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RECONNAISSANCE OF POTENTIAL HARDROCK QUARRY SITES
SONOMA COUNTY, CALIFORNIA

PART II OF THE SONOMA COUNTY QUARRY STUDY
1979

Rolfe Erickson .... Director
Randy Demaree .... Technical Assistant
Mark Kautsky .... Technical Assistant
David Thormalen .... Technical Assistant

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PLANNING DEPARTMENT COUNTY OF SONOMA
I. Introduction

The purpose of this study was to do a reconnaissance of potential major hardrock resource areas in Sonoma County, California. The study is the second part of an overall study of hardrock quarries in the county, and is a component of the Sonoma County Aggregate Resource Study, involving both hardrock and riverine sources. The first part of this study was a description and discussion of the detailed geology of the 23 recently or presently active hardrock quarries in Sonoma County. All definitions of terms used below are in the glossary of part I.

Part II of the study uses the county geologic map (Knox, Huffman, and Armstrong, 1974) as a basis, with subsequent extensive field exploration for specific potential deposits in favorable areas outlined on the map. Field exploration was concentrated near major population centers, so that deposits outlined below in general are those closest to major towns and haulage routes. In general we looked for deposits as close as possible to existing roads. Other than the above, no non-geologic factors were taken into account in evaluating the various deposits; very specifically, there is no implication that the owners of any particular site would favor or not favor quarry development.

The deposits discussed below appear to be good quarry sites. It should be emphasized that a great many more remain undiscovered as yet. 61 specific deposits were identified.
A copy of the new county geologic map has been filed with the Sonoma County Planning Department (attention Gregg Carr), locating each deposit visually and showing present and potential haulage routes.

This report contains a brief discussion of favorable prospecting areas in general, and brief discussions of each potential deposit located in reconnaissance, together in most cases with a location map for that deposit taken from the appropriate U.S.G.S. 7½' quadrangle, indexed below the map.

II. General Statement on Rock Bodies Suitable for Quarrying

The new county geologic map displays a good degree of subdivision of geologic information on different rock units. The user should be aware that it is still somewhat generalized in nature, and is a compilation of old and new work. It is not always correct. It is generally not detailed enough to outline single bodies of the size being sought for quarry sites. For example, all kinds of different flows, dikes, and intrusive masses of basalt will be called 'basalt' and no separation of the sub-units made.

Three main rock units make up suitable quarry site targets in Sonoma County. These are: (1) Sonoma Volcanic lavas, generally basalt; (2) Franciscan Complex sandstones; (3) Franciscan Complex greenstones.

The lavas of the Sonoma Volcanics make up most of the Sonoma Mountains, in massive stacks of flows later strongly
deformed by faulting and folding. In these mountains minor
tuff and agglomerate are interbedded with the flows, but lavas
greatly predominate. Basalt exists almost anywhere, and
finding good quarry sites mostly involves finding the best
basalt and a site which meets proper planning criteria. These
lavas are called andesite on the county map but basalt is a
better term. The user of the study should be aware of this
dual terminology.

As one leaves the Sonoma Mountains in any direction,
other units of young sediments and tuffs interbedded with the
lavas become more and more abundant. To the north and east
into the ridge beyond the Valley of the-Moon and into the
area north of Santa Rosa interbedded tuffs become much more
abundant while to the south and west sediments of the Merced
Formation are common and the lavas become small and widely
separated. In these areas lava rock quarry sites are accord-
ingly more restricted, but still plentiful.

Franciscan Complex sandstones are presently quarried at
several sites in the county. West of the Cotati-Santa Rosa
Plain they are the most abundant resource. Unweathered
sandstone or shale (usually called blue rock) is generally
quite strong and often makes successful aggregate for high-
strength purposes. Weathered brown sandstone and shale is
much poorer. These sandstones are part of stratified (lay-
ered) sequences which may vary rapidly from place to place,
and in many areas are part of melange units (see Part I)
which are highly variable in strength and contained rocks. Rock type and quality are very unpredictable in this unit and careful exploration of any prospective site should be done by test excavations, core drilling, and detailed geologic mapping by a qualified consultant.

