UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

In the Matter of	)	
	)	
PUGET SOUND POWER & LIGHT COMPANY, et al.,	)	DOCKET NOS. STN 50-522 50-523
	)	
	)	
(Skagit Nuclear Power Project, Units 1 and 2)	)	Sept 14, 1979
	)	
	)	

INTERVENOR SCANP'S INTERROGATORIES AND REQUESTS FOR PRODUCTION TO APPLICANT

TO: APPLICANT PUGET SOUND POWER & LIGHT AND ITS ATTORNEYS

In accordance with 10 CFR §2.740(b) and 10 CFR §2.741, please answer the following Interrogatories and respond to the accompanying Requests for Production.

Documents to be produced should be presented at the offices of undersigned counsel at 5:00 p.m. Oct 1, 1979, or at such other time and place as may be agreed upon.

As used herein, the term "document" means all writings and records of every type in the possession or control of Applicant or its directors, officers, members, employees, attorneys, consultants, agents or representatives, including, but not limited to, memoranda, correspondence, reports, surveys, charts, books, photographs, maps, notes, studies, drawings, writings, minutes,

notes of telephone conversations, notes of meetings or other conversations, and all other records.

DATED this ___ day of _____, 1979.

_____
ROGER M. LEED

The following interrogatories are in regard to the three volume submitted entitled "Report of Geological Investigations in 1978-1979" for Puget Sound Power & Light Company by Bechtel Incorporated.

INTERROGATORY NO. 1: For Appendix H and for each geological and geophysical map in Section 3 (volume 2) please specify the following:

(a) the name of the geologist or geophysicist who did the field work,

(b) whether this person is a Bechtel consultant or employee.

(c) the professional qualifications and experience of each employee of Bechtel named in (a) above,

(d) in the event that more than one person conducted the field work, indicate which portion of each map each person is responsible for, and

(e) the dates when each person named in (a) or (d) conducted the field work.

ANSWER:

INTERROGATORY NO. 2: Please indicate by overlays or index maps the sources of data for each portion of Appendix A. A map similar to Figure 1-3 is requested. Please identify each area on the map as to the name of the author, the date of the publication (or if the map is not part of a thesis, dissertation or other publication, the date of field work) and the scale of the author's map. Do not include within the authoriship of the Applicants' employees or consultants areas that were mapped by others, but merely field checked by the Applicants' employees or consultants.

ANSWER:

1269 086

REQUEST FOR PRODUCTION NO. 1: Please provide the field notes, field maps, and compilation maps of each area mapped since May 1, 1978 by the Applicants' employees or consultants.

INTERROGATORY NO. 3: Please provide names and professional qualifications of all geological and geophysical consultants to the appliccants that are/were not employees or consultants to Bechtel Corp.

ANSWER:

REQUEST FOR PRODUCTION NO. 2: Please provide all field notes, field maps, compilation maps and other documents produced by the consultants (listed in the answer to interrogatory No. 3) or by the applicants in relation to said consultants.

INTERROGATORY NO. 4: Please identify the person or persons who described each thin section in Appendix E.

ANSWER:

1269 087

INTERROGATORY NO. 5: Please indicate each thin section in Appendix E that was examined by Dr. Misch or by Dr. Gerald Miller and indicate each description in Appendix E that has been explicitly approved by either Dr. Misch or Dr. Miller.

ANSWER:

INTERROGATORY NO. 6: Please submit the professional qualifications and experience of the following persons:

Mr. Jorge Martinez
Dr. Robert L. Rose, San Jose State University
Dr. Terry Davis, Los Angeles State University

ANSWER:

1269 088

INTERROGATORY NO. 7: Three high resolution seismic reflection surveys are shown on Figure 3.4.1-7. Please provide the following information:

(a) those portions (give S.P. numbers or other intercepts for each portion) in which penetration unequivocally was down to or below the bedrock surface,

(b) the depth (both as two way travel time and as feet) at which bedrock was penetrated,

(c) the location of these bedrock intercepts on Figure 3.4.1-7,

(d) the age in years of each prominent reflector above each bedrock intercept,

(e) Give the depth (both as two way travel time and as feet) for each of these prominent reflectors in (d).

The following suggestions are offered to facilitate responding to this interrogatory:

(a) Instead of compiling lists of the data requested in (a), (b), (c), (d) and (e) each portion of a seismic reflection line that does penetrate bedrock could be Xeroxed, S.P. numbers (or other intercepts) and the scale for two way travel times written on Xerox where necessary, bedrock marked in green, and prominent reflectors (above the bedrock) and their age marked in some other color.

(b) It might also be noted that the bedrock surface is fairly easily identifiable on the lower frequency reflection lines run by MOBIL, thus if some doubt exists as to whether bedrock was penetrated on one of the high frequency lines, the depth to bedrock on nearby MOBIL lines could be checked for comparison.

ANSWER:

1269 089

INTERROGATORY NO. 8: Several of the maps in Section 3 have a scale of approximately 1:24,000 and overlap to provide continuous coverage (Figures 3.2-2, 3.1-15, 3.1-16 3.1-17, 3.2-10, and 3.4.3-1). Furthermore, Figure 3.1-14 is within 1/2 mile of the edge of Figure 3.2-2, and the edge of PSAR Figure 2.5-26b is only 2 miles from the edge of Figure 3.2-2.

In some cases the geology shown on one map is different than that shown for the same area on an overlapping map (for example see Interrogatory #41). In another case the geological units shown on one figure do not show on another (compare Figure 3.2-2 with Figure 3.1-5). Additionally, geological information critical to interpreting the maps commonly occurs on one map but not in the area of overlap of another map

(compare Figure 3.2-2 and 3.2-10 with Figure 3.1-15). Discrepancies also occur between these maps at a scale of 1:24,000 and Appendix H (for example see Interrogatory #23).

In order to facilitate and clarify review of these volumes this interrogatory requests the following compilations and uniformity in scale (at 1:24,000):

(a) that two geological maps at a scale of 1:24,000 be prepared and that these maps include all of the 1:24,000 geological maps noted above,

(b) that one of the requested maps show the bedrock geology, the other the glacial geology,

(c) that geological discrepancies between these maps, between them and Appendix H, and between the compilation maps on a scale of 1:24,000 and Appendix H be resolved.

(d) that all geological cross sections that have been prepared at various scales larger than 1:24,000 (for example Figure 3.1-13) for areas within the requested compilation maps also be redrafted to 1:24,000,

(e) that all aeromagnetic coverage within the area of the compilation map of a scale of 1:24,000 also be presented at a scale of 1:24,000 (Appendix A, page 7, notes that the data were originally presented ona scale of 1:24,000) and that this map be prepared as an overlay to the geological maps (see Interrogatory No. 98).

(f) that all gravimetric coverage within the area of the compilation map of a scale of 1:24,000 also be presented at a

a scale of 1:24,000, and that this map be prepared as an overlay to the geological maps,

(g) that all ground magnetic traverses and aeromagnetic flight lines within the area of the compilation geological maps of a scale of 1:24,000 also be plotted at a scale of 1:24,000 and that the location of these traverses also be prepared as an overlay to the geological maps,

(h) that an index map be presented showing which geologists mapped which portion of the requested 1:24,000 scale geological maps (see Interrogatories #2 and 36).

