
SOURCE: TRENCH # 3

PROJECT NO: 289189
DATE RCVD: 11/15/89
SAMPLED BY: CLIENT
TESTED BY: JR

PARTICLE SIZE ANALYSIS OF SOILS

METHOD: ASTM D 422

SIEVE SIZE	% RETAINED	% PASSING
4 "	0	100
3 1/2 "	0	100
3 "	0	100
2 1/2 "	0	100
2 "	0	100
1 1/2 "	0	100
1 "	5	95
3/4 "	3	92
1/2 "	7	85
3/8 "	8	77
1/4 "	16	61
# 4	13	48
# 8	6	43
# 10	1	42
# 16	4	38
# 30	6	32
# 40	3	29
# 50	3	26
# 100	8	18
# 200	6	12
Pass # 200		12.0

Moisture Content (%) 1.10

Respectfully Submitted,
ATL Testing Laboratories

William D. Pierce
Laboratory Supervisor

CLIENT: USDA FOREST SERVICE
2324 E McDOWELL RD
PHOENIX, AZ. 85006
ATTN: ROBIN STRATHY

DATE: 12/07/89
LAB NO: 89-2029

PROJECT: CHEM STONE P.O.# 8371-0-0148
MATERIAL: SANDY GRAVEL
SOURCE: TRENCH # 6

PROJECT NO: 289189
DATE RCVD: 11/15/89
SAMPLED BY: CLIENT
TESTED BY: JR

PARTICLE SIZE ANALYSIS OF SOILS

METHOD: ASTM D 422

SIEVE SIZE	% RETAINED	% PASSING
4 "	0	100
3 1/2 "	0	100
3 "	0	100
2 1/2 "	0	100
2 "	0	100
1 1/2 "	2	98
1 "	3	95
3/4 "	2	93
1/2 "	3	89
3/8 "	3	87
1/4 "	4	83
# 4	3	80
# 8	7	73
# 10	2	72
# 16	5	66
# 30	8	58
# 40	5	53
# 50	5	48
# 100	14	34
# 200	11	23
Pass # 200		23.0

Moisture Content (%) 4.37

Respectfully Submitted,
ATL Testing Laboratories

William E. Fierce
Laboratory Supervisor

ATL TESTING LABORATORIES
GEOTECHNICAL AND MATERIALS CONSULTANTS

CLIENT: USDA FOREST SERVICE
2324 E McDOWELL RD
PHOENIX, AZ. 85006
ATTN: ROBIN STRATHY

DATE: 12/07/89
LAB NO: 89-2032

PROJECT: CHEM STONE P.O.# 8371-0-0148
MATERIAL: SANDY GRAVEL
SOURCE: GRAB # 2

PROJECT NO: 289189
DATE RCVD: 11/15/89
SAMPLED BY: CLIENT
TESTED BY: WP

PARTICLE SIZE ANALYSIS OF SOILS

METHOD: ASTM D 422

SIEVE SIZE	% RETAINED	% PASSING
4 "	0	100
3 1/2 "	0	100
3 "	0	100
2 1/2 "	3	97
2 "	0	97
1 1/2 "	1	96
1 "	2	94
3/4 "	1	92
1/2 "	3	89
3/8 "	4	85
1/4 "	6	79
# 4	5	74
# 8	9	65
# 10	3	63
# 16	8	54
# 30	12	42
# 40	6	36
# 50	5	31
# 100	11	20
# 200	8	12
Pass # 200		11.6

Moisture Content (%) 3.83

Respectfully Submitted,
ATL Testing Laboratories

William D. Pierce
Laboratory Supervisor

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ATL TESTING LABORATORIES
GEOTECHNICAL AND MATERIALS CONSULTANTS

CLIENT: USDA FOREST SERVICE
2324 E McDOWELL RD
PHOENIX, AZ. 85006
ATTN: ROBIN STRATHY

DATE: 12/07/89
LAB NO: 89-2033

PROJECT: CHEM STONE P.O.# 8371-0-0148
MATERIAL: SANDY GRAVEL
SOURCE: GRAB # 4-B

PROJECT NO: 289189
DATE RCVD: 11/15/89
SAMPLED BY: CLIENT
TESTED BY: WP

PARTICLE SIZE ANALYSIS OF SOILS

METHOD: ASTM D 422

SIEVE SIZE	% RETAINED	% PASSING
4 "	0	100
3 1/2 "	0	100
3 "	0	100
2 1/2 "	0	100
2 "	0	100
1 1/2 "	0	100
1 "	0	100
3/4 "	T	100
1/2 "	1	98
3/8 "	1	97
1/4 "	3	94
# 4	3	91
# 8	.6	86
# 10	2	84
# 16	7	77
# 30	11	66
# 40	7	59
# 50	6	53
# 100	17	36
# 200	12	24
Pass # 200		23.4

Moisture Content (%) 2.26

Respectfully Submitted,
ATL Testing Laboratories

William D. Pierce
Laboratory Supervisor

ATL TESTING LABORATORIES
GEOTECHNICAL AND MATERIALS CONSULTANTS

CLIENT: USDA Forest Service
2324 E. McDowell
Phoenix, AZ 85006

DATE: 12/11/89

LAB NO: 89-2023

PROJECT: 43-8371-0-0148

JOB NO: 289189

MATERIAL: Sandy Gravel

RECEIVED: 11/15/89

SOURCE OF SAMPLE: Trench #1

SAMPLED BY: Client

SOURCE OF MATERIAL: Not Reported

REPORT OF LABORATORY TEST:

UNIT WEIGHT MEASUREMENT
METHOD: AASHTO T-19

DRY WT. = 95.1 pcf

Respectfully submitted,
ATL TESTING LABORATORIES

William D. Pierce, CET.
Laboratory Lead Technician

APPENDIX 6

CHEM-STONE, INC.
PRODUCT PATENTED
Quality that's Consistent

September 5, 1989

Mr. Leonard A. Lindquist
Forest Supervisor
U.S. Dept. of Agriculture
Kaibab National Forest
800 South 6th Street
Williams, AZ 86046

Dear Mr. Lindquist:

On May 4, 1989, Mr. Ken Phillips, Mr. Tom Gillette, Mr. Cary Price and myself met and took a brief look at the proposed mining locations.

There was discussion that a portion of the material was in excess of the minimum requirements for block pumice and also that there may be a need to trench and core drill to determine the extent of this size material.

Keeping this in mind, I feel that I must apologize for unknowingly misleading Mr. Gillett and Mr. Price in that the size of the pumice was the only reason we felt that this was a locatable deposit of material, when in fact the size of the material is important, it is of lesser importance than the chemical composition of the pumice, and that the most important property of this deposit is the physical characteristics of this particular deposit when compared to other pumice in the market-place from other deposits around the world.

Putting all of the special characteristics together makes this find an extremely uncommon and valuable deposit for us at Chem-Stone as a raw material used for our impregnation process that has been issued a patent by the United States Patent Office, granting rights to not only the process, but also to the product created by the process, which is: A ready-to-use material in the garment and fabric finishing industry.

Over the past two years, I have tried to use pumice stone from all over the world and we are constantly receiving calls from Guatemala, Ecuador, Mexico, Greece, Turkey, Iceland, Spain, California, Arizona, Utah, Wyoming, Washington, Colorado, and New Mexico.

2215 W. MOUNTAIN VIEW • PHOENIX, AZ 85021 • (800) 223-3155 • (602) 997-2013 • FAX (602) 870-1668

One gentleman from Santa Fe, New Mexico thought his material was so good, he shipped in two truckloads free for us to try. All we had to do was look at it and we sent it away, because it was too soft and the pores were too large, its size too small, and it had a clayish texture.

In all of the world, to our knowledge, there is only one active deposit that meets our standards to produce our product that will satisfy our customers and our requirements. That particular deposit just happens to be in the Flagstaff, AZ area and is being operated by Arizona Tufflite.

What makes their deposit and material so special is its size, its density, its chemical composition and probably the most important reason is its physical characteristics of a closely knit regiment of small chambers to encapsulate chemicals (or dye as the case may be) and allow the chemicals to be released onto the garment in a uniform and controllable fashion without being too abrasive to the garment while being abrasive enough during that particular formula run time.

This is a very delicately balanced system of controlled chemical concentration, moisture content (both on the part of the stone and the garment) size of machines, speed of machines, ratio of stone to garment, size of the stone, and rate of chemical release by the stone.

Our products are designed to last load after load after load until the stone actually disintegrates through continual wear.

Should the stone be too porous, it will allow the chemical or dye out too quickly causing spotting or blotting on the garment and the stone will run out of chemical or dye prematurely, creating an unhappy customer with a by-product of no use to anyone, thus also creating a disposal problem for the customer.

Therefore, as you can see, it is of great importance that the porosity of the stone is NOT TOO LARGE NOR TOO SMALL for our process. The claims have very acceptable porosity even comparable to portions of the Arizona Tufflite deposit.

Some of the mineral components may not be harmful for one of our processes, but they would end up in the final product or in the processing plant's waste water systems, causing problems there and while other components such as the clays and ashes do affect the garment's overall color and texture if they are used during processing, our customers would suffer severe losses through damaged goods by not being able to control the delicate balance during processing.

The material in question has been examined by Evergreen Analytical Lab Inc. and has acceptable and comparable quality to the Tufflite deposit in Flagstaff as noted by the attached comparison.

I have developed an idea, taken that idea through patent on into a business, and created a totally unique business that enjoys a reputation and customer list of excellence in the garment industry from the smallest of garment companies to the very largest of manufacturers, who use our products to create an unlimited number of distinctive and different "looks".