Franciscan Complex greenstone bodies are weakly metamorphosed lavas, and like the lavas of the Sonoma Volcanics tend to be fairly homogeneous. They have in general been structurally deformed; They are almost always fault-bounded and the faults can have many different attitudes. Careful geologic work is needed to outline the deposits.

III. Individual Deposits

The sequence followed in the descriptions is from Santa Rosa down the Valley of the Moon, on south past Sonoma to Sears Point, and then up the west side of the Sonoma Mountains to Santa Rosa. Then the deposits west of Highway 101 and south of Sebastopol are outlined. Then, deposits north of Santa Rosa, and finally the deposits up 101 toward and to Cloverdale are examined. Where a Figure is used to locate the deposit, cross-striping means walked out material, dots mean visually examined, and arrows pointing beyond defined boundaries mean the body probably extends in that direction further.

A. Buzzard Peak Area, East of Santa Rosa (Fig. 1)

Along Los Alamos Road and to the southeast, across the southern slope of Buzzard Peak, extends a linear zone of
basalt which has been quarried in the past in an old working on Los Alamos Road and another across Santa Rosa Creek from the first. The zone was surveyed in the field to the creek southeast of Buzzard Peak, and is about 2 miles long by circa 500 feet wide. The zone continues on to the southeast, where it enters Mt. Hood county park, and to the northwest. A secondary outcrop of basalt may connect up with the first zone.
as shown by the county map (see Fig. 1 outline on county geologic map). The knobby outcrop and fresh nature suggests excellent rock properties. Access is from a road up the unnamed creek southeast of Buzzard Peak, from Los Alamos Road, and from a road up Santa Rosa Creek. Assuming an average mineable depth of 100 yards, some $3 \times 10^7$ cubic yards are present. A single practical quarry would no doubt be much smaller.

B. Southwest of Kenwood

1. About 1 mile southwest of Kenwood on the Geib ranch is a previously unmapped basalt flow interbedded with tuffs (Fig. 2). The flow underlies an area about 2000x600 feet and is perhaps 50-60 feet thick. It appears to be rather flat-lying, and contains approximately $3 \times 10^6$ cubic yards of fresh-looking basalt.
2. On Warm Springs Road about 1 mile south of Kenwood (Fig. 2), is exposed another previously unmapped basalt flow interbedded with tuff. It is exposed in a steep slope about 150 feet high and extends east and west an unknown amount. Circa $1 \times 10^6$ cubic yards of basalt or less may be available here.

C. East of Kenwood

1. Figure 3 shows a small basalt deposit just off Nun's Canyon Road. It is a flow interbedded with tuff and may be cut off by a fault to the northeast. It contains perhaps $1 \times 10^6$ cubic yards. The body may extend to the south at a low elevation. Just south of it is a large quarry in flow felsite, which varies in quality but is probably fairly abundant.
2. Most of Nelligan Road is on basalt, but the surrounding area is planted in vineyards. Along the higher part of the road (Fig. 3) a canyon 300-400 feet deep offers excellent basalt exposures in an undeveloped area. Circa 1-5x10^6 cubic yards are available.

D. Trinity Road

Figure 4 shows part of eastern Trinity Road. Rock exposed here is poorly to moderately lithified felsite which has been exploited at the old quarry marked, and in that case is variable from very hard to punky. The geology on the county map is very generalized in this area, and no guide to exploration. A worthwhile deposit might be developed by careful exploration.

At the western end of Trinity Road, Trinity and Nun’s Canyon quarries and several nearby ones to the east not now being worked are in flaggy felsite flows, and an
excellent aggregate could probably be developed.

E. Cavedale Road and Goldstein Road

Figure 5 shows two basalt outcrop zones on Cavedale Road and one on Goldstein Road. The basalt here is complexly interbedded with tuff, but the general abundance of basalt is clear. Cavedale Creek Canyon is up to 500 feet deep and excavation from near creek level could remove large amounts of rock in a small area. Up to $1 \times 10^8$ cubic yards of high-quality basalt may be available in this immediate area. Extensive lateral cutting from the canyon would involve relocating one or both roads. The area along upper Goldstein Road is now heavily planted in vineyards up to the base of Mt. Pisgah.