The following suggestions are made in hopes of producing geological maps of the highest possible quality:

(a) that the mapped units be in color as they are for Figures 3.1-12, 3.1-14, 3.1-15, 3.1-16, 3.1-17, etc., and the PSAR Figures 2.5-4b, 2.5-7s, etc.,

(b) that in addition to colors, individual strike and dip symbols be shown as they are in Figure 3.2-2 and 3.2-10 rather than the barely legible style used in Figure 3.4.31, (PSAR Figure 2.5-7ab is a possible model),

(c) that contacts (observed, covered, or inferred) be shown for mappable units (which might be defined as two or more nearby outcrops of similar lithologies) be shown so as to indicate the structural and stratigraphic features of the area,

(d) that by using techniques (a), (b), and (c), notations on the maps can be considerably reduced, thereby enhancing clarity of concept and of presentation,

(e) that the Applicant be encouraged to expand the area of the compilation maps here requested if he has available additional mapping at a scale of 1:24,000 or greater, and

(f) that if the compilation maps become so large as to be cumbersome, the Applicant consider preparing two or more adjoining maps (as Federal and State geological surveys commonly do for adjoining quadrangles).

ANSWER:

Many of the interrogatories that follow are requests for additional information, clarification of geological or geophysical data, and requests for a common data base of 1:24,000 within the area for which this interrogatory requests a compilation at a unified scale of 1:24,000. Thus some of the following interrogatories duplicate the request made here. If the Applicant meets the requests made herein and believes that in doing so he has answered individual interrogatories that follow, he should so indicate for each interrogatory.

INTERROGATORY NO. 9: Page 3.4.1-16 states that strandlines occur in Everson drift on either side of the "B&B" (and by implication the BB-LC) fault. Please provide the following information:

(a) a geological map of the Everson drift in the areas indicated on Figure 3.4.1-3 at a scale of 1:24,000 or greater. This map should depict the stratigraphy of the Everson in at least as much detail as the "Description of Map Units" given by Easterbrook (1976, USGS Map I-854-B) and by Siegfried (1978, M.S. AT WWU),

(b) the location of strandlines across the B&B fault that are known to be correlative,

(c) the evidence for the absolute age of these correlative strandlines,

(d) the methods for determining the altitudes of these strandlines within 10 feet (see Interrogatory No. 57), and

(e) because this map will be at a scale of 1:24,000, please include it as part of Interrogatory #8, including aeromagnetic data at the same scale.

ANSWER:

1269 094

INTERROGATORY NO. 10: Page 3.1-24 states that the rocks of the Church Mountain plate give "rise to a high-intensity magnetic background with high amplitude, short wave length magnetic anamolies characterizing the magnetic signature of the plate."

Please provide an aeromagnetic map of any major portion of the type area of the Church Mountain plate from the Canadian border to the Sauk River that shows its characteristic magnetic signature. For ease in comparison, please provide this map at the same scale and with the same contour interval of gammas as was used in Appendix I (or whatever map best characterizes the magnetic signature of the Church Mountain plate in the vicinity of the plant site; as indicated in Interrogatory No. 8, the best scale would be 1:24,000). Please evaluate or model the effects that differences in the (1) spacing of flight lines and (2) ground clearance of the aircraft in the two areas might have in making the magnetic signatures appear to be different.

ANSWER:

INTERROGATORY NO. 11: Please provide an aeromagnetic map of the San Juan Islands (from San Juan Island on the west to Interstate 5 on the east) showing the characteristic magnetic signature of these rocks. For ease in comparison, please provide this map at the same scale and with the same contour interval of gammas as was used in Appendix I (or whatever scale [such as 1:24,000] best characterizes the magnetic signature of the alleged Church Mountain plate in the vicinity of the plant site). Please evaluate or model the effects that differences in the (1) spacing of flight lines and (2) ground clearance of the aircraft in the two areas might have in making the magnetic signatures appear to be different.

ANSWER:

REQUEST FOR PRODUCTION NO. 3: Please provide the field notes, field maps, and compilation maps of the geological mapping mentioned on page 3.4.1-5 of Pleistocene sediments done for the 1978-1979 study. Please name all persons involved in this mapping.

If this mapping is available on a scale of 1:24,000, please include it as part of Interrogatory No. 8.

INTERROGATORY NO. 12: Please explain what lithological criteria can be used to distinguish the Shuksan thrust from other faults that may have juxtaposed rocks of the Shuksan plate agians the alleged "Church Mountain" plate.

ANSWER:

1269 097

INTERROGATORY No. 13: Figure 3.1-11 shows the alternative interpretations for a thrust plate south of the Skagit River. In Appendix E, pages E-6 and E-19 state that Vance believes that the rocks beneath the Shuksan thrust plate in the study area are correlative with some rocks of the San Juan terrane. Please list the reasons why Vance believes that these rocks are part of the "San Juan terrane" and the criteria he uses to distinguish "San Juan" rocks from rocks of the Church Mountain thrust plate.

ANSWER:

INTERROGATORY NO. 14: Please list the criteria that Bechtel and its consultants (especially Miller) use to distinguish "San Juan" rocks from rocks of the Church Mountain thrust plate.

ANSWER:

1269 098

INTERROGATORY NO. 15: Page E-19 states that greenschists have been recognized on the west side of upper Day Creek. Please indicate which of these samples are described in Table E-2 as implied on page E-19.

ANSWER:

INTERROGATORY NO. 16: Page 3.1-29 states that the Shuksan thrust is a zone. However, Figure 3.4.3-1 appears to be the only figure that shows even a portion of this zone as a separate mapable unit. Therefore, please show this zone on the 1:24,000 compilation map requested in Interrogatory No. 8 or the revised maps requested in Interrogatories No. 19 and 22) and on Appendix H (if this zone is wide enough to show at 1:62,500).

Wherever possible, please show the following within the thrust zone:

(a) the extent of exotic slices of serpentinite, silica carbonate rock, and other rock types,

(b) foliations within (a),

(c) shear zones, catalastic zones, and mylonitic zone, and

(d) any other features that are distinctive of this thrust zone.

ANSWER:

REQUEST FOR PRODUCTION NO. 4: If all of the evidence is not shown on Appendix H or described in Appendix G, please provide the maps and field notes that show and describe the evidence upon which each of the following geological maps is based:

1) 3.1-14,
2) 3.1-15,
3) 3.1-16, and
4) 3.1-17.

INTERROGATORY NO. 17: Page 3.1-29 states that the Darrington phyllite on Cultus Mountain has prominent and pervasive kink bands, crenulations, and quartz veins and pods. Please show the location and orientation of the king bands of discordant quartz veins on Appendix H, Figure 3.1-12, or Figure 3.1-14.

ANSWER:

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INTERROGATORY NO. 18: What other localities (other than the locality mentioned on p. 3.1-29) within the area of Appendix H have prominent kink bands and discordant quartz veins? Please give the strike and dip of these features at each locality.

ANSWER:

INTERROGATORY NO. 19: Page 3.1-29 states that the Shuksan fault as shown on Figure 3.1-12 and 3.1-14 is a zone marked by intensely sheared rock, serpentinite, and altered serpentinite. Please show the geographical extent of this zone on Figures 3.1-12 and 3.1-14 and the strike and dips measured on rocks within this zone.

ANSWER:

INTERROGATORY NO. 20: Cross section A-A of Figure 3.1-13 shows structures and lithologies in the Shuksan plate that do not appear on Appendix H (which, according to Note #1 is the source of the data for Figure 3.1-13). Please explain the source of the data for the following:

a) the antiform and synform shown in the Shuksan rocks underlying the Cultus mountain,

b) the stippled unit shown in the Shuksan rocks underlying Cultus Mountain,

c) what this stippled unit is, and

d) the synform shown in Shuksan rocks in the valley of Day Creek.