To maintain this progress and enjoy this leading position, we have created 20 different categories of products. We tailor these products to meet the customer's exact needs to be able to consistently produce the "look" that is desired on that particular garment.

The old term used in this industry was a "stone-washed" garment. We still use that term but we have turned the industry into an exact science that requires specifically designed materials and we require specifically acceptable raw materials. Our proposed site has just that type of material and it is not just any old "common" pumice.

Stone washing has been in the market-place since the early to mid-70's. From my own personal experience, 1978. The newer innovations that began in Europe in the early 80's is what is now called frosting. By any stretch of the imagination these processes will NOT go away, they will continue to evolve into a more refined process, tailoring garments to exact formulation and precisely designed "looks" that are attractively advertised and sold in the market-place, at sometimes, an alarming cost. The frosting process and resulting garments have carved their style or "look" into our economy, fashion, and sales records books, and have become another staple product from which to build upon with dye and accessories.

The contribution that Chem-Stone makes to the overall retail and environmental stability of the country is quite significant. For example, our finished products pose such a small degree of hazard that even the Department of Transportation for the State of Arizona has issued us a non-hazardous rating.

The Environmental Protection Agency has recommended Chem-Stone to garment finishers with potentially high levels of pollutants so that these levels may be reduced substantially and their business conducted safely.

Chem-Stone's affect on the retail economy could be considered national because we generate not only approximately 60 jobs locally, but our products sold during the month of June totalled over 1,000,000 pounds. Each pound will produce 5 pounds of garment, totalling 5,000,000 pounds. The average weight of a full size garment is approximately 1.7 pounds, thus equalling 2,941,176[~~pounds of~~] garments. It would be simple to say each of these garments retailed at $25 or more, thus totalling $73,529,411.75 in sales.

Common pumice is sold in the block and building trade for $12 to $15 per ton. I can show you invoice after invoice where we have paid $75 to $120 per yard and a yard only weighs from 640 lbs to 950 lbs depending upon its location and whether it is wet or dry.

Information received from Mr. Ken Phillips, Chief Engineer of the State of Arizona Department of Mines and Mineral Resources indicated that companies such as Cypress Copper Stone will process a ton (2,000 lbs.) of ore at a processing cost of approximately $33 per ton to yield about .09 troy oz. of gold for a retail value of about $45. This represents a 23,999.91 troy ounce byproduct or waste, and a .09 product for an approximate gross margin of 35%.

Along those same lines is the typical copper mining operation processing a ton of rock to come up with 10 lbs. of copper ore worth about $12.

The proposed sites would produce products used in our industry at a rate of approximately 1.25 yards per raw wet ton of material handled. A yard weighing approximately 800 lbs. semi-dry at the time of the sale to the customer, would be worth from $.12 per lb. or $96 per yard, to .572 per lb. or $457.60 per yard, depending upon the final product ordered. Keep in mind this is all the same stone with just chemicals added to it. All of the stone is used as an abrasive material, most are treated with chemicals to be used for frosting processes while abraiding the garment. Others are merely used in laundering processes to abraid and soften the garment.

Regular pricing for plain pumice in this industry runs from 12 cents per lb. to 22 cents per lb. depending upon its source and its special characteristics, and that's not delivered. Nor would these be of any value to us because they are lacking in one or more of the above mentioned qualities.

We have tried to use stone from Greece and Turkey which seemed to be comparable to the Tufflite quality but have side-affects that cause processing problems for our customers.

The Turkish stone has a specific gravity so light that they actually float in the tumblers, rendering the process uncontrollable.

The Greek stone is too porous and has too much clay, creating a slippery slimy mess and a paste-like coating on the garment - also rendering the process uncontrollable.

The Equadorian stone has pores that connect, allowing the chemical to deposit out too quickly, thus rendering the stone's release of the chemicals uncontrollable and the chemical is gone while the stone is only half used up. Also, it is so light that it does not wear evenly on the fabric during tumbling.

The Oregon pumice was used by us as a filler to try to cut our costs, but our customers complained, mainly because of its clay and ash content, but also because its porosity was too large, dropping out chemical too quickly.

These little episodes of trying other deposits of pumice are registered in our claims, returns and discounts because of bad raw material (pumice, not chemical) in the months of February, March and April of this year, returns and allowances totalled approximately $123,000.00) and the trucking from the eastern seaports is extremely costly and undependable.

These losses coupled with the need to reduce our cost to be more competitive with other products in our industry, and also to insure a consistent supply (it has happened that occasionally the stone from Tufflite is wet, dirty, laden with hard rock, or our demand increased so rapidly that Tufflite was unable to supply enough) forced us to unsuccessfully try these other deposits to meet our customer's demands.

Now it is time to get back to why we did not file a plan to explore through trenching and core drilling.

I was under the impression that these tests were for my benefit to determine if these deposits would be profitable. After extensive prospecting, I determined that trenching and core drilling was an unecessary expense and delay because of the area that is already exposed and displayed and because I am not relying solely upon the block pumice portion of these deposits to sustain my claim that this material is a locatable and valuable deposit.

The uncommonly high quality of the pumice was evident to me the first time I saw it and was proven through lab analysis and our own in-house testing.

I do not know where to direct you to find an authority on pumice for this unique and distinctive use in this industry for I am the inventor and the only producer of this product in the United States, Mexico, Canada, Europe and as far as we can tell, the world!

Most everyone else calls me. I am NOT telling you this to appear arrogant, but to merely inform you that authorities in this particular field are scarce.

Enclosed you will find analysts reports from Arizona Testing Lab and Evergreen Analytical Lab in Denver on various deposits including the proposed sites. Also enclosed is a copy of a letter from our patent attorney on our patent situations.

As additional proof of the differences of these pumice deposits, we have authorized Robert M. Hutchinson, Ph.D, Professor of Geology from the Department of Geological Engineering at the University of Mineral Resources in Golden, Colorado to perform a microscopic petrographic analysis on ten (10) specimens from around the world, including the deposits and the Arizona Tufflite material. When this information is completed I will forward the findings to you.

Sincerely,

David L. Bellaire, President
Chem-Stone, Inc.

DLB/bb

Enclosures

cc: Howard Twitty
A. Michael Bernstein
Harvey Smith
Joseph H. Roediger

APPENDIX 7

DEL TIERRA ENGINEERING & MINING CORP.

HARVEY W. SMITH, E.M. PRESIDENT

Registered Mining Engineer
U.S. Approved Title Abstracter

U.S. Mineral Surveyor
Registered Land Surveyor

4310 North Brown Avenue / Suite 3 Scottsdale, Arizona 85251
Tel. 602 / 946-3996

December 13, 1989

Ms. Robin Strathy
U. S. Forest Service
Arizona Zone Office
2324 E. McDowell
Phoenix, AZ 85006-2497

Dear Robin:

Enclosed is a copy of the report by Robert M. Hutchinson on the "Microscopic Analysis of Ten Rock Pumice Samples" exclusive of photographs. If you would like to view the latter, I shall be glad to make the necessary arrangements. However, I don't believe they are critical to our present problem.

Concerning the report, I believe the porosity of the samples is the most important and the Williams pumice has the smallest percentage. The remaining factors all seem very similar.

If you have any questions, please call.

Sincerely,

Harvey W. Smith, E.M.
President

HM/hm
Enclosure

MICROSCOPIC ANALYSIS OF TEN ROCK PUMICE SAMPLES

For

DAVID L. BELLAIRE, PRESIDENT
CHEM-STONE, INC.
2215 WEST MOUNTAIN VIEW
PHOENIX, ARIZONA 85021

By

Dr. Robert M. Hutchinson
Consulting Geologist
CPG 326

November 9, 1989

Robert M. Hutchinson
November 17, 1989

CONTENTS

ILLUSTRATIONS

EXECUTIVE STATEMENT

(TO BE COMPLETED AFTER DETERMINATION OF THE SPECIFIC GRAVITY AND DENSITY OF THE TEN PUMICE ROCK SAMPLES)

PREPARATION OF MATERIAL

Ten pumice rock samples were cut and trimmed to 22 x 44 mm with a diamond rock saw and 40 microscopic thin sections ground to a thickness of 30 microns (0.03 mm). Four thin sections were made for each type of rock pumice sample. Two of the thin sections were not stained and two were stained with Orasol Blue Green Dye in order to emphasize the pore spaces (vesicles) throughout the rock sample. In order to carry out the index of refraction measurements of the glass, pieces of the volcanic glass were scraped off each rock sample with a sharp pointed disecting needle. These broken grains varied from0.03 to 0.23 mm average size and were very angular.

METHOD OF ANALYSIS

Index of Refraction measurements were made in white polarized light using the petrographic microscope and a series of immersion oils with indices of refraction ranging from 1.498 to 1.510. These measurements and the Index of Refraction determinations are given in Table 1.

Microscopic analysis of the rock pumice thin sections was made also using plane polarized white light and five different micro-scopic lens objectives of magnifications 1X, 2.5X, 3.2X, 5.6X, and 10X. The eyepiece (ocular) had a magnification of 10X.

With the microscopic analysis it was possible to (1) identify the components of each rock, i.e., volcanic glass, crystals of different minerals, pore spaces (vesicles), chemical alteration of the glass and/or the crystals, (2) estimate the proximate volume per cent porosity of each rock sample, (3) identify and describe the internal fabric, structural arrangement, shape and orientation of both crystals and pore spaces, (4) classify each of the rock samples in terms of volume percentage ratios of crystals to volcanic glass to pore spaces (See Tables 2 and 4). A photographic record has been made for each of the ten rock pumice samples (See text Figures 1 - 21).