F. Norbohm Road and Gehricke Road, North of Sonoma

1. Just outside of Sonoma at the southern end of the road lies a small basalt body shown on Fig. 6. This
has numerous old cobblestone quarries in it, but has scarcely been touched. As shown it contains perhaps $1-3 \times 10^6$ cubic yards if 50 yards thick, and it probably extends further to the north and west.

2. The southern part of Fig. 7 shows a large mass of basalt south and southeast of Norbohm Road. A good-sized dormant quarry is present as marked. Several million cubic yards of basalt are available.

3. The southeastern part of Fig. 7 shows a small mass of basalt along Gehricke Road pocked by old cobblestone quarries. This would furnish perhaps $1-5 \times 10^5$ cubic yards of basalt.
4. The north part of Fig. 7 shows three outcrop zones of basalt which probably connect and extend much further as shown. These are underlain by tuff in all likelihood, and are probably a sequence of flows up to 100-150 yards thick. The hills to the east and west of the road exposures probably contain over $1 \times 10^7$ cubic yards of high quality basalt.

5. In Agua Caliente creek, the basalt mass described in (4.), above, extends west from the area of Fig. 7 across Agua Caliente creek according to the county geologic map. The canyon of the creek is up to 1000 feet deep and a possible excellent quarry site is present here. This site was not visited.

G. Lovall Valley Road East of Sonoma

The only material of much use is a small felsite flow whose outcrop minimum is shown on Fig. 8. This rock is fairly hard and might make a good quarry rock. It contains about $1 \times 10^6$ cubic yards if it averages 10 yards thick.

H. Arrowhead Mountain

The county map shows Arrowhead Mountain to consist
largely of felsite flows, and observation from Lovall Valley Road suggests a very large resource may be present there. The area was not examined on foot.

I. **North of Sears Point**

1. Sonoma Rock Quarry 3 miles north of Sears Point on Highway 121 is mining basalt. Fig. 9 shows that more basalt is available across the highway. A large zone containing perhaps $15 \times 10^6$ cubic yards of basalt underlies a ridge trending northeast-southwest just north of the quarry. This mass is pretty deeply weathered and outlined by sparse float on the surface. Quarrying this rock would involve removal of considerable overburden usable only for fill. A very hard probable dike of basalt trends east-west across the southern end of this ridge, and contains a little-
weathered aggregate resource of circa $1 \times 10^5$ cubic yards if mined to an average depth of 10 yards; the shape of the body makes it an unlikely prospect, however.

2. About 1 mile south of Sonoma Rock Quarry (see Fig. 9) is a small basalt flow interbedded with tuff; the flow is cut by Highway 121. Up to $1 \times 10^5$ cubic yards may be present here as shown, and the county map suggests that the unit may extend to the west considerably further than shown.

J. North of Sonoma Rock Quarry

Fig. 10 shows a flow or sequence of flows of basalt cut by Highway 121 two miles north of Sonoma Rock Quarry. The main mass southeast of the highway contains at least $2 \times 10^6$ cubic yards of good basalt, and more is available to the west of the road.
K. West of Sonoma Rock Quarry

A private dirt road extends from a point a bit over a mile south of Sonoma Rock Quarry west-northwest into the Sonoma Mountains. In the area of Figure 11, two known and one highly probable deposits were outlined. In the eastern part of the figure is a large deposit of excellent basalt probably bounded by a fault at its northeast margin. It contains about $10^7$ cubic yards of basalt. Just west of this body is a smaller one containing perhaps $1-2 \times 10^6$ cubic yards.