ANSWER:

INTERROGATORY NO. 21: To draw the eastward dipping zone of the Shuksan thrust fault shown on Profile A-A of Figure 3.1-14, marker units must have been recognized in adjacent holes (or in all three holes). Please describe these units, give their intercepts in each hole, and shown them on a cross section through the holes.

ANSWER:

INTERROGATORY NO. 22: Please show on Figures 3.1-15 and 3.1-16 the features that are discussed on pages 3.1-34 to 3.1-36:

a) the strike and dip of quartz stringers, highly crenulated foliation planes, and zones of contortion of the Darrington phyllite,

b) the geographic extent, and the strike and dip of the contacts of tectonic inclusions within the Shuksan thrust plate within the alleged Church Mountain plate in the southern half of sections 5, 8, and most of the western half of section 9, T34N, R6E,

c) the geographic extent, contacts, and strike and dip of the rocks of the prominent greenstone ridge that extends from Little Haystack Mountain through the west side of section 9 nearly to Rocky Creek,

d) all of the several folds mapped in the metasediments in the southwest quarter of section 5 north of Little Haystack Mountain,

e) the geographic extent, contacts, and the strike and dip of the contacts and of rocks in the several tectonic blocks that are well exposed in the SW/4 section 9,

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f) the strike and dip of the contact between the Shuksan plate and the serpentinite that is clearly faulted from Rocky Creek to the gap between Little Haystack Mountain and Talc Mountain, especially in Section 9, and

g) the geographic extent, contacts, and strike and dips of any other units or outcrops in the areas of Figure 3.1-15 and Figure 3.1-16 that are not shown on Appendix H. (One example might be the zone of intensely sheared rock at the base of Shuksan thrust as mentioned on pages 3.1-29 for other areas and as requested in Interrogatory No. 16).

ANSWER:

INTERROGATORY NO. 23: Please explain the reasons for the difference in the mapped location of the northern part of the major serpentinite belt in Figure 3.1-15 and in Appendix H.

If the strike and dip of the contacts and of the rocks adjacent to and within the serpentinite belt are available but are not shown on Appendix H, please show them on Figure 3.1-15 or the map requested in Interrogatory #8.

ANSWER:

1269 104

INTERROGATORY NO. 24: Profile A-A of figure 3.1-16 indicates that TH-3C and TH-3B penetrated two bodies of serpentinite within the Shuksan thrust plate. Please indicate where these units are describeed in the core logs of Appendix G.

ANSWER:

INTERROGATORY NO. 25: Page 3.1-37 and Appendix G indicat that hole TH-3C penetrated more than 90 feet of serpentinite. Please explain how this serpentinite is known to be the sam one that is shown on the map on Figure 3.1-16.

ANSWER:

1269 105

REQUEST FOR PRODUCTION NO. 5: The Applicants' geological interpretation of South Chucaknut Mountain remains substantially different than Schmidt's (1972). EDCON's interpretation of the aeromagnetic pattern over South Chuckanut Mount (Appendix A, Figure 23A to 23D) is presented at a scale of 1:24,000. Please submit a ggeological map with a scale of 1:24,000 (or larger) that shows the Applicant's interpretation of the geology and which was used as the geological base for EDCON's 1:24,000 study. Because part of the aeromagnetic pattern extends from Dogfish point on the northwest to Whitehall Creek on the south, a geological map at a scale of 1:24,000 (or larger) of all T36N/R3E is requested.

INTERROGATORY NO. 26: EDCON's interpretation that Goat Mountain is a body of ultrafamic rock that dips southwesterly 60 to 70° (Appendix A, p. 44) is different than the interpretation of Thompson (1973), Christensen (1971), and Thompson and Robinson (1975) that the much larger Twin Sisters body immediately to the north is essentially a flat lying slab only a kilometer or two thick. Please explain the reason that EDCON came to such a different conclusion.

Also please submit any geological map on a scale of 1:62,500 (other than Appendices H and I) or larger that the Applicant may have that supports EDCON's interpretation of the aeromagnetic data. This map should delineate the zones of serpentinization as these will drastically affect the magnetic signature of the body and the interpretations based thereon.

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ANSWER:

INTERROGATORY NO. 27. Please submit a geological map with a scale larger than 1:62,500 covering the area on Lyman Hill with a one mile radius beyond the mapped portion of the greenstone in Section 24, T36N, R5E that is shown in Appendix H.

Secondly in addition to Figure 22B and 22C of Appendix A, please indicate the best possible fit of a calculated magnetic response to the observed response of the body in Section 25 that can be generated by varing (a) the thickness of the body from 250 to 500 feet, (b) the length of the body in a northwesterly direction from 0.5 to 1.25 miles, and (c) the width of the body from 0.25 to 0.5 miles in a northeasterly direct. Assume during this modeling that the body is roughtly tabular and that it dips no more than 20° in any direction.

ANSWER:

INTERROGATORY NO. 28: Please provide the best two alternative 2 dimensional models to explain aeromagnetic high in sections 11, 12, 14 and 14, T 35N, R 4E and the adjacent aeromagnetic low to the northwest.

ANSWER:

INTERROGATORY NO. 29: Please explain what criteria the applicants used to distinguish Darrington phyllite from the pelitic rocks of the San Juan Islands. That is, if both rocks occurred within the same area, what criteria could be used to tell them apart?

ANSWER:

1269 108

INTERROGATORY NO. 30: Please explain the basis for the statement on page 3.2-3 that if a normal fault were parallel to Gilligan Creek, it "would require a minimum of 1500 ft. of down-on-the east displacement".

Please provide the numerical value (or range of values) of the dips, amount of apparent offsets, and other data that were used to calculate the 1500 feet of displacement.

ANSWER:

INTERROGATORY NO. 31: Assuming that the Gilligan Creek fault does exist in the location shown by Whetten (Figure 3.1-11) but that the Shuksan thrust plate dips in the direction opposite to that shown by Whetten (that is, about as shown in the PSAR Interpretation and the Vance Interpretation of Figure 3.1-11), please calculate the maximum and minimum possible offsets of the Gilligan Creek fault for two possibilities:

a) if it were a high angle (predominantly dip-slip) fault;

b) if it were a strike-slip fault.

Thus, four calculated offsets are requested. Please provide the numerical values of the dips, amount of apparent offset, and other data used to make each of these four calculations.

ANSWER:

INTERROGATORY NO. 32: Please draw a non-diagrammatic (i.e. actual) cross section along A-A of Figure 3.1-12 (to replace A-A of Figure 3.1-13). Please extend this cross ection to the same depths as shown in cross section A-A of Figure 3.1-13. Because this cross section is within the area of the compilation map requested in Interrogatory No. 8, please present this cross section at a scale of 1:24,000.

ANSWER:

INTERROGATORY NO. 33: Please provide a geological map of the glacial sediments referred to on pages 3.2-5, 3.2-8, and 3.2-12. The scale of this map should be the same as Figures 3.2-2 and 3.2-3.

ANSWER:

INTERROGATORY NO. 34: Please indicate the location and orientation (strike and dip symbols) of the following on Figure 3.2-2:

a) the kink banding and isoclinal folding of intervals of Darrington phyllitementioned on p. 3.2-2,

b) the deformed glacial clays shown in the NW/4 section 35, at the mouth of Gilligan Creek;

c) serpentinites in Section 13 adjacent to Gilligan Creek that are shown on Appendix H,

d) belts of greenschist or other lithologies within the Darrington phyllite.

ANSWER:

1269 111

INTERROGATORY NO. 36: Please indicate which geologists mapped which portions of the area of Figure 3.2-2 and when each mapping project was conducted.