Specific Gravity and Density measurements are currently in process. Equipment being used is (1)the Spring or Jolly Balance for Specific Gravity as well as the Beam Balance. Density will be calculated from the Specific Gravity measurements on each rock sample (See Table 3). It is to be expected, of course, that Pumice Rock from Williams Site B, Williams Site A, and Tufflite will have a somewhat greater density value than the other seven samples. Amounts of broken crystals in the volcanic glass as well as lower porosity values should increase density of the rock. This would be true especially for Williams Sites B and A samples.

SIGNIFICANCE OF INDEX OF REFRACTION MEASUREMENTS

There is a systematic relationship between the amount of the Index of Refraction and the weight per cent of the silica (SiO_2) that makes up the volcanic glass for that particular index of refraction or range of indices of refraction (See Fig. 7-9). As mentioned previously the indices of refraction for the ten rock samples ranged from 1.498 to 1.510 (See Table 1). Referring to the variation graph shown in Fig. 7-9 the content weight per cent of the silica for each rock sample has been obtained.

Silica content for the volcanic glass of the ten rock samples ranges from 69 wt. % up to 71.5 wt. %. This is visibly a very narrow and restricted range indicating that all ten rock samples are derived from similar lava type or types.

All volcanic glasses derive from silicate melts and may vary in composition over the range of the common igneous rocks (silica ranges from about 40 to over 77 percent), excluding the ultramafic types. Only from chemical analysis or refractive index determinations can we equate a glass to its crystalline analog and designate it as a rhyolite glass, andesitic glass, basaltic glass, and so on. A given volcanic rock may be entirely glass, glass with crystallites, glass with broken or perfect crystals (phenocrysts) or largelly crystalline, with only minor glass filling interstices. Most rocks that are largely glass are rhyolitic. And this is the case with the ten samples herein analyzed. They are all rhyolitic glass.

Characteristic and typical index of refraction values for the different rock glass types are as follows:

Rhyolitic glass	1.49
Trachytic glass	1.51
Andesitic glass	1.52
Leucite tephrite glass	1.55
Basaltic glass	1.60

SIGNIFICANCE OF MICROSCOPIC ANALYSIS OF THIN SECTIONS

All shown in Table 4 all ten rock samples have been classified as PUMICE and have the proper characteristics. Pumice is properly defined and must have the following features and properties:

PUMICE - A rock-froth which forms crusts on more compact lava or occurs in the form of volcanic ejectamenta. It is glass so filled with air bubbles that the pore space maybe much greater than the glassy material. Usually, the bubbles are drawn out in parallel or wavy lines, which bend around the rare broken crystals and phenocrysts. Microlites and crystallites are common. The word is very old. It is mentioned by Pliny, but the was known long before and was mentioned by Theophrastis.

The following comments and observations can be made from the microscopic examination and analysis of the samples:

(1) Williams Site B rock has more or less circular pore spaces and is non-compacted. Proximate porosity is 40-50% (See Figs 1, 2, 3).

(2) Williams Site A rock shows moderate compaction with pores elongate to subcircular. Proximate pore porosity is 40-50% (See Figs. 4,5).

(3) Tufflite shows pore spaces with moderate compression with pore spaces 45-55% (See Figs. 6-7).

(4) Oregon, Cascade Province rock has strong compaction layering with hollow tube-like pore spaces and some suboptical extremely microscopic-sized dusty material (clay?). Porosity is 65-70% (See Figs 8,9).

(5) Greek Type "H" shows extreme compaction along with tubular openings which seem to be partly interconnected. Pores are 60-65% (See Figs. 10,11).

(6) Equadorian Type "F" has strong compaction and flow lines with hollow tubular pore spaces varyingly connected. Pore spaces are 70% (See Figs. 12,13).

(7) Greek Type "B" has 65-75% pore spaces and similar to Williams Site B rock the openings are not compressed and are somewhat connected. Combination of the high porosity and the sub-optical dust-like material lowers the quality of the rock (See Figs. 14,15).

(8) Turkish Type "D" has moderate compaction with large oval to crudely circular pore spaces. Porosity varies 60-70% (See Figs. 16,17).

(9) Both Mexico ASW-White and Mexico ASG-Gray have very high porosity of 75-80% and moderate to moderately strong compaction. (See Figs 18,19 and Figs. 20.21, respectively)

TABLE 1 - INDEX OF REFRACTION AND WEIGHT PER CENT OF SiO_2 OF THE PUMICE ROCK SAMPLES.

SAMPLE IDENTIFICATION	INDEX OF REFRACTION	WT. % SiO_2
WILLIAMS SITE B	1.502 - 1.506	69-70
WILLIAMS SITE A	1.498	71.5
TUFFLITE	1.498 - 1.502	70 - 71.5
OREGON, CASCADE PROVINCE	1.502	70
GREEK TYPE "H"	1.498	71.5
EQUADORIAN TYPE "F"	1.498 - 1.502	70 - 71.5
GREEK TYPE "B"	1.502	70
TURKISH TYPE "D"	1.498 - 1.502	70 - 71.5
MEXICO ASW - WHITE	1.500 - 1.502	70 - 71
MEXICO ASG - GRAY	1.502	70

APPENDIX 8

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INORGANIC ANALYSIS DATA SHEET

Client Sergent, Hauskins & Beckwith Client Project # ---

Lab Project # 5012 con't Date of Analysis June 23, 1989

Basis: As Received

Client Sample #	Williams SITE A	SITE B	SITE C	SANTA FE	TUFF-LIGHT	MEXICO
	Unit %	Unit%	Unit %	Unit %	Unit %	Unit %
Manganese	.063	.060	.0625	.03	.02	.02
Iron	2.6	2.6	2.2	1.0	2.0	1.0
Calcium	1.0	1.3	1.6	1.0	.05	.02
Sodium	1.4	1.3	1.3	>1.0	>1.0	>1.0
Potassium	2.4	2.4	2.1	1.0	1.0	1.0
Vanadium (F)	.0014	.0016	.0024	.003	.003	.003
Boron (2)	.01	.01	.01	.002	.005	---

(F) Furnace atomic absorption determination.
(1) Values are milligram/Kilogram except where noted.
(2) Analysis performed by Hazen Research, Inc., Golden, CO.

Approved

Quality Assurance Officer

Respectfully submitted,

ARIZONA TESTING LABORATORIES

Claude E. McLean, Jr.

Evergreen Analytical, Inc.

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INORGANIC ANALYSIS DATA SHEET

Client Sergent, Hauskins & Beckwith Client Project # ---

Lab Project # 5012 Date of Analysis June 23, 1989

Basis: As Received

Client Sample #	Williams SITE A	SITE B	SITE C	SANTA FE	TUFF-LIGHT	MEXICO
	THESE ARE EVERGREEN ANALYTICAL, INC. RESULTS			THESE ARE ARIZONA TESTING LABS RESULTS		
	Unit %	Unit %	Unit %	Unit %	Unit %	Unit %
Antimony (F)	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Arsenic (F)	.039	.042	.050	<.50	<.50	<.50
Beryllium	.0002	.00024	.00024	.0005	<.0005	<.0005
Cadmium	<.00005	<.00005	<.00005	<.00005	<.00005	<.00005
Chromium	.0009	.0007	.0008	<.0009	<.0009	<.0009
Copper	.0011	.0014	.0012	.001	.003	.001
Lead	<.002	<.002	<.002	<.002	<.002	<.002
Mercury	<.000002	<.000002	<.000002	<.000002	<.000002	<.000002
Nickel	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
Selenium (F)	<.005	<.005	<.005	<.005	<.005	<.005
Silver	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Thallium (F)	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Zinc	.0023	.0026	.0020	<.0026	<.0026	<.0026
Silicon	31	30	25	<31	<31	<31
Aluminum	5.6	5.8	5.4	8.	9.	10.
Magnesium	.5	.52	.63	.2	.04	.02

(*) Values are milligram/Kilogram except where noted.
(*) Interference in the Selenium determination (most likely Iron) forced dilution and the higher than [illegible] limits.