In the western part of Fig. 11 is outlined a very large probable deposit, indicated on the county map and checked from a half-mile distance in the field—time constraints forbade a direct visit. Knobby outcrop and rock walls suggest abundant basalt here. The topography suggests $5 \times 10^7$ cubic yards are present if the whole outlined area is basalt.
In the east central part of Fig. 11, Wildcat Peak crops out. It shows very hard knobby outcrop and, if basalt as the county map shows, would be a resource of $10^6 \times 10^7$ cubic yards. A quarry here would be quite conspicuous, however!

L. West From Sonoma on Highway 116

As you approach the Sonoma Mountains from the east along Highway 116, you enter the foothills near Stage Gulch Quarry. South and slightly to the east of the quarry and south of 116 is a large mass of basalt (Fig. 12) explored on foot just south of the road. A minimum of $5 \times 10^6$ cubic yards is present and a much greater amount is probable.

The county map shows a very large body here, up to circa $10^8$ cubic yards. The county map needs to be backed up by considerable new exploration, however. The writer should point out that it shows the area around Stage Gulch Quarry as lava, which it isn't--only tuff is present!
West of Arnold Drive

1. Felder Road goes west from Arnold Drive, which in turn trends north-northwest, south-southeast along the western edge of Sonoma Valley. Felder Road ends in a former quarry in the Sonoma Mountain foothills. (Fig. 13). This quarry is in massive basalt with very minor tuff; the explored body is about $5 \times 10^6$ cubic yards and extends to the south and perhaps west an unknown distance.

![Diagram showing probable basalt and basalt](image)

Inspection from a distance agrees with the county geologic map that a large basalt mass underlies the low ridge to the northeast of the quarry. This body is potentially quite large, in the $10^7$ cubic yard range.

2. Grove Road runs west from Arnold Drive about two miles north of Felder Road. It develops into an excellent highway as it enters the mountains and goes
up to a large development. On Fig. 14 can be seen a large probable basalt mass observed from the roadway not further examined. To the east of it is a smaller basalt mass at an old quarry. The rock in the quarry area is excellent basalt, which goes off to the north.

The area marked in the field is small but the body extends to the north and the west an unknown distance. Perhaps $5 \times 10^5$ cubic yards of basalt are present in the area paced.

N. North of Adobe Road

Adobe Road, on the southwest flank of the Sonoma Mass, has an unnamed private road lead north, northeast from it as shown in Fig. 15, about three miles northwest of the Adobe Road-Highway 116 junction. This road ends in the mountains, and near the end of it is exposed a slightly
worked small basalt flow interlayered with far more abundant tuff. This flow holds perhaps $8 \times 10^5$ cubic yards of basalt, and probably does not extend much beyond its outlined extent.

0. Rodgers Creek

The Triangle G Ranch is located at the head of Manor Road. About 1 mile southeast of the ranch house, rising northeast from Rodgers Creek Valley, is a large body of knobby-outcropping basalt (Fig. 16). This mass as defined in the field contains perhaps $1 \times 10^7$ cubic yards of basalt and probably much more extends to the north and east.

![Figure 16: S. Glen Ellen, Q.](image)

The potential here is very large and access exists down Rodgers Creek Valley to Arnold Drive or out past Spaleata Quarry to Adobe Road and then Highways 116 and 101.

P. Sonoma Mountain Road

The separate segment of Sonoma Mountain Road that leads northeast from Adobe Road about $3\frac{1}{2}$ miles southeast of Penngrove goes far into the basalt-rich core of the Sonoma Mountains. Three exceptionally good quarry sites
were marked out where the road skirted the base of high, steep ridges—these are shown on Fig. 17. The southern two lie along the south and west faces of a 400 foot high southwest-trending flattop ridge, and the whole ridge is probably basalt, as shown by the county map. Up to $4 \times 10^7$ cubic yards may be present in this area. Further north on the road a very long, steep face of probable basalt lies on the western face of Sonoma Mountain; the site was reviewed from the road but not visited due to access problems. The northwestern-trending ridge which carries the face described contains perhaps $1 \times 10^7$ cubic yards of basalt.
Q. Hardin Lane and Lynch Road