ANSWER:

INTERROGATORY NO. 36: A comparison of Figure 3.2-2 and 3.2-5 indicates that the lineation labled 4 in Section 31 (in the upper Bear Creek drainage) is not coincident with the edge off the Bear Creek slide as stated in the Explanatiion to Figure 3.2-5. Please provide another explanation for this lineation.

ANSWER:

INTERROGATORY NO. 37: Please present all figures in Appendix B (which show ground magnetic lines) at the same scale as the geological maps with which they are to be used. For example, Figures B-5 and B-6 should be presented at the same scale as Figures 3.2-2 and 3.2-5, Figure B-4 should be at the same scale as Figure 3.2-10, etc.

ANSWER:

1269 113

INTERROGATORY NO. 38: With regard to the ground magnetic survey discussed on page 3.2-14, please explain what type of magnetic anomaly was anticipated near the mouth of Gilligan Creek where Darrington phyllite would be faulted against Darrington phyllite according to the Whetten Interpretation of Figure 3.1-11.

With regard to the anomalies detected near the mouth of Gilligan Creek, they are reported to be related to terrain effects or other near surface features (pages 3.2-14 and B-7). Please explain what these other near-surface features are and where they are on specific traverses.

ANSWER:

INTERROGATORY NO. 39: With regard to the gravity survey across the mouth of Gilligan Creek mentioned on page 3.2-14, please indicate the depth to bedrock beneath isogals 32 and 29 (at the edge of the Skagit River) and calculate the maximum

offset that could occur in the bedrock at those depths that would remain undetected by the gravity survey.

ANSWER:

INTERROGATORY NO. 40: Figures 3.2-10, 3.1-17 and 3.4.3-1 are almost identical in scale and show the same geological units, but within their area of overlap they differ somewhat. Please combine these three maps into a single map at a scale of approximately 1:24,000 and indicate which of the three current maps is preferred and why.

ANSWER:

1269 115

INTERROGATORY NO. 41: With regard to the shear zone mentioned at the bottom of page 3.2-17, where in figure 3.2-10 are the overlying Chuckanut strata along the strike of this shear that the shear allegedly does not cut?

If these strata are beyond the limits of Figure 3.2-10, please enlarge the areal extent of Figure 3.2-10 to include the Chuckanut strata.

ANSWER:

INTERROGATORY NO. 42: With regard to the ground magnetic survey discussed in section 3.2.5.4 on page 3.2-18, please explain what type of magnetic anomaly was anticipated near the mouth of Day Creek where Darrington phyllite would be faulted against Darrington phyllite.

ANSWER:

INTERROGATORY NO. 43: Please indicate the thickness of unconsolidated sediments over bedrock along the traverse shown in Figure B-4 and evaluate the effect of this variable thickness on the profiles shown.

ANSWER:

INTERROGATORY NO. 44: Please indicate on the map compiled from Figures 3.1-17, 3.2-10, and 3.4.3-1 (as requested in Interrogatories No. 8 and 40 15), or on an overlay at the same scale, the location of the flight lines of the LKB aeromagnetic survey that are shown in Figure 17 of Appendix A.

In addition, please show on the map compiled from the above figures (or on an overlay at the same scale) the location of the ground magnetic surveys shown in Figure B-1.

ANSWER:

1269 117

INTERROGATORY NO. 45: Please provide all of the ground magnetic profiles indicated on Figure B-1 that are not currently included in Appendix B. Please draft these profiles at the same scale as the largest scale geological maps available (or as overlays for these maps).

ANSWER:

INTERROGATORY NO. 46: In the gravity survey mentioned on page 3.2-18, please indicate the depth to bedrock beneath isogals 28 to 34 where they cross Day Creek and calculate the maximum offset in the bedrock at those depths that would remain undetected by the gravity survey.

ANSWER:

1269 118

INTERROGATORY NO. 47: Please provide the following information on each of the aeromagnetic highs (except Butter Hill and South Chuckanut Mountain) with more than 100 gammas of closure on that part of Appendix I southwest of a northwesterly line drawn through the southwestern part of the town of Sedro Woolley:

a) the composition, depth, and orientation of alternative models for the causitive bodies,

b) maps similar to 22B, 22C, 23B, 23C, 23D of appendix A for the observed high and for the alternative models of each high.

ANSWER:

REQUEST FOR PRODUCTION NO. 6: On page 3.4.1-2 and on Figure 3.1-4 personal communications are attributed to Peter Misch. Please provide the follow information:

a) the person to whom each personal communication was addressed,

b) the date of each personal communication,

c) the text of this communication if it was written, and

d) if the text of the communication was not written, please have Peter Misch write an appropriate text that also includes the evidence for his conclusions.

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ANSWER:

INTERROGATORY NO. 48: Please show on Figures 3.4.1-1, 3.4-2, or 3.4.1-3 the linear features that are discussed on page 3.4.1-3.

ANSWER:

REQUEST FOR PRODUCTION NO. 7: Please provide the field notes, field maps, and compilation of maps of the geological mapping mentioned on page 3.4.13 as having been done for the 1978-1979 study. Please name all of the persons who conducted this mapping.

REQUEST FOR PRODUCTION NO. 8: Please provide the log of the telephone call of April, 1978 to Dr. Peter Ward (see pages 2.4.1-5 to 3.4.1-6).

INTERROGATORY NO. 49: With regard to the geology of the No Name Creek area depicted in Appendix H and Figure 3.4.3-1, please describe the following:

(a) any mappable units that were recognized within the Chuckanut formation,

(b) any mappable units that were recognized within the Chuckanut formation,

(c) any mappable units that were recognized in the alleged "church Mountain plate",

(d) any faults other than the Shuksan thrust were recognized, and

(e) whether any attempt was made to trace any of the features described in (a), (b), (c), or (d) along strike away from No Name Creek.

ANSWER:

1269 121

INTERROGATORY NO. 50: Page 3.4.2-4 states that "Surface sediments have been incorporated into the flow complicating the internal structure... No shearing or slikensides were found in the andesite dike-rock which constitutes the bulk of the knob, in which the sheared flow rock occurs."

Does this description include the nob of volcanic rock labeled "Ev" shown near the center of Section 14, T 33N, R5E? If not, please identify the location of the knob described above.

ANSWER:

INTERROGATORY NO. 51: Please explain the significance of the following features that occur in the knob of volcanic rock in Section 14, T 33N, R5E:

(a) the large slickensided joint that strikes approximately N30°W and dips approximately 70°NE near the top of the quarry,

(b) the tectonic lens of volcanic rock bounded by sheared argillite near the top of the talus in the western part of the quarry (the shear bounding the upper part of the lens strikes about N30°W and dips about 30°NE,

(c) the shear that strikes about N20°E and dips about 50° NE across the eastern part of the quarry, and

(d) the pervasive fracturing and local hydrothermal alteration of the rocks in the quarry.

ANSWER:

INTERROGATORY NO. 52: In the discussion of the age of the Chuckanut formation starting on page 3.4.1-6 reference is made to the Comox formation and to Ward's stratigraphy, neither of which are included on Figure 3.4.1-5 entitled "Stratigraphic Relationships Nanaimo and Chuckanut." In order to evaluate the age of the Chuckanut, please include the following on Figure 3.4.1-5:

a) Comox formation,

b) Ward's stratigraphy (1978) including his concept of the relative age of the Chuckanut formation and the Extension formation,

c) the relationship to the faunal stages of the Upper Cretaceous or the Paleogene that each author assigns to the formation shown,

d) the relationship of the DeCoursey formation to the Chuckanut formation (page 3.4.1.9),

e) which formations in the table are continental-deltaic deposits (page 3.4.1-10 states that Table 3.4.1-5 shows which deposits are continental-deltaic deposits, but this is not shown on the table).

f) the constraints on the age of the Chuckanut formation imposed by sample 26 of Table F-1.