APPENDIX 9

TABLE 2. COMPLETE ANALYSES OF OXIDES IN WEIGHT PERCENT, SOUTHWEST MAP AREA

Sample No.	SiO_2	Al_2O_3	Fe_2O_3	FeO[1]	MgO	CaO	Na_2O[2]	K_2O[2]	H_2O[3]	TiO_2	P_2O_5[2]	MnO[3]	CO_2[3]	Total	Lab. No.	Analysts[4]
0301	46.34	17.83	11.78	0.00	7.45	10.43	3.07	0.86	0.00	1.26	0.39	0.16	0.00	99.57	M136987	LE
0305	47.13	14.87	10.99	0.00	11.11	10.13	2.69	0.84	0.00	1.46	0.31	0.16	0.00	99.69	M138255	JC
1101	45.14	16.94	13.11	0.00	7.61	10.59	3.28	1.11	0.00	2.44	0.69	0.00	0.00	100.91	M131510	LE
1101A	52.23	17.59	9.90	0.00	3.96	7.02	4.39	1.87	0.00	1.65	0.78	0.00	0.00	99.39	M131511	LE
1101B	47.93	17.60	11.44	0.00	5.76	9.71	3.73	1.46	0.00	1.70	0.70	0.00	0.00	100.03	M131512	LE
1102	45.42	16.80	12.80	0.00	7.08	10.48	3.10	1.15	0.00	2.42	0.69	0.19	0.00	100.13	M138224	SK
1103	53.30	14.29	8.02	0.00	7.11	7.89	3.32	2.01	0.00	1.21	0.52	0.15	0.00	97.82	M138223	SK
1104	47.57	16.69	12.04	0.00	7.09	8.34	3.59	1.25	0.00	2.43	0.53	0.17	0.00	99.70	M138230	SK
1105	49.84	16.88	10.51	0.00	6.04	8.59	3.64	1.34	0.00	1.82	0.58	0.15	0.00	99.39	M138231	SK
1110	47.45	17.24	8.31	2.71	5.11	9.71	3.36	1.26	1.37	1.78	0.72	0.17	1.10	100.29	M129291	HE,LE,JT
1110A	54.88	15.16	7.84	0.00	4.97	8.15	3.58	2.11	0.00	1.20	0.53	0.14	0.00	98.56	M138222	SK
1110B	48.83	17.97	11.66	0.00	5.65	9.22	2.89	1.39	0.00	1.76	0.71	0.18	0.00	100.26	M138280	JC
1111	48.57	17.68	11.56	0.00	4.94	9.34	3.22	1.43	0.00	1.72	0.73	0.16	0.00	99.35	M138281	JC
1122	59.51	17.28	5.50	1.40	1.02	3.90	5.79	2.40	0.95	1.04	0.70	0.13	0.12	99.74	M129289	HE,LE,JT
1123	46.80	16.38	12.00	0.00	7.71	11.15	3.10	1.10	0.00	1.90	0.61	0.00	0.00	100.75	M131484	LE
1123A	47.65	17.15	11.87	0.00	5.59	10.92	3.36	1.42	0.00	1.64	0.69	0.00	0.00	100.29	M131485	LE
1135	45.60	15.80	3.80	6.83	7.41	11.95	3.05	1.20	0.57	1.62	0.82	0.19	0.26	99.10	M129290	HE,LE,JT
1136	45.78	14.41	11.68	0.00	9.33	14.12	2.06	0.56	0.00	1.22	0.70	0.00	0.00	99.86	M131499	LE
1136A	49.55	16.61	11.31	0.00	6.24	8.41	3.75	1.42	0.00	1.99	0.60	0.00	0.00	99.88	M131500	LE
1201	45.15	17.33	11.06	0.00	6.72	12.24	2.37	1.26	0.00	1.79	0.66	0.18	0.00	98.76	M137102	GK
1202	63.43	15.77	4.07	0.00	1.33	3.58	4.04	2.85	0.00	0.64	0.46	0.08	0.00	96.25	M137104	GK
1203	63.99	14.73	1.46	2.44	1.82	3.72	3.79	2.95	4.00	0.66	0.15	0.08	0.04	99.83	M129294	HE,LE,JT
1203A	65.57	15.50	1.81	2.09	1.33	3.34	4.29	3.30	1.63	0.67	0.18	0.08	0.03	99.82	M129327	HE,LE,JT
1204	57.55	16.83	3.72	4.48	1.97	5.10	5.09	2.05	1.06	1.35	0.57	0.14	0.06	99.97	M129286	HE,LE,JT
1206	60.67	17.08	3.38	2.37	1.86	4.46	4.24	2.48	1.76	0.93	0.33	0.11	0.06	99.73	M129283	HE,LE,JT
1207	53.97	16.00	4.56	3.63	6.36	7.47	4.38	1.23	1.34	1.46	0.10	0.00	0.00	100.50	R21	RM
1208	64.64	15.66	1.83	2.45	1.60	3.63	4.10	3.01	2.05	0.76	0.20	0.09	0.07	100.09	M129301	HE,LE,JT
1209	62.74	16.69	2.64	1.73	1.39	4.14	4.18	2.72	2.06	0.75	0.21	0.09	0.67	100.01	M129292	HE,LE,JT
1209A	63.20	16.58	1.89	2.60	1.68	4.08	4.22	2.92	1.22	0.88	0.19	0.09	0.28	99.83	M129293	HE,LE,JT
1209B	64.17	16.37	2.86	1.60	1.44	4.08	4.45	2.58	1.28	0.75	0.22	0.08	0.14	100.02	M129298	HE,LE,JT
1209C	46.50	17.49	3.93	5.86	5.38	10.55	3.20	1.25	1.83	1.77	0.62	0.17	2.08	100.63	M129302	HE,LE,JT
1212	45.78	18.11	10.93	0.00	6.96	11.02	3.00	1.08	0.00	1.86	0.51	0.17	0.00	99.42	M137103	GK
1215	48.75	17.34	10.41	0.00	4.96	8.97	3.94	1.63	0.00	1.69	0.51	0.00	0.00	98.20	M131489	LE
1215A	45.23	17.01	11.59	0.00	7.84	12.94	2.80	0.75	0.00	1.66	0.71	0.00	0.00	100.53	M131492	LE

TABLE 2. COMPLETE ANALYSES OF OXIDES IN WEIGHT PERCENT, SOUTHWEST MAP AREA--Continued

Sample No.	SiO_2	Al_2O_3	Fe_2O_3	FeO[1]	MgO	CaO	Na_2O[2]	K_2O[2]	H_2O[3]	TiO_2	P_2O_5[2]	MnO[3]	CO_2[3]	Total	Lab. No.	Analysts[4]
1215B	68.97	16.97	2.19	0.03	0.49	3.38	5.55	1.27	0.51	0.27	0.06	0.03	0.08	99.80	M131382	MV,SN
1215C	47.83	15.22	4.68	5.67	7.73	11.17	3.00	0.88	1.43	1.66	0.40	0.16	0.10	99.93	M131383	MV,SN
1215D	41.19	5.72	17.09	0.00	28.79	6.33	0.64	0.01	0.00	0.59	0.03	0.18	0.00	100.57	M133119	LE
1215E	41.25	8.30	17.20	0.00	17.81	8.29	1.21	0.10	0.00	1.27	0.02	0.19	0.00	95.64	M133120	LE
1215F	45.33	7.20	11.93	0.00	13.97	15.73	1.12	0.03	0.00	1.19	0.00	0.27	0.00	96.77	M133121	LE
1215G	47.69	5.85	7.38	0.00	15.94	18.70	0.86	0.05	0.00	0.74	0.08	0.16	0.00	97.45	M133122	LE
1216	43.89	13.74	1.99	8.62	8.87	14.69	2.29	0.45	1.48	1.51	0.67	0.19	1.54	99.93	M129297	HE,LE,JT
1216A	44.80	14.95	11.42	0.00	10.47	13.30	2.79	1.08	0.00	1.45	0.86	0.00	0.00	101.12	M131493	LE
1216B	45.00	13.70	11.60	0.00	9.34	15.60	2.06	0.44	0.54	1.52	0.69	0.22	0.00	100.71	D235644	JW,JTG,JB
1217	64.48	16.34	3.16	1.31	1.55	3.88	4.65	2.68	0.70	0.83	0.17	0.08	0.10	99.93	M129299	HE,LE,JT
1217A	63.33	16.08	1.80	2.17	1.49	3.63	4.44	2.72	3.08	0.70	0.17	0.08	0.07	99.76	M129300	HE,LE,JT
1217B	65.90	15.80	2.80	1.47	1.60	3.90	4.20	2.60	0.90	0.69	0.20	0.06	0.02	100.14	W188075	LA
1217C	66.50	15.40	3.50	0.52	1.30	3.20	4.30	2.90	0.72	0.69	0.17	0.06	0.01	99.27	W188081	LA
1218	65.99	16.14	2.28	1.84	1.47	3.57	4.73	2.90	0.82	0.68	0.15	0.00	0.00	100.57	R12	HR
1218B	64.93	15.59	2.20	1.84	1.51	3.86	4.36	2.83	1.52	0.73	0.17	0.08	0.09	99.71	M129284	HE,LE,JT
1218C	55.54	12.40	3.38	4.76	6.88	7.76	3.34	2.73	0.84	1.62	0.40	0.13	0.09	99.87	M131434	MV,BK,PK
1218D	69.69	13.62	3.11	0.00	0.83	1.98	3.99	3.95	0.00	0.47	0.12	0.08	0.00	97.84	M131529	MV,BK
1218E	70.60	13.86	2.88	0.00	0.73	1.91	3.94	4.28	0.00	0.41	0.12	0.08	0.00	98.81	M131530	MV,BK
1218F	48.15	16.76	11.36	0.00	6.38	10.28	3.35	0.98	0.00	1.71	0.39	0.17	0.00	99.53	M131528	MV,BK
1220	64.63	15.85	2.84	1.34	1.64	3.78	3.95	3.26	1.76	0.70	0.17	0.08	0.05	100.05	M129287	HE,LE,JT
1221	65.71	15.22	2.02	1.77	1.51	3.57	4.33	2.87	1.60	0.66	0.15	0.08	0.17	99.66	M129295	HE,LE,JT
1221A	41.83	2.59	2.03	1.89	30.47	6.54	0.50	0.05	0.00	0.48	0.02	0.18	0.05	97.19	M129296	HE,LE,JT
1221B	52.40	18.66	10.28	0.00	4.67	7.66	3.89	1.18	0.00	1.61	0.28	0.00	0.00	100.63	M131486	LE
1221C	49.17	16.91	11.16	0.00	7.06	10.85	3.29	1.10	0.00	1.58	0.43	0.00	0.00	101.55	M131494	LE
1222	46.90	15.90	11.70	0.00	8.94	11.20	2.83	0.88	0.00	1.97	0.41	0.18	0.00	100.91	D235645	JW,JTG,JB
1223	51.80	18.00	10.55	0.00	2.84	5.96	4.75	1.73	0.00	1.93	0.65	0.15	0.00	98.36	M137109	GK
1224	52.94	15.02	9.53	0.00	6.17	8.17	3.56	1.64	0.00	1.63	0.44	0.00	0.00	99.10	M131498	LE
1224A	53.77	18.05	9.91	0.00	2.75	5.98	4.80	1.76	0.00	1.78	0.73	0.14	0.00	99.67	M137080	LE
1226	50.38	16.68	9.35	0.00	6.43	10.11	3.62	1.67	0.00	1.63	0.46	0.00	0.00	100.33	M131505	LE
1226A	50.20	17.38	11.66	0.00	6.23	8.42	3.93	1.04	0.00	1.82	0.45	0.00	0.00	101.13	M131506	LE
1227	52.59	16.00	9.46	0.00	5.32	9.18	3.77	2.08	0.00	1.44	0.61	0.00	0.00	100.45	M131495	LE
1227A	49.73	17.28	11.18	0.00	5.31	8.46	3.73	1.58	0.00	2.01	0.57	0.00	0.00	99.85	M131496	LE
1227B	46.61	16.45	11.78	0.00	8.72	11.71	2.92	0.79	0.00	1.90	0.36	0.00	0.00	101.24	M131507	LE
1229	52.86	18.91	9.97	0.00	4.91	7.91	3.86	1.20	0.00	1.56	0.28	0.00	0.00	101.46	M131508	LE