These two roads trend northeast from Adobe Road and join some two miles northeast of it. Fig. 18 shows 4 smaller deposits located along the roads. The southwestern-most one is large in area but of low relief; the other three have more relief but are smaller. They contain perhaps $1-5 \times 10^5$ cubic yards of basalt. The one second from the northeast corner of Fig. 18 has a dormant quarry which could be expanded if the road was relocated west of it. The two northernmost areas probably connect but the others are separated by crumbly felsite or alluvium-filled valleys. The area of the mountains north and northeast of the end of Lynch Road contains all basalt according to the county map, and has excellent topography for quarry development.
R. Kanawa Springs Area, South of Santa Rosa

The Kanawa Springs Road heads east from Petaluma Hill Road just south of Santa Rosa. The eastern end of the road provides access to relatively invisible terrain at the northern end of Taylor Mountain. Here is exposed a large deposit of basalt shown on Fig. 19. A number of large exposures of knobby-outcropping basalt which probably all connect together beneath the soil outline a deposit which minimally contains $10^8$ cubic yards of basalt. Much more is available mining back toward the heights of Taylor Mountain.

![Figure 19: Santa Rosa](image)

The felsite body being presently mined by Zamarone Quarry extends over the area shown on the county map. The felsite is weaker than the basalt, and perhaps overlaps and buries it.

S. Basalt on Western Avenue

About three miles southwest of Petaluma Western Avenue cuts a thin basalt flow which is sandwiched between the
Merced Formation and older Franciscan sandstone mélange.

The flow extends some larger area south of Western Avenue than shown on the map, but does not appear to cross the road to the north as shown on the county map—exposures visited there are Franciscan sandstone and chert blocks. This deposit contains perhaps $10^6$ cubic yards of basalt. Fig. 20 shows the geology of the deposit.

T. Stony Point Area

Stony Point Quarry is in one of several basalt bodies interbedded with the Merced Formation in that area. The county map shows the general situation but is not correct in all specifics. The Tolay fault zone extends through here and complicates the geology. Careful exploration will no doubt reveal large deposits here. No field visit here was made, since the deposits are so well known.
U. Roblar Road Basalt

A fairly large basalt flow interbedded with the Merced Formation is exposed on the top and northern slope of a ridge just south of Roblar Road halfway between Stony Point and Bloomfield. This deposit was carefully mapped and is shown on Fig. 21. It is probably a north-dipping thick flow containing circa $10^8$ cubic yards of basalt. To the west lie several smaller flows and dikes; the subhorizontal flow deeply buried in the Merced at the west end of the figure has been quarried a bit long ago, but seems very small and has very thick overburden.

V. Franciscan Sandstone North of Walker Lane

Fig. 22 shows an area of Franciscan rock north of Walker Lane, easily reached by farm roads. Checks at several exposures along the southern side of the valley showed only massive sandstone showing burial metamorphism and a high potassium feldspar content. Investigation along the northern slope of the valley showed some sandstone and several large chert blocks, showing the Franciscan here to be a sandstone mélange (see Part I). Detailed mapping and test excavating have a high probability of outlining
a large sandstone mass of up to $10^7$-$10^8$ cubic yards in the area, but problems with contained chert blocks could be expected.

![Diagram](image)

W. English Hill Area

English Hill is a large uplifted exposure of Franciscan sandstone mélange capped by Merced Formation, lying 2-3 miles north of Bloomfield. Examination of this rock along Bloomfield Road and beyond the northern end of Carroll Lane showed many outcrops of massive metamorphosed feldspathic sandstone containing chert blocks to 20-30 feet across. This is the same material found in area 22. A large quarry is possible, especially to the west of Bloomfield Road. Problems in handling large chert blocks should be expected.

X. Forestville-Guerneville Area

Highway 116 (Pocket Canyon Road) from Forestville to Guerneville and Mays Canyon Road, which loops off from it and rejoins it, follow canyons 400-600 feet deep cut in Franciscan sandstone. The existing Blue Rock and Canyon
Rock Quarries are excavated in this rock. The sandstone, and even interbedded shale where unweathered, makes good rock, and the sandstone seems free of blocks of other rocks--it's not a melange. The deposit is almost infinite in volume and quarry size will not be geologically limited. Detailed exploration will be needed to define the most favorable areas.