ANSWER:

1269 123

INTERROGATORY NO. 53: Page 3.4.1-9 states that Bechtel conducted mapping in the San Juan Islands. Please provide the following:

a) the names of all geologists (including paleontologists) involved in the mapping,

b) the paleontological and lithological criteria for identifying each of the formations that were mapped or studied, and

c) the names of any paleontologists that advised the Applicant in any way.

ANSWER:

REQUEST FOR PRODUCTION NO. 9: Please provide all field notes, field maps, and compilation maps, and all other documents produced by the geologists (including paleontologists) named in the response to Interrogatory No. 53.

INTERROGATORY NO. 54: On pages 3.4.1-8 to 3.4.1-10 and on Figure 3.4.1-5 a number of authorities are cited on the Nanaimo strata and the Chuckanut formation. These include the Bechtel

employees to be named in the foregoing interrogatory and the following consultants to the Applicants: Miller, Misch, Vance, and Easterbrook.

Please have each of these authorities provide in writing:

(a) both the paleontological and the lithological criteria that they use for correlating the Chuckanut formation with any part of the Nanaimo group,

(b) Their reasons for disputing any of the correlations attributed to Ward in Section 3.4.1.3 or made by him in his letter of 5 December 1977, or in his 1978 article, and

(c) their evaluation of Ward's assertion in his letter 5 December 1977 that "... there has never been any discovery of Nanaimo fossils on the mainland of British Columbia or in Washignton State. The report of Mathews (1958 of Inoversamus schmidti from Mt. Garibaldi was a misidentification..."

ANSWER:

1269 125

INTERROGATORY NO. 55: Pages 3.4.1-10 and 3.4.1-11 and Figure 3.4.1-4 imply that the Chuckanut formation is coeval and on strike with the Gabriola formation. Please discuss all possible structural implications of these relationships, especially if these formations are correlative (coeval) but not equivalent.

ANSWER:

INTERROGATORY NO. 56: Please describe any instrumental methods that were used to determine the altitudes of any correlative strandlines (see page 3.4.1-15). Please provide the names of the persons who performed these instrumental determinations.

Please provide references to any publication or report that cites any instance in which the altitudes of correlative strandlines have been instrumentally determined within an error less than 10 feet.

ANSWER:

1269 126

INTERROGATORY NO. 57: With regard to Appendix H, please explain the following:

a) the criteria for including the Tertiary units in T 33 N west of Interstate 5 within the Chuckanut formation,

b) the reason for reversing the barbs on the thrust fault shown by Schmidt (1972) on south Chuckanut Mountain, especially as the photograph he labels Figure 20 shows Yellow Aster complex over phyllite,

c) the location of unit Mn (which is listed under "Geologic Units" on the explanation to Appendix H).

d) the reason for the omission of the fault that trends southeasterly from Chuckanut Bay through Chuckanut strata and which is shown on Figure 3.1-3, Figure 2 of Miller and Misch (1963), and Figure 2.5-4b of Amendment No. 19 of the PSAR).

e) why the areas of outcrop of the Chilliwack group rocks north of the confluence of Rocky and Day creeks and of Chuckanut strata north of Day Lake that are shown in Figure 3.1-3 are not shown,

f) why the ridge to southwest of the upper portion of Day Creek (near Day Lake) is shown as Church Mountain thrust plate but is shown as being underlain by rocks of the Shuksan plate in Figure 3.1-3,

g) why the outline of the alleged Shuksan thrust near Table Mountain is substantially different than as shown on Figure 3.1-3.

h) why in the vicinity of Devils Mountain map unit Ev appears to be in contact with (and presumably overlies) the Chuckanut formation; whereas on Figure 3.1-3 what appears to the the same "Eocene silicic volcanic and sedimentary rocks" are in contact with rocks of the Chuch Mountain plate,

i) why the contact between rocks of the Shuksan Plate and Chuckanut strata is shown as a depositional one in section 17, T 33 N, R 7 E; whereas in Figure 3.1-3 the same contact is shown as a fault,

j) why the rocks in the NW corner of Section 18, T 33 N, R 7 E are thought to be Tertiary grantic rocks; whereas in Figure 3.1-3 these are shown as rocks of the Church Mountain plate,

k) the distinctive nature of the descriptions of the cuttings at a depth of 700 feet in the well in section 32, T 36 N, R 4 E that permit the rocks to be identified as Darrington phyllite rather than pelitic rocks within the Chilliwack group or within the San Juan rocks,

l) why the area of outcrop of greenstones and serpentinites on the northwestern side of Lyman Mountain and at Mt. Josephine are so much smaller than as shown in Figure 3.1-3, and

m) the tectonic significance of serpentinite mapped within the Chuckanut formation.

The following suggestion is made as an aid in responding to this interrogatory:

Rather than submitting a written answer to some portions of this interrogatory, it may be simpler to revise Appendix H (as is also suggested in Interrogatory No. 58) and then to note that the answers to specific parts of this interrogatory can be found on the revised map.

ANSWER:

1269 128

INTERROGATORY NO. 58: With respect to Appendix H, please show or provide the following:

a) formational labels for the following outcrops or units:

	Portion of Section	Section	Township North	Range East
1.	NE NW	4	33	5
2.	E half	14	34	6
3.	SW NE	29	34	5
4.	units on south edge of map			7 & 8
5.	center	7	33	6
6.	SW	31	33	7
7.	NE	32	33	7
8.	SE	12	33	6
9.	SW	7	33	7
10.	SW	3	36	3
11.	S edge	29	35	5
12.	center	22	33	7
13.	NE SW	19	35	8
14.		28	35	8
15.	NW	7	35	8
16.	NW	13	36	6
17.	SW	12	36	6
18.	SW	18	36	6
19.	NE	26	36	6
20.	SW	24	36	6
21.	NE	13	36	3
22.	NE	20	34	7
23.	center NE	13	33	4
24.	SW	6	33	3
25.	SE	36	34	2
26.	SE NE	23	33	7
27.	NW	33	37	6
28.	SE SW	7	36	6
29.		9 & 10	32	5
30.		28 & 33	33	5
31.	NW SW	10	33	7

b) how the queried contacts in Sections 19 and 30 of T 33 Range 8 E continue to the east,

c) resolutions of discrepancies between the present version of Appendix H and other geological maps in the 1978-1979 report,

d) delineation of the Darrington phyllite from the Shuksan greenschist within the Shuksan thrust plate. Note that pages 3.1-25 to 3.1-26 state that the greenschist "is mapped generally in the southeast part of the map area (see the geologic map in appendix H)". Note also that the greenschist is shown on the smaller scale map of Figure 3.1-3 (Sheet 1) and also is shown by Morrison (1977) and Wilson (1978). Thus, this information must be available. This portion of this interrogatory, therefore, also applies to the 1:24,000 Map of the bedrock requested in previous interrogatories).

e) delineation of the Chilliwack group rocks from Mesozoic rocks, especially Mesozoic rocks of San Juan affinities, in the alleged Church Mountain thrust plate (this portion of this interrogatory probably also applies to the 1:24,000 map of the bedrock requested in previous interrogatories)

f) delineation of "Tectonic slices of metaplutonic rocks, Pre-Dev. - Mesozoic (?)" from other rocks of the alleged Church Mountain thrust plate as is done in the smaller scale map of Figure 3.1-3 and by Miller (1979, in press).

g) the position of the greenschist belt which page E-19 states that "Field observations indicate that the belt is probably bounded by tectonic contacts... Geologic Map, Appendix H)."