APPENDIX 10

PUMICE PHYSICAL PROPERTIES AND THE BILL WILLIAMS MOUNTAINS AND COPAR PUMICES

By

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915/755-3268

January 26, 1990

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INTRODUCTION

The physical properties of the pumices tested from Bill Williams Mountain, Arizona and Copar, New Mexico are compared to pumices tested from the U.S. (California, New Mexico, Arizona), Mexico, Guatemala, Ecuador, Indonesia, and Turkey. The results are shown below.

SURFACE FINES

Surface fines from 103 tested pumices range from 0.1 to 19.8%; the average is 4.3%. The Bill Williams and Copar samples contain very small amounts of fines averaging only 0.8 (BWM), 0.3 (BWM-MP),and 0.5 (Copar) (see Fig. 1).

ABRASION LOSS

The loss of weight, during 30 minutes of tumbling, for 50 pumice samples, is given in Table 1. Abrasion losses range from 1.4 to 9.0%, the average value is 4.6%. The Bill Williams Mountain pumices occur at the lower end of the group (2.0 and 2.6%). The softer Copar pumice shows a loss of 6.5% (Table 1).

HARDNESS

Hardness can be defined as the relative resistance of a substance to scratching, denting, or penetration. The hardness values reported in this study represent penetration depth of a steel blade on the surface of the pumice. The larger the penetration depth (in mm's), the softer the pumice.

FIG. 1 PUMICE SURFACE FINES (101 Samples)

Range = 0.1 to 19.8%; Average = 4.3%

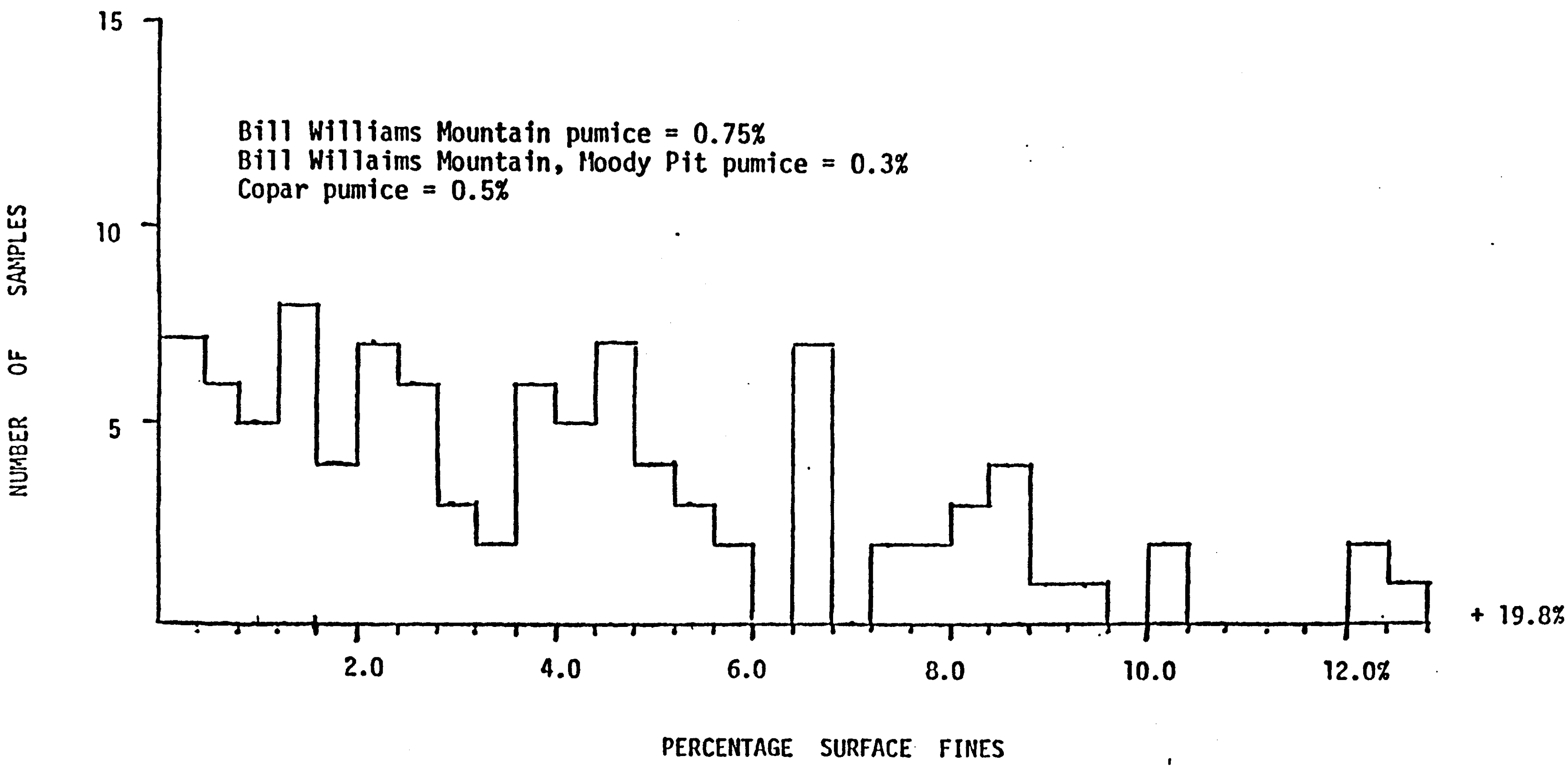

Table 1. Pumice Abrasion Loss

Pumice	Samples	Range (% Loss)	Average (% Loss)
California A	6	0.8-2.0	1.4
Indonesia	3	1.4-1.8	1.6
BWM-MP	1	---	2.0
Guatemala	2	1.1-2.3	2.0
New Mexico	2	2.1-2.7	2.4
Turkey	5	1.5-3.3	2.5
Mexico A	5	2.3-2.9	2.6
BWM	2	1.9-3.3	2.6
Mexico B	7	2.6-6.2	4.2
Ecuador A	8	2.4-6.6	4.4
Copar	1	---	6.5
Ecuador B	3	5.0-10.9	7.2
California B	7	5.3-11.9	8.7
Ecuador C	3	5.3-13.2	9.0
	50		Ave. = 4.6

All three samples tested are hard to moderately hard (BWN = 1.1, hard; Copar = 1.2, hard; and Copar = 1.4, moderately hard) (Table 2).

DENSITY

The true density of pumice is about 2.5 g/cm^3; but because of its cellular structure, it has an apparent density of less than 1.0 g/cm^3.

The BWM pumice has the highest density tested, 0.92 g/cm^3, BWM-MP the lowest, 0.58 g/cm^3, and Copar is about average at 0.75 g/cm^3 (Table 3).

Table 2. Pumice Hardness
(penetration in mm)

Pumice	Samples	Range (mm)	Average (mm)
Turkey	5	0.7-1.0	1.6
Mexico A	11	0.6-1.0	1.0
New Mexico	6	0.8-1.5	1.0
California A	6	0.9-1.2	1.1
BWM	2	1.0-1.1	1.1
Arizona	3	0.9-1.3	1.1
Copar	1	---	1.2
BWM-MP	1	---	1.4
Mexico B	4	1.3-1.8	1.6
Guatemala	2	1.5-1.6	1.6
Indonesia	3	1.4-1.8	1.6
Ecuador A	16	0.9-2.7	1.7
California B	20	0.7-2.7	2.0
Mexico C	8	1.4-2.7	2.0
Ecuador C	2	2.4-2.7	2.6
	94		Ave. = 1.6

EFFECTIVE POROSITY AND POROSITY

The porosity is defined as the volume of voids in a rock divided by the total volume. Porosity is determined by measuring the vesicle density from a rock section. The effective porosity is measured by the increase in pumice weight from absorption by a pumice fragment submerged in water for a period of five months (Table 4). The Copar and BWM-MP samples are a little above average in porosity, i.e. 27 and 28%, respectively, whereas the BWM pumice has a low porosity value of 14% (Table 5). The effective porosity of the three samples display similar results (Table 4).