Y. Greenstone Northwest of Camp Meeker

A large body of Franciscan greenstone (Fig. 23), is exposed along the Bohemian highway about 1¼ miles northwest of Camp Meeker. It was not investigated off the road, but contains perhaps $10^7$ cubic yards of weakly metamorphosed greenstone if the county map is correct, which will probably be excellent quarry rock. The body is fault-bounded and thereby limited in extent.

Z. Basalt Along St. Helena Road

Several basalt bodies lie interbedded with tuff along St. Helena Road. The first (see Fig. 24), lies at the
intersection of Calistoga and St. Helena roads, is about 80 feet thick at the road and has an existing small pit in it. Perhaps $5 \times 10^6$ cubic yards are available here.

The second (Fig. 25) lies just east of the first and south of the road which loops around its northern end. Up to $1 \times 10^8$ cubic yards may be present in this mass.
The third (Fig. 26), lies north of the road and northeast of the second. It was not directly visited in the field but county map and U.S.G.S. map analysis suggest up to $5 \times 10^7$ cubic yards of basalt are present.

The fourth (Fig. 27), lies south of the road and east of the others. This is a single flow, fairly thin, containing perhaps $5 \times 10^6$ cubic yards of basalt. The deposit is rather strung out and locally has a thick tuff overburden.

AA. Franciscan Greenstone on Calistoga and Porter Creek Roads

The area of the intersection of Porter Creek and
Calistoga roads is underlain by a large greenstone body from the Franciscan (Fig. 28). This is a pillowed basalt, weakly metamorphosed, and very strong where fresh. Mark West Shale Pit is in this material. There is great room for expansion here, and the steep slopes would allow removal of much rock in a small area. There is a considerable amount of weathered overburden which needs to be removed, but which could be used for the less restrictive uses of quarry rock. On the order of $10^8$ cubic yards of greenstone is available, with half of that in the best quarry site in the big ridge across from the Petrified Forest tourist shop.

BB. Chalk Hill Road Area Between Windsor and Healdsburg

1. Leslie Road runs northeast from Chalk Hill Road for about 2 miles, ending in the northwestern end of a
huge body of basalt extending from there southeast, across Mark West Springs Road and on to Calistoga Road. This huge body (see county geologic map) is not penetrated by main roads except for Mark West Springs Road. The eastern segment of Leslie Road and Alpine Road off Calistoga Road enter or touch it. Considerable development is taking place atop this mass in the Mark West Springs area and on its southwest face above Riebli Road. The segment contacted by the western part of Leslie Road along Pool Creek is not so developed and provides an excellent potential quarry site. The quarry resource is essentially infinite and quarry size will be controlled by nongeologic factors.

2. A large irregularly shaped mass of basalt is present just east of Chalk Hill Road. Two smaller quarry site possibilities in the $10^5$ cubic yard range are present. Several roads cut through the area.
3. South of Chalk Hill itself the road follows southeast along the valley of Brooks Creek. The recent deposits in the creek flood plain contain abundant pebbles reworked from the Glen Ellen Formation and may be an aggregate resource.
CC. Basalt Along Brooks Road

Figure 30 shows a large faulted basalt mass crossed by Brooks Road. Brooks quarry is in this body. Large resources are available here; two areas marked have $10^7$ cubic yards of basalt available. Brooks Road is an excellent paved road and there is little development in the area.

DD. Basalt Southeast of Fitch Mountain

Figure 31 shows a large multiply faulted basalt body lying southeast of Healdsburg and Fitch Mountain. The northwesternmost end is cut by Bailhache Road, where a very large quarry utilizing $10^7$ to $10^8$ cubic yards could be developed. Visual impact
here would be severe, and planning factors will determine the ultimate usefulness of this site.

An unnamed dirt road crosses the southern part of the body and an excellent quarry resource of about $10^7$ cubic yards size lies north of the road. Visual impact here would not be severe.