ANSWER

1269 130

INTERROGATORY NO. 59: In Appendix D Miller states that "All of the structures can be related to either the mid-Cretaceous or Eocene orogenies...", but in the preprint of his paper entitled "Western extent of the Shuksan and Church Mountain Thrust Plates" he states (p. 3) clastic deposition "was followed by mild folding and faulting of probable Miocene and younger age." Please explain what appears to be a contradiction in these two statements.

ANSWER:

INTERROGATORY NO. 60: Please explain the following apparent anomalies on Figure 3.1-3 and make any corrections to Appendix H that may be required by these explanations:

a) the apparent thrusting of the Church Mountain plate over the Shuksan greenschist in the area adjacent to the north-eastern border of Sheet 2,

b) the repetition of the Shuksan thrust east of Deer Creek on Sheet 2

c) the curved traces of the faults that bound the Church Mountain rocks at Mt. Josephine (such a configuration would seem to preclude a horst, and barbs are needed if these faults are imbricate thrusts).

ANSWER:

INTERROGATORY NO. 61: Page 3.4.2-3 states that geologic mapping has been done by Bechtel geologists in Walker Valley since April 1978. Please name all persons who conducted this mapping and describe their geographic and geological areas of responsibility.

ANSWER:

REQUEST FOR PRODUCTION NO. 10: Please provide the field notes, field maps, compilation maps and other documents pro-

duced during the geologic mapping ntoed in Interrogatory No. 61.

INTERROGATORY NO. 62: Please submit a sufficiently detailed geological map on a scale of 1:24,000 or greater that will verify the following statements:

a) with regard to the N 70° W fault mapped by Lovseth (1975) and Jenkins (1924) "nearly continuous, unfaulted exposures of Chuckanut sandstones and minor siltstones cross this projection without evidence of fault offset" (p. 3.4.2-3),

b) with regard to Lovseth's N 30° W linear segment, "mapping demonstrates that the contact is not as linear as Loveseth indicated; rather it curves in a repeated S-shaped pattern..." (p. 3.4.2-4),

c) with regard to the N 30° W contact "that similar volcanics... locally cover or interrupt the contact, without apparent offset" (p. 3.4.2-4),

d) with regard to Lovseth's N 30° W fault segment "The Devils Mountain fault zone crosses this projection...without offset" (p. 3.42-5)., and

e) with regard to Oligoncene conglomerates on Frailey Mountain on strike with Lovseth's N 30° W fault segment, "they are not disrupted by northwest-trending faulting" (p. 3.4.2-5).

In addition, this map should have sufficient detail to refute the following:

f) "All lineations associated with the [Devils Mountain] fault zone are interrupted and discontinuous including the most prominent feature... The lineation is clearly interrupted on the imagery for about one mile. The easternmost segment of this lineation...terminates against ridges, found by field mapping to be formed by conglomerate." (PSAR Amendment No. 11, p. 2.5-10c),

g) with regard to the Tertiary volcanic rocks, Lovseth's statement (see Cheney, 1978, p. 22) that these rocks are cut by northwesterly trending shears.

In addition, Aero Service Aeromagnetic Sheet 1 (proprietary Figure 8 of Appendix A) with the location of the flight lines indicated upon it is requested as an overlay to the geological

map of this area in order to verify the discussion of the following on p. 3.4.2-5:

> h) the coincidence of a sinuous aeromagnetic gradient with Lovseth's N 30° fault, and
>
> i) the coincidence of Lovseth and Jenkin's N 70° W fault with the strong N 60 to 70° W gradient (The discussion of the aeromagnetic patterns mentioned in (h) and (i) should include calculated models to evaluate the depth, composition, and orientation of the causitive bodies, including the possibility that the N 70° fault is not as steep as Lovseth inferred),
>
> j) the lack of any interruption of the isogammas along the Devil's Mountain fault on striike with the N 30° W trend

In addition, Amendment No. 19 of the PSAR includes a report by Harding-Lawson Associates on ground-based gravity and magnetic surveys in this area. This information should be discussed, the location of traverses shown on the overlay requested above, and the profiles of Harding and Lawson should be presented at a sale of 1:24,000.

ANSWER:

INTERROGATORY NO. 63: Please show Figure 3.4.3-2 at the same scale as the map and cross sections requested in Interrogatory No. 8. Do not make any portion of the cross section diagramtic. Show the Darrington phyllite and the Shuksan greenschist as separate units. Show any other units that the responses to Interrogatories No. 8 and 57(e) indicate to be present.

ANSWER:

INTERROGATORY NO. 64: Page 3.4.3-7 points out that the PSAR concludes that the "anti-slope scarps" or "sackung" features along the Straight Creek fault are not of tectonic origin. However, McClearly, Dohrenwend, Cluff, and Hanson (1978, Straight Creek Fault study zone, a report prepared by Woodward-Clyde Consultants for United Engineers and Constructors, INc., as part of the WPPSS study of the 1872 earthquake, 72 p.) tentatively came to the opposite conclusion. Please evaluate each piece of

evidence that McClearly, et al. tentatively advance in favor of a tectonic origin, and document where Bechtel's evidence is more extensive and more definitive that than of McClearly, et al.

ANSWER:

INTERROGATORY NO. 65: Assuming for the moment that the "sackung" features described in section 3.4.3 are tectonically induced, to what known or hypothesized faults could they be related?

ANSWER:

1269 136

INTERROGATORY NO. 66: According to page 3.5-4 and page 52 of Appendix A, Anomaly #5 is caused by a 15 to 20 foot thick ferruginous schist (hereinafter referred to as a banded iron formation or BIF) at or ner the surface, and Anomaly #3 is caused by a similar body. Please explain the following:

a) where EDCON's report states that the causitive body of Anomaly #3 plunges from 500 feet to 4000 feet below the surface (see page 3.4-4),

b) how such a thin, discontinuous, impure BIF at such great depth could create an anomaly as large as #3; whereas bodies closer to the surface in the Finney Creek area (described by Morrison, 1977) do not generate such a big anomaly on appendix I,

c) how thick and how long a BIF would be required at depths of 500 to 4000 feet to generate Anomaly #3,

d) the evidence that the Chuckanut rocks at the plant site are in a northwestward plunging syncline (see page 3.5-4),

e) why the magnetic body had to be emplaced prior to folding of the Chuckanut; for example, why can't the anomaly be a mafic or ultramafic rock emplaced along a fault.

Because Shedd (1922) and Morrison (1977) indicate that the BIFs are close to the contact between the Darrington phyllite and the Shuksan greenschist, this contact must be mapped to evaluate the hypothesis that a BIF is the causative body. Thus, the area surrounding ths anomaly as well as the contact elsewhere should be included in the area to be mapped at 1:24,000.

ANSWER:

INTERROGATORY NO. 67: If the Devil's Mountain fault is a southward dipping normal fault as stated on page 3.5-5, how can the "autochthonous" rocks below the alleged Church Mountain plate occur at the surface on the south side of the fault; that is, how can structurally lower rocks occur at the surface on the downthrown side of the fault?

ANSWER:

INTERROGATORY NO. 68: Please provide an explantion for the following relative to the Devils Mountain fault:

a) why the aeromagnetic anomalies bend southeastward as they approach the fault from the north (see Appendix I),

b) why lineations bend southeastward as they approach the fault from the north (see Figure 3.2-6) and

c) why the "autochthonous" rocks south of the fault bend northwestward as they approach the fault from the south (see Figure 3.1-3).