Table 3. Pumice Density

Pumice	Samples	Range (g/cm^3)	Average (g/cm^3)
BWM-MP	2	0.57-0.58	0.58
Mexico A	8	0.40-0.68	0.61
Indonesia	3	0.64-0.67	0.65
Ecuador A	119	0.40-1.14	0.66
Guatemala A	7	0.50-0.86	0.66
California A	24	0.52-1.07	0.72
Ecuador B	14	0.39-0.76	0.73
Arizona	5	0.72-0.77	0.74
Copar	2	0.73-0.77	0.75
California B	8	0.46-1.02	0.75
Ecuador C	11	0.56-1.14	0.76
Turkey	5	0.73-0.89	0.80
Guatemala B	3	0.78-0.83	0.81
New Mexico	7	0.67-1.04	0.81
Mexico B	21	0.60-1.13	0.84
Mexico C	2	0.85-0.88	0.87
BWM	5	0.66-1.07	0.92
	246	0.39-1.14	Ave. = 0.70

IMPREGNATION RATE

The rate of fluid absorption by a pumice fragment is defined as the impregnation rate. Measured impregnation rates, for five minute intervals, range from 0.6 to 11.3% weight increase per minute. The BWMsample shows the lowest valued measured, 2.3, whereas the Copar and BWM-MP samples are somewhat above average at 4.5 of 4.7, respectively (Table 6).

Table 4. Pumice Effective Porosity

Pumice	Samples	Range (%)	Average (%)
Mexico A	24	5-21	11
BWM	5	8-17	12
Turkey	7	9-24	13
California A	10	10-33	13
Arizona	3	10-21	14
California B	27	1-50	14
Mexico B	4	10-20	15
Guatemala A	3	14-19	16
Copar	2	15-29	22
BWM-MP	2	18-28	23
Guatemala B	9	18-43	24
Indonesia	3	21-33	25
Mexico C	8	15-35	25
Ecuador A	113	8-56	27
New Mexico	7	17-37	27
Ecuador B	14	16-38	30
Ecuador C	9	15-52	35
	250	1-56	Ave. =23

Table 5. Pumice Porosity and Vesicle Size

California B	Samples	Vesicle (mm)	Range (%)	Average (%)
Mexico A	2	0.27	6-14	10
BWM	2	0.30	9-18	14
Arizona	1	0.15	---	15
California A	13	0.23	4-27	16
Turkey	1	0.20	---	16
Mexico B	5	0.19	5-24	16
Guatemala	3	0.30	15-19	17
California B	5	0.22	14-28	21
Ecuador A	2	0.35	16-32	24
Ecuador B	2	0.45	21-29	25
Copar	2	0.40	22-31	27
BWM-MP	2	0.20	27-29	28
New Mexico	4	0.40	26-34	30
Indonesia	3	0.50	28-33	31
Mexico C	4	0.50	21-48	38
	60	0.15-0.50	4-48	Ave. = 24

Table 6. Pumice Impregnation Rate
(% wt. Increase/min for 5 minutes)

Pumice	Samples	Range (% wt./min.)	Average (% wt./min.)
BWM	5	1.6-3.5	2.3
Mexico A	45	0.7-4.2	2.4
California A	36	0.8-6.2	2.5
California B	10	0.6-5.5	2.6
Mexico B	4	2.0-3.0	2.6
Arizona	5	2.8-4.3	3.0
Turkey	5	1.6-4.7	3.2
Guatemala	3	2.7-3.8	3.2
Copar	2	3.1-5.9	4.5
BWM-MP	2	3.7-5.6	4.7
Mexico C	11	1.9-7.0	4.7
Indonesia	3	4.1-6.7	5.0
New Mexico	7	3.4-7.5	5.3
Ecuador A	38	2.2-11.3	6.3
Ecuador B	8	4.7-7.5	6.5
Ecuador C	4	5.9-7.5	6.8
	188	0.6-11.3	Ave. = 3.9

SUMMARY OF PHYSICAL PROPERTY

In order to determine the uniqueness of the Bill Williams-Copar pumices, based upon physical properties, pumices from all occurrences were ranked according to density, hardness, abrasion loss, effective porosity, and impregnation rate values (1 = most desireable, 15 = least desireable). A final value was thus calculated by averaging the rankings of all the above properties. The overall rankings in Table 7 do not necessarily represent the "best" pumice, because there is no "best" pumice, one that produces all the styles desired in acid and stone washing. The rankings were merely calculated to determine if any of the pumices "stand apart from the group" or are unique, based upon their physical properties.

TABLE7. Summary of Pumice Physical Properties (1 = most desireable; 15 = least desireable; * = no abrasion loss data available)

Pumice	Total Points	Average	Rank
Indonesia	20	4.0	1
Ecuador A	24	4.8	2
BWM-MP	26	5.2	3
Ecuador B	26	5.2	3
Guatemala	28	5.6	5
Ecuador C	28	5.6	5
New Mexico	37	7.4	7
California A	45	9.0	8
Copar	46	9.2	9
California B	48	9.6	10
Arizona	41*	10.3	11
Mexico B	52	10.4	12
Mexico A	53	10.6	13
Turkey	55	11.0	14
BWM	66	13.2	15

CONCLUSIONS

The Bill Williams Mountain pumice ranks last compared to other tested samples. Its very high density (most samples do not float in water), high hardness, and low porosity make it appear undesirable for jeans washing. It could be considered unique, but uniquely poor.

The Copar pumice is not unique but is in the average category compared to other tested pumice. Its high abrasion loss during tumbling is a major negative factor.

The most promising pumice for jeans washing is the pumice from the Moody pit at Bill Williams Mountain. While it is not unique among pumices, it ranks high based upon its low density, moderate porosity, and low abrasion loss.

Finally, it should be pointed out that my conclusions are based only on the samples that I have tested. It is assumed that they are representative of each individual deposit.

January 26, 1990

To: U.S. Department of Agriculture
Forest Service, Arizona Zone
2324 E. McDowell Road
Phoenix, Arizona 85006
ATTN: Robin Strathy

Re: Physical Properties of Bill Williams Mountain and Copar Pumices, i.e. Bill Williams Mountain -2026 (BWM-2026), Bill Williams Mountain - 2029 (BWM-2029), Bill Williams Mountain, Moody Pit (BWM-MP), and Copar (C)

I. Surface Fines (%):
a. BWM-2026 = 0.1 c. BWM-MP = 0.3
b. BWM-2029 = 1.4 d. C = 0.5

II. Abrasion Loss (%):
a. BWM-2026 = 3.3 c. BWM-MP = 2.0
b. BWM-2029 = 1.9 d. C = 6.5

III. Hardness (mm):
a. BWM-2026 = 1.0 c. BWM-MP = 1.4
b. BWM-2029 = 1.1 d. C = 1.2

IV. Density (g/cm^3):
a. BWM-2026 = 0.98 c. BWM-MP = 0.58
b. BWM-2029 = 0.88 d. C = 0.75

V. Effective Porosity (%):
a. BWM-2026 = 11.1 c. BWM-MP = 23.1
b. BWM-2029 = 12.6 d. C = 22.3

VI. Porosity (%):
a. BWM-2026 = 9 c. BWM-MP = 28
b. BWM-2029 = 1.8 d. C = 27

VII. Impregnation Rate (g/min.):
a. BWM-2026 = 2.1 c. BWM-MP = 4.7
b. BWM-2029 = 2.5 d. C = 4.5

VIII. Vesicle Size (mm):
a. BWM-2026 = 0.3 c. BWM-MP = 0.2
b. BWM-2029 = 0.3' d. C = 0.4

IX. Surface Coloration
a. BWM-2026 = light to medium gray with black mafic and feldspar crystals; 2-5% iron oxides
b. BWM-2029 = medium gray with 5-10% black mafic and feldspar crystals
c. BWM-MP = white to light gray; up to 2% iron oxide stain
d. C = light tan, 3-4% small black mafic crystals

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August 22, 1989

CLASSIFICATION OF PUMICE FOR CLOTH WASHING BASED UPON PHYSICAL PROPERTIES

I. Surface Fines:

- A. Excellent = < 1.7%
- B. Acceptable = 1.8 - 2.9%
- C. Poor = > 3.0%

II. Abrasion (loss of weight from tumbling for 30 minutes):

- A. High = < 2.0%
- B. Medium = 2.0 - 5.0%
- C. Low = > 5.0%

III. Hardness (penetration, mm):

- A. Hard = < 1.0
- B. Med. Hard = 1.0 - 1.4
- C. Medium = 1.5 - 1.7
- D. Med. Soft = 1.8 - 2.0
- E. Soft = > 2.0

IV. Density (g/cm^3):

- A. Very High = > 1.0
- B. High = 0.85 - 1.00
- C. Medium = 0.60 - 0.84
- D. Low = 0.40 - 0.59
- E. Very Low = < 0.39

V. Effective Porosity (immersion in water, 5 minutes):

- A. Low = < 15%
- B. Average = 15 - 25%
- C. High = > 25%

VI. Porosity (percentage of connected vesicles):

A. Low = < 10%
B. Moderate = 11 - 20%
C. High = > 20%

VII. Impregnation Rate (percent fluid weight absorbed per minute):

A. Slow = < 2.0%
B. Moderate = 2.0 - 3.5%
C. Rapid = 3.6 - 5.5%
D. Very Rapid= > 5.5%

VIII. Vesicle Size:

A. Small(low permeability) = < 0.2mm
B. Moderate = 0.2 - 0.6mm
C. Large(hi permeability) = > 0.6mm

IX. Surface Coloration:

A. Poor = greater than 5% iron oxide stain
B. Acceptable = 2 - 5% iron oxide stain
C. Good = less than 2% iron oxide stain

APPENDIX 11

UNITED STATES
v.
PAUL M. THOMAS ET AL.

IBLA 70-46 Decided JAN 12 1971

Mining Claims: Common Varieties of Minerals: Generally--Mining Claims: Discovery: Marketability

To satisfy the requirements for discovery on a placer mining claim located for a common variety of pumiceous material before July 23, 1955, it must be shown that the exposed material could have been removed and marketed at a profit on that date, as well as at the present time; where such a showing is not made, the claim is properly declared null and void.