EE. **Franciscan Greenstone Northeast of Alexander Valley**

The northeastern margin of central Alexander Valley is composed of strongly faulted Franciscan rocks of several types. The best quarry rock is greenstone. Fig. 32 shows this group of units, which are cumulatively very large. The northwesternmost mass is fault-bounded. The central part has access by a dirt road which goes northeast from the Geysers road about 1 mile from its beginning on Highway 128. Here the topography and rock combine to make an excellent deposit of circa $10^8$ cubic yards of greenstone.

A smaller greenstone body shaped like a pork chop lies a half mile north of Pine Flat Road in N Section 19. It contains circa $5 \times 10^5$ cubic yards of greenstone and is easily reached by a small dirt road.

The very large greenstone mass southeast of Pine Flat Road has two northern extensions cut by that road; an old quarry is present there, but the deposit is too small there for major development. A dirt road marked on Fig. 32 cuts through the center of this body, whose major resource is up to $10^{10}$ cubic yards of greenstone. This is an excellent site for a truly major quarry.
FF. Mill Creek Road Sandstone

Mill Creek Road runs roughly west for several miles from Westside Road southwest of Healdsburg. It follows the creek valley, which is cut in massive to bedded nonmelange sandstone of the Franciscan Complex. The county map submitted with this report shows the road and three old small quarries located along it. Many acceptable large deposits could probably be located and developed along the road; the topography is certainly favorable. No detailed field work was done.

GG. Bradford Mountain Greenstones

Bradford Mountain lies along the southwest side of Dry Creek Valley a few miles northwest of Healdsburg. It is a huge fragment of oceanic crust, composed of pillow greenstones and intrusive rocks. The main body of it is a huge resource of excellent rock, easily reached by a modifiable dirt road along Pena Creek which cuts into the core of the body. Up to perhaps 10^{11} cubic yards of high-quality hard rock are present in the main part of this body; it is probably the biggest single quarry resource in the county. The county map submitted with this report shows it.

HH. Units Near Cloverdale

Several developable units have been located near Cloverdale. Since no major quarry activity is present there now, little time was spent on them, but they have been located on the colored county map submitted with this report. They are briefly described as follows:
1. An enormous Franciscan greenstone mass containing up to $10^{10}$ cubic yards of greenstone can be reached by a dirt road following up Crocker Creek northeast from Asti, easily seen on the county map or the Asti quadrangle. The southernmost part of the body can be reached by a dirt road which leaves River Road $\frac{3}{4}$ mile west of its intersection with Highway 128 and goes up to and along Gill Creek. The Geyserville quadrangle shows it. The map suggests a good deal of development along the lower reaches of Gill Creek. This greenstone resource is tremendous.

2. Massive Franciscan sandstone lies along Crocker Creek southwest of the Chianti fault. This unit is closer to haul routes than the greenstone body described in (1.) and quarries in it could be completely hidden due to the topography. Rock quality is probably inferior to the greenstone, however. Geysers Road swings around the north end of this body and on the northeast side a large quarry could be developed on the southwest bank of Big Sulphur Creek. A very large resource is present, though again the rock is probably inferior to the greenstone.

3. A small greenstone body crops out on Highway 128 about 4 miles northwest of Cloverdale. This body contains perhaps $10^6$ cubic yards of greenstone and is immediately accessible.
4. A greenstone mass of large but undetermined size crops out along Cherry Creek Road west of Cloverdale. No estimate can be given of the size of the deposit.

IV. Conclusion

This concludes the discussion of individual units in Sonoma County. A large number of geologically acceptable quarry sites have been located, and other factors must be used to determine where quarries should go. Users of this survey are again cautioned that this is a reconnaissance study, and much detailed work by competent geologists must be done to fully evaluate any deposit or area of interest described herein. They are also cautioned that no effort has been made to determine landowner attitudes toward quarry development.

It is hoped by the authors that this reconnaissance study will assist in the sensible development of planning for future quarry development in Sonoma County.