ANSWER:

INTERROGATORY NO. 69: Please explain the ways in which the gravity survey described in Appendix C is superior to the one conducted by Smith and Foxhall (1976, Appendix 2M, Amendment No. 11 of the PSAR), and, conversely, the aspects of the survey by Smith and Foxhall that are superior.

Explain whether it is practical or not to combine the results of these two surveys into a single map.

ANSWER:

1269 139

INTERROGATORY NO. 70: Please include the results of Easterbrook's study of 3 April 1979 in Appendix D on the previously requested 1:24,000 map of glacial sediments.

ANSWER:

INTERROGATORY NO. 71: The following pertain to the report of Easterbrook in Appendix D dated 3 April 1979. Please explain or provide the following:

a) the location on Figure 1 (or other appropriate figures) of the several outcrops that were used to compile the composite section shown in Figure 3 (this information could be supplied on the 1:24,000 map of glacial sediments)

b) how cuttings from auger holes can be used to determine whether sediments have been overriden by ice.

c) a discussion of the discrepancies, if any, and the reasons for these discrepancies, between the logs of adjacent USGS and Bechtel auger holes

d) the altitude of the collar of each auger hole,

e) Dr. Easterbrook's logs of each hole,

f) the following additions to Figure 4,

1) an explanation describing the patterns used to describe the various types of sediments in each hole,

2) the hole number for each log shown, and

3) a datum of 895 feet showing the altitude of the collar of each hole,

g) the location, extent, and thickness of the morainal ridge that is reported to be 1/2 mile west of the auger holes

h) a description of the processes that commonly are thought to generate "flow tills,"

i) the units that unequivocally correlate from hole No. 20 through 21, 22, and 23 below a depth of 25 feet, thereby indicating lack of offset,

j) depiction of the synclinally folded units on Figure 4,

k) the evidence (including 14 C ages and detailed stratigraphic studies) that the basal till encountered in the auger holes is Vason as assumed on page 7.

l) the maximum offset that could occur in the basal till (but not the overlying sediments) that could escape detection between holes 1 to 20, between 25 and 1, and between 20 to 23,

m) the orientation, location (both on the requested 1:24,000 map and on Figure 4) and origin of the fractures described as having 1 to 4 feet of displacement.

n) a geological map showing the extent and orientation of the units shown in the composite section (Figure 3) and in Figure 4,

o) Dr. Easterbrook's geological cross section drawn through the drill holes, and any other cross sections he drew through the area of the geological map requested in (n) above,

p) the thickness of the till penetrated in holes 21, 22, 23, and 25 compared to the thickness of the upper till penetrated in holes 1 to 20,

q) the lithological criteria that can be used to distinguish the till encountered in holes 21, 22, 23, and 25 from the till encountered at about 20 feet in holes 1 to 20, and

r) a correlation of the sediments below the till penetrated by holes 21, 22, 23, and 25 with the sediments below the till encountered at about 20 feet in holes 1 to 20.

ANSWER:

INTERROGATORY NO. 72: Table F-1 and Figure F-1 do not adequately locate the rocks that have been dated. For example, sample 26 reputedly was collected from Section 2, T33 N, R 7E: yet no outcrop symbol for a grantic rock occurs in that section on appendix H; so it is difficult to evaluate the significance of the sample and impossible to collect a duplicate sample. Thus, this interrogatory requests that dated samples be identified on the detailed maps requested in earlier interrogatories.

ANSWER:

INTERROGATORY NO. 73: Page F-2 states that a search for radiolaria was unsuccessful. Please indicate which outcrops were investigated, the methods used to search for radiolaria and the names of the persons who collected, processed, and examined the specimens. Please provide the professional qualifications of these persons.

ANSWER:

INTERROGATORY NO. 74: With regard to petrographic examinations of the thin sections of dated rocks please provide the following:

a) the name of the persons who examined the thin sections,

b) the professional qualifications of these persons,

c) the petrographic descriptions of the thin sections.

The sample numbers of the thin sections range from 1 to 33. Few such numbers appear to be present in Table E-2. If this is not the case, please indicate which samples in E-2 were dated. Otherwise, the simplest way of responding to this interrogatory might be to include the dated samples in Table E-2.

ANSWER:

INTERROGATORY NO. 75: Please provide the names of the formations from which the samples were collected for dating. This is done for a few samples in the text, but needs to be done for all samples in Table F-1 and Figure F-2 (or in a single table that includes the formational names, petrographic descriptions, and the information now appearing separately in Table F-1 and Figure F-2).

ANSWER:

INTERROGATORY NO. 76: Which of the three samples discussed in Section 4.1.2 is deuterically altered?

ANSWER:

1269 145

INTERROGATORY NO. 77: What are the Eocene volcanic rocks on the San Juan Islands that are referred to on the bottom of page F-9?

INTERROGATORY NO. 78: Which of the pre-Tertiary igneous rocks listed in Table F-1 retain enough of their original mineralogy and texture to suggest that K-Ar age may approximate the true age of the rock? Note that this interrogatory might be satisfactorily answered by a satisfactory response to Interrogatory No. 74.

ANSWER:

INTERROGATORY NO. 79: Which of the pre-Tertiary rocks listed in Table F-1 have been dated by other means by other authors? If the results of Table 1 and the other authors yield concordant dates, what is the significance of these concordant dates?

ANSWER:

INTERROGATORY NO. 80: With regard to the lithological logs of the drill holes accompanying Appendix G, please supply the following:

a) the names and professional qualfications of the persons who logged each hole (or parts of a hole),

b) the names and professional qualifications of the persons who assigned formational names to the lithologies described in the logs (The formational names do not occur on the logs but had to be assigned for such Figures as 3.1-14, 3.1-15,, 3.1-16, 3.1-17, etc.),

c) so that no uncertainty can arise about which lithologies have ben assigned to which formation or mappable unit, logs of each hole are needed that state the intercepts of each formation and mappable unit and of all shear zones, mylonitic zones, or faults of sufficient importance to be shown on Figures in the PSAR or the 1978-1979 Report.

ANSWER:

1269 147

INTERROGATORY NO. 81: As a result of the gravimetric survey of Appendix C, it must be possible to revise a portion of the State Bouguer Gravity Map (Bonini, Hughes and Danes, 1974, Wash. Div. Geology and Earth Resources, Geologic Map GM-12), and thereby improve the gravimetric evidence for the absence or presence of structures of regional importance. Therefore, please provide at a scale of 1:500,000 a revision of Bonini et al. between 121°50' and 122°15' West Longitude and between 48°25' and 48°35' North Latitude. A minimum of the following gravity base stations from Plate 1 should be shown: COKBAS, 57, 75, 22, 681, 36, 80, 610, 57, 21, 564, and 67.

ANSWER:

1269 148

INTERROGATORY NO. 81: As a result of the gravimetric survey of Appendix C, it must be possible to revise a portion of the State Bouguer Gravity Map (Bonini, Hughes and Danes, 1974, Wash. Div. Geology and Earth Resources, Geologic Map GM-12), and thereby improve the gravimetric evidence for the absence or presence of structures of regional importance. Therefore, please provide at a scale of 1:500,000 a revision of Bonini et al. between 121°50' and 122°15' West Longitude and between 48°25' and 48°35' North Latitude. A minimum of the following gravity base stations from Plate 1 should be shown: COKBAS, 57, 75, 22, 681, 36, 80, 610, 57, 21, 564, and 67.

ANSWER:

1269 149

INTERROGATORY NO. 82: Page E-20 makes much of the alleged widespread occurrence of titaniferous augite. Please explain why the trace element composition of the host rocks might not prove to be more diagnostic of originally similar (or different) protoliths than the presence of titaniferous augite.