Mining Claims: Common Varieties of Minerals: Marketability

Where it appears that some material was removed from a mining claim and marketed prior to July 23, 1955, but it also appears that the market for such material terminated before that date, and where there is no positive evidence of the removal thereafter of any significant quantity of material from the claim for purposes other than fill material, it is properly concluded that the material was not marketable on July 23, 1955.

Mining Claims: Common Varieties of Minerals: Special Value--Mining Claims: Common Varieties of Minerals: Unique Property

The fact that pumiceous material may occur in nature in pieces having one dimension of two inches or more does not, by itself, establish that the material is "block pumice" which is excluded by statute from the category of common varieties of pumice.

Mining Claims: Common Varieties of Minerals: Special Value--Mining Claims: Common Varieties of Minerals: Unique Property

To determine whether a deposit of pumiceous material is a common variety, there must be a comparison of the material in that deposit with other similar-type materials in order to ascertain whether the material has a property giving it a distinct and special value; where the material can be used for purposes for which common varieties of other materials can be substituted, and where it is not shown that it has any advantage over such substitute materials which is reflected in a higher price in the market place, it is properly determined that the material is a common variety not subject to location under the mining laws of the United States after July 23, 1955.

IBLA 70-46 : Arizona Contest No. 033071

UNITED STATES
v.
PAUL M. THOMAS ET AL.

: Patent application rejected and placer mining claims declared null and void

: Affirmed

DECISION

Paul M. Thomas, Gilbert E. Olson and Ida L. Thomas, executrix of the estate of Roger C. Thomas, have appealed to the Secretary of the Interior from a decision dated March 21, 1969, whereby the Office of Appeals and Hearings, Bureau of Land Management, affirmed a decision of a hearing examiner rejecting their application, Arizona 033071, for patent to the Bill Williams No. 4, Aluminum Oxide Nos. 1, 2, and 4, and a part of the Aluminum Oxide No. 7 (amd.), placer mining claims and declaring the claims to be null and void.

Appellants' claims were located during the period September 19, 1947, to September 8, 1954 (Exs. 24, 25). They are situated approximately 1-3/4 to 3 miles south of Williams, Arizona, and embrace lands in secs. 9, 15 and 16, T. 21 N., R. 2 E., G.&S.R.M., Kaibab National Forest, Coconino County, Arizona. According to appellants' patent application, filed on November 7, 1963, the claims contain "a valuable deposit of pumice and cinders which has been and is being marketed as a mineral aggregate."

Upon the recommendation of the Forest Service, United States Department of Agriculture, a contest complaint was filed in the Arizona land office on June 8, 1966, on charges that:

> 1. A valid mineral discovery, as required by the mining laws of the United States, does not exist within the limits of the Bill Williams Placer Mining Claim #4, Aluminum Oxide #'s 1, 2, 4, and Aluminum Oxide No. 7 (amd.) placer mining claims.

2. The land within the limits of the said placer mining claims is nonmineral in character within the meaning of the mining laws.

A hearing was held at Phoenix, Arizona, on February 1, 2, 3, 6 and 7, 1967. From the evidence developed, the hearing examiner found, in a decision dated May 21, 1968, that, although most of the contestees' witnesses consistently referred to material exposed on the claims as pumice, the contestant's expert witness, Robert E. Wilson, as well as the contestees' expert witness, George A. Kiersch, Chairman of Geological Sciences at Cornell University, described the material as "pumiceous material." Since pumiceous material is not a true pumice, the hearing examiner said, it cannot be classified as "block pumice" which is expressly excepted by section 3 of the act of July 23, 1955, as amended, 30 U.S.C. § 611 (1964), from the category of common varieties of pumice. He further found that deposits of pumiceous materials are of widespread occurrence in northern Arizona, that the pumiceous materials on the claims are suitable for many uses, including lightweight aggregate, concrete block, precast concrete products, acoustical plaster and base course, but that none of the unusual characteristics ascribed to them by contestees' witnesses had been shown to render the materials suitable for uses over and above the normal uses of the general run of such deposits. The fact that production from the adjacent patented Aluminum Oxide No. 5 claim was phased out in 1954, he stated, and that scoria volcanic cinders were used thereafter in the manufacture of concrete, showed clearly that cinders could be substituted for pumiceous material in such products. He concluded that the pumiceous materials on the claims are of a common variety, not subject to mining location after July 23, 1955, and in order to establish the validity of the claims, the deposits on the claims must be shown to have been marketable prior to that date.

The hearing examiner found the testimony of the Government's witness, Wilson, that no cinders had been removed from the claims, to be unrefuted by specific evidence. He also determined that significant amounts of material had been removed from only two places—the "Massey pit" on the Aluminum Oxide No. 1 claim and the "pumice pit" in the extreme northeast corner of the Aluminum Oxide No. 4 claim. There was no positive evidence, he found, of the use of any significant portion of the material removed from the Massey pit after 1954 in the manufacture of concrete or for any purpose other than as fill.1/ Nor did he find evidence of removal, after that time, of pumiceous aggregate, the bulk of which had been supplied from the patented Aluminum Oxide No. 5 rather than from the contested claims. The market which previously had existed, the hearing examiner found, was supplied after 1954 from other cinder deposits in northern Arizona. From these findings he concluded that the deposits were not marketable on July 23, 1955, and declared the claims null and void for lack of a valid discovery.2/

The Office of Appeals and Hearings concurred in the findings of the hearing examiner, rejecting arguments raised by appellants before the Director, Bureau of Land Management, that the hearing examiner had erred in applying the act of July 23, 1955, and that the proceedings before the hearing examiner had been so onerous and unfair as to deprive the contestees of due process of law.

In appealing to the Secretary appellants argue, in substance, that:

(1) All of the contested mining claims were located before July 23, 1955, and there is, therefore, no requirement that the mineral deposits on the claims be other than common varieties in order to constitute a valid discovery;

1/ Material which is valuable primarily for fill use has never qualified as a mineral subject to location under the mining laws. United States v. George W. Black, 64 I.D. 93 (1957), and cases cited; United States v. E. A. Barrows and Esther Barrows, 76 I.D. 299 (1969), aff'd, Esther Barrows v. Walter J. Hickel, Civil No. 70-215-F, in the United States District Court for the Central District of California (April 20, 1970), appeal docketed, No. 25944, 9th Cir., May 6, 1970.

2/ The hearing examiner also found that Public Land Order No. 3417 of July 30, 1963 (Ex. 1), withdrew the lands embraced in the Aluminum Oxide Nos. 4 and 7 claims and the north half of the Aluminum Oxide No. 2 claim from mining entry as of July 29, 1955, the date on which the application for withdrawal was filed in the Arizona land office. The fact of the withdrawal is inconsequential unless the validity of those claims rests upon a discovery of an otherwise-locatable mineral after July 23, 1955.

(2) The pumice on the claims is "block pumice" which is expressly excluded from the category of common varieties of pumice;

(3) The mineral deposits on the claims have properties which give them a "distinct and special value" which removes them from the category of common varieties;

(4) The evidence shows continued marketability and production of material from the claims prior to, during and subsequent to July 23, 1955; and

(5) The decisions of the hearing examiner and the Office of Appeals and Hearings are not supported by the evidence and are, therefore, a denial of administrative due process to appellants.

In challenging the applicability of the act of July 23, 1955, to mining claims located prior to that date, appellants assert that the legislative history of section 3 of the act "clearly shows that the Congress had no intention of changing the mining law of the United States so as to affect rights under existing valid mining claims." (Emphasis added.) We have no quarrel with appellants over that assertion. However, appellants assume one of the critical facts in issue, i.e., the validity of the claims on July 23, 1955.

Appellants' contention is one which has been urged and rejected many times. In United States v. Charles H. Henrikson and Oliver M. Henrikson, 70 I.D. 212 (1963), aff'd, Henrikson v. Udall, 350 F.2d 949 (9th Cir. 1965), cert. denied, 380 U.S. 940 (1966), as well as in numerous other decisions (see, e.g., United States v. Kenneth F. and George A. Carlile, 67 I.D. 417 (1960); United States v. Fisher Contracting Company, A-28779 (August 21, 1962); United States v. William M. Hinde et al., A-30634 (July 9, 1968); United States v. E. A. Barrows and Esther Barrows, supra, n. 1), the Department has held the validity of a mining claim located prior to July 23, 1955, for a common variety of sand, gravel or other material specified in the act of that date can be established only by showing the requirements of a discovery were satisfied before the date of the act. Those requirements include a showing that the material on a claim could have been profitably mined and marketed on that date. United States v. Alfred Coleman, A-28557 (March 27, 1962), aff'd, United States v. Coleman, 390 U. S. 599 (1968).

Appellants' attempt to avoid the consequences of the ruling in the Henrikson case, supra, by arguing that, although the Department's decision was affirmed by the United States District Court for the Northern District of California in Henrikson v. Udall, 229 F. Supp. 510 (1964), the court "clearly did not affirm the Secretary's erroneous application of 30 U.S.C. to mining claims located prior to the 1955 Act."

Appellants' position is untenable. The Henrikson case, also, involved the determination of the validity of a mining claim located prior to July 23, 1955, for a material (sand and gravel) of common variety. The primary distinction between that case and the one before us lies in the fact that, whereas in this case there is a question with respect to the marketability of the material on the claims on July 23, 1955, in Henrikson the question was whether sufficient work had been done by that date to ascertain the existence of sand and gravel in sufficient quantity to constitute a valuable mineral deposit. The Department's determination in the Henrikson case that the claim was invalid could be sustained only upon acceptance of the premise that the location of a mining claim for a deposit of a common variety of sand, gravel or other mineral named in the 1955 act, unperfected by a discovery prior to the date of the act, established no rights against the United States. Accordingly, appellants were properly required to demonstrate a discovery on each of the contested claims prior to July 23, 1955, if the materials found thereon are common varieties of pumice, cinders or other material.

If the materials on appellants' claims are not "common varieties," of course, the significance of a discovery before July 23, 1955, is immaterial. However, it must be shown, in any event, that there was a valid discovery on each claim at the time of the application for patent. That is, irrespective of the date on which a discovery may have been made, the claims are now invalid if, because of exhaustion of the deposits, a change in economic conditions, cessation of a market for the material, or some other equally cogent factor, the value of the minerals will not justify further expenditures for the development of a mine. See, e.g., Best v. Humboldt Placer Mining Co., 371 U.S. 334 (1964); Adams v. United States, 318 F.2d 861 (9th Cir. 1963); Mulkern v. Hammitt, 326 F.2d 896 (9th Cir. 1964); United States v. R. W. Wingfield, A-30642 (February 17, 1967); United States v. Evelyn M. Kiggins et al., A-30827 (July 12, 1968); United States v. Warren E. Wurts and James E. Harmon, 76 I.D. 6 (1969).

We note at this point that it was not alleged in the contest complaint that the materials found on appellants' claims were "common varieties." Nor was it expressly charged that a discovery had not been made prior to July 23, 1955. It appears, in fact, that the contestants' basic premises in contesting the claims were that the materials for which the claims were alleged to be valuable do not occur in sufficient quantity to sustain a commercial operation and the materials cannot now be produced and sold at a profit (see Tr. 27-28).

Without making any findings with respect to the quantity of the mineral materials present on the claims or their present marketability, as we have seen, the hearing examiner concluded from the evidence that the materials shown to exist are common varieties for which no market existed on July 23, 1955. This conclusion is not necessarily incongruous, however. The first charge of the complaint (that a "valid discovery, as required by the mining laws of the United States, does not exist" within the limits of the claims) could be sustained upon a finding either that (1) the materials found on the claims cannot presently be mined and marketed at a profit or (2) the materials are common varieties of pumice, or other substance, for which there was no market on July 23, 1955.

We turn now to the question of whether or not the materials on the claims are, in fact, common varieties of pumice, cinders or other material removed from operation of the mining laws by the 1955 act. We do not find it necessary to determine whether, as the hearing examiner and the Office of Appeals and Hearings found, "pumiceous material is not a true pumice." Even if we assume that there is no clear distinction between "pumice" and "pumiceous material," it does not necessarily follow that pumiceous material occurring in nature in pieces having one dimension of two inches or more is "block pumice."3/

3/ The 1955 act expressly excepts from the category of "common varieties" deposits of "so-called 'block pumice' which occurs in nature in pieces having one dimension of two inches or more." 30 U.S.C. § 611 (1964). The statute does not define "block pumice." Nor have we found the term in any glossary of technical terms. It seems clear, however, that the drafters of the statute contemplated a material of fairly definite specifications which had a recognized use in industry. Thus, in reporting the bill which ultimately became the act of July 23, 1955, the House Committee

As the decisions below stated, appellants' witness, Kiersch, after defining pumice (Tr. 351) and acknowledging that many materials are pumiceous but may not necessarily meet a specific geologic classification of pumice (Tr. 365), stated that he "would prefer" to call material from the claims "pumiceous material" (Tr. 366-367). Although other witnesses referred to material from the claims as pumice, no witness described any of the material as "block pumice." In the absence of competent evidence to that effect, we cannot conclude that "block pumice" has been shown to exist anywhere on appellants' claims.

Even if the material is not "block pumice," appellants argue, it is an uncommon variety of pumice because of properties which give it a distinct and special value. The properties which allegedly do this are:

Fn. cont.

3/ on Interior and Insular Affairs stated that the clause excluding "block pumice" from common varieties of pumice "recognizes a class of pumice having distinct and special properties." H.R. Rep. No. 730, 84th Cong., 1st Sess. 9 (1955).

It is reported in Bureau of Mines Bulletin 630, Mineral Facts and Problems (1965), that:

"Under various conditions pumice competes as a lightweight aggregate with expanded clays and shales, expanded perlite, exfoliated vermiculite, slag, cinders, and diatomite. . . .

"As an abrasive in block form, pumice competes in the market with brick made from silicon carbide, aluminum oxide, and natural rock such as novaculite and sandstone.

. . . .

"Pumice used as a concrete aggregate, railroad balast, and for road surfacing is sold in a low-price market and must compete with many substitutes. Hence the market area for any deposit is limited by transportation costs and the availability of competitive materials. As abrasives, pumice sells at a much higher average unit price; transportation is a smaller part of the total cost, and shipments are made over much greater distances. High-quality pumice is imported from foreign sources in crude form for processing domestically for abrasive purposes." P. 736 (emphasis added).

It may reasonably be inferred that the "block pumice" which is not a common variety must be of abrasive grade and the term was not intended to embrace all pumiceous materials occurring in nature in pieces having one dimension of two inches or more. There is no evidence that the material found on appellants' claims is marketable as an abrasive.

(1) The material is stronger than common pumice;
(2) It is less absorbent than common pumice;
(3) It is more coarse and does not generate fines as does common pumice;
(4) It can be run through a crushing cycle without powdering;
(5) It can be used as a lightweight concrete aggregate; and
(6) It has an extraordinary insulation quality.

The Department has held that, in order to determine whether or not a deposit of stone, or other material, has a unique property which gives it a distinct and special value, there must be a comparison of the material under consideration with other deposits of similar materials. It must then be shown that the material under consideration has some property which gives it value for purposes for which other materials are not suited, or, if the material is to be used for the same purposes as other materials of common occurrence, that it possesses some property which gives it a special value for such uses, which value is reflected by the fact that it commands a higher price in the market place. Differences in chemical composition or physical properties are immaterial if they do not result in a distinct economic advantage of one material over another. United States v. U. S. Minerals Development Corporation, 75 I.D. 127 (1968); United States v. Gene De Zan et al., A-30636 (July 24, 1968); United States v. Alice A. and Carrie H. Boyle, 76 I.D. 61 (1969), as supplemented, 76 I.D. 318 (1969). Moreover, the comparison is not limited to other deposits of the same material. That is, it may not be enough to show that pumice from a particular deposit can be used for purposes for which ordinary pumice cannot be used. If the special use to which it may be adapted is one for which common varieties of other materials are equally adaptable, and if the price commanded by the pumice is no greater than that paid for other materials, pumice must still be considered a common variety. See United States v. Norman Rogers, A-31049 (March 3, 1970). Assuming that material from appellants' claims has all of the characteristics attributed to it and the Williams deposits are, as indicated by appellants' witness, Gilbert Olson, the only source of pumice in the State of Arizona suitable for the manufacture of concrete block (Tr. 101-104), what is the special and distinct value derived from these properties?

As noted, the hearing examiner found the pumiceous materials on appellants' claims are suitable for a number of uses. Whether or not other pumiceous materials found in Arizona can be used for all the purposes for which appellants' materials reportedly are adaptable, it is clear from the record that other materials are used for all of the listed uses. There is, in fact, no evidence that material from appellants' claims can be used for any purpose for which a common variety of some material is not already being used or that the material from appellants' claims has any advantage over other materials with which it must compete which is reflected in the market price which it can bring. Accordingly, we cannot conclude from the showing appellants have made that their "pumice" has a distinct and special value.

Appellants suggest that, if the Secretary is not convinced that the pumice from the contested claims commands a higher price at the market place than material not having such special properties, he should remand the case for the development of more complete and full evidence on this issue. The Secretary has, in several recent decisions, remanded cases for the development of additional evidence relating to the market price of material where the evidence bearing upon that question was inconclusive. Appellants, however, have not offered any evidence that material from their claims commands a better price than other materials used for the same purposes. In the absence of an offer of proof, there is no reason for further inquiry into the question.

In support of their contention that the decisions below constitute a denial of due process, appellants argue that there must be support in the record for a decision. The decisions appealed from, appellants charge, clearly are not supported in the record and are, therefore, a denial of administrative due process.

There can be no doubt that an administrative decision must have support in the record. However, there is an enormous gulf between the acceptance of that rule and the conclusion that a particular decision is not supported by the record. Appellants have attempted to bridge that gulf with a single giant step which we are unable to duplicate.

Having concluded that the provisions of the act of July 23, 1955, are applicable in this case and the evidence does not establish the uncommon nature of the materials found on appellants' claims, there remains only the question of whether or not the deposits were, by virtue of the then-existing market, valuable mineral deposits on July 23, 1955.

Careful review of the record is conclusive that the hearing examiner's factual findings, which have previously been set forth, are supported by the evidence. Those findings justify his conclusion that a discovery, within the meaning of the mining laws of the United States, has not been shown on any of the claims in question. Accordingly, the claims were properly declared null and void.

Appellants have petitioned the Secretary to grant an opportunity to present oral argument in this matter. They have not, however, shown wherein such argument would serve a useful purpose, and the petition is hereby denied.

Therefore, pursuant to the authority delegated to the Board of Land Appeals by the Secretary of the Interior (211 DM 13.5; 35 F. R. 12081), the decision appealed from is affirmed.

Martin Ritvo

Martin Ritvo, Member

I concur:

Edward W. Stuebing

Edward W. Stuebing, Member

I concur:

Francis E. Mayhue

Francis E. Mayhue, Member