ANSWER:

INTERROGATORY NO. 83: With regard to the petrographic descriptions of Appendix E, please provide the metamorphic facies of each rock (specify index minerals) or the reasons why a metamorphic facies cannot be assigned to the specimen.

Please also include this information in the description requested in Interrogatory #74(c).

ANSWER:

INTERROGATORY NO. 84: If Interrogatory #83 is not answered, please provide the thin sections of all of the metavolvanic rocks, greenschists, greenstones, and ultramatic rocks described in Tables E-1 and E-2 and rocks of these types that are included in Interrogatory #74(c).

ANSWER:

1269 151

INTERROGATORY NO. 85: Please provide the following information with regard to thin section 760-16 described on page E-9 and in Table E-2:

a) which of the characteristics described in Table E-2 can be used to identify this rock as Shuksan greenschist,

b) the extent (including contacts on the map requested in Interrogatory #8) of this biotic rock type, and

c) the tectonic significance of this rock type at this locality.

ANSWER:

INTERROGATORY NO. 86: With regard to the type of low frequency seismic reflections lines run by MOBIL in the Strait of Georgia and shown on Figure 3.4.1-7 please indicate whether such surveys can routinely recognize faults within the following:

a) plutonic igneous rocks and metamorphic rocks,

b) metamorphic rocks, including phillites, and

c) clastic sedimentary rocks with dips in excess of 40°,

In addition please indicate whether such surveys can recognize faults that juxtapose the following:

d) plutonic igenous and metaigneous rocks against metamorphic rocks (including phillites),

e) plutonic igneous and metaigenous rocks against clastic sedimentary rocks with dips in excess of 40°, and

f) metamorphic rocks (including phyllites) against clastic sedimentary rocks with dips in excess of 40°.

ANSWER:

INTERROGATORY NO. 87: Where the answer to any part of Interrogatory #86 is yes, please cite an an example of such a record as a Figure published in a well known scientific journal (such as AAPG Bull.) or a textbook.

ANSWER:

INTERROGATORY NO. 88: Have the Applicants obtained any age determinations on the sediments penetrated by the high frequency seismic reflection surveys shown in Figure 3.4.1-7 or by the high frequenc_ surveys between Whidbey and Lopez Islands?

ANSWER:

1269 153

INTERROGATORY NO. 89: Figure 3.4.1-7 shows the intersection of the inferred "Ward fault" with MOBIL seismic line 70-9. Dobrin's letter of 15 May in Appendix D implies that near this intersection "the trend of events leads to the identification of the reflections just above "b..ement" on W-70-9 as Miocene."

Please describe in detail how this identification of Miocene was made on that part of W-70-9 and southwest of the "Ward fault." In answering this interrogatory please include traces of the relevant parts of lines W-70-4, and the entire length of W-70-9, marking the contact between the middle Eocene and the Miocene in blue and the contact between the Miocene and the Pleistocene in green.

ANSWER:

INTERROGATORY NO. 90: Referring to Figure 3.4.1-7, in your professional opinion, what is the reason that MOBIL did not run its low frequency seismic reflection lines east of 122° W longitude?

ANSWER:

1269 154

INTERROGATORY NO. 91: If the last paragraph of page 2 of Dobrin's letter of 15 May 1979 in Appendix D is considered to be a substantive argument, please describe the traces of the following faults:

a) Devil's Mountain (Whetten, 1978)
b) San Andreas south Latitude 36° N
c) Denali of Alaska
d) Hosgri and related faults of California
e) Fraser - Ross Lake of British Columbia and Washington
f) Fairweather on Land in Alaska
g) San Andreas north of 39° N
h) Garlock fault of California
i) Big Pine of California
j) Atacama of Chile
k) Tintina - Kaltay fault of Alaska
l) North Anatolian fault of Turkey
m) Median tectonic line of Japan
n) Phillipine fault on northern Luzon Island
o) Motagua fault, Guatemala

ANSWER:

INTERROGATORY NO. 92: Please clarify the following (from Page 33 of Appendix A):

a) what a "geological inhomogeneity" is, and
b) what combinations of rock types might cause a susceptibility contrast of 500 x 10^{-6} cgs units.

ANSWER:

INTERROGATORY NO. 93: With regard to the samples listed in Appendix 1 of Appendix A, please provide the following information:

a) the megascopic difference between samples labeled either "metavolvanic" or "metaplutonic" and those labeled "greenstone."
b) any petrographic descriptions that have been made of thin sections of any of the samples of sites 1 to 25.
c) the name of petrographer who did the petrographic descriptions,
d) which of the samples at site 9 are serpentine,
e) whether any of the susceptibility values listed for site 9 are typical of serpentinite,
f) which rocks at site 10 are metasedimentary and which are metavolcanic,
g) whether any of the susceptibility values listed for site 12 are typical of serpentine,
h) whether any information is available since October 1978 that causes a reidentification of the rock types at site 12, or at any other site,
i) which thin sections (if any) in Table E-2 that correspond to each of the samples BCH-101 to BCH-116.

ANSWER:

INTERROGATORY NO. 94: Please explain why most of the meta-volcanic rocks described in the upper 800 feet of Test Hole 1A (see Table E-1) are inferred to have been derived from basic, or andesitic protoliths despite the fact that these rocks have more than 10% quartz.

ANSWER:

INTERROGATORY NO. 95: The aeromagnetic figures of Appendix A that have been generated by the Applicants are considered to be proprietary for commercial reasons.

a) Please explain the specific commercial potential of the area within each aeromagnetic figure that is considered to be proprietary.
b) Please provide the name and qualifications of the economic or other geologist or geophysicist who provided the input for (a) above.

ANSWER:

1269 157

INTERROGATORY NO. 96: The lack of geographic features on the aeromagnetic maps of Appendix A that are considered proprietary makes it extremely difficult to evaluate the aeromagnetic data. In addition, the maps that have been reduced from 1:24,000 to 1:62,500 are virtually illegible. Furthermore, the data-reduction techniques used by LKB (see page A-9) that any potential similarity in the aeromagnetic patterns in the areas of the two surveys is obscured.

Thus, in the interest of presenting the aeromagnetic patterns in the areas, the following are requested:

a) that clear, transparent copies of all aeromagnetic maps be printed so that they can be used as overlays on geological and other maps
b) aeromagnetic overlays be prepared on two scales:
   1. 1:24,000 for the areas of Figure 2, 3, 4, and 8 in order to comply with Interrogatory No. 8, and
   2. 1:62,500 in order to recognize regional aeromagnetic features,
c) that all aeromagnetic maps be drafted with a contour interval of 10 gammas, with darker isopleths at 50 gamma intervals,
d) that the 10 gammas isopleths from the Aero Services survey (Figure 8) be plotted without shading so that the resultant patterns are more nearly similar to those of the LKB survey.
e) that all figures be drafted with sufficiently large lettering that reductions to 1:62,500 are clearly legible
f) that a single transparent overlay be drafted at a scale of 1:62,500 to the above standards for the areas currently covered by Figures 2, 3, 4, and 8 (this map would replace Figures 2, 3, 4, 8 and 15),
g) that all aeromagnetic maps show the flight lines and that these lines be given their appropriate number so that the same flight line on two or more figures can be readily identified,
h) that all aeromagnetic maps, including Figures 1-4, 1-12, and 3.1-18, have identifiable fiducial marks (crosses) at each intersection of 7.5' of longitude and latitude.

ANSWER:

1269 158

INTERROGATORY NO. 97: In the interest of clarity a single map at a scale of 1:62, 500 is requested that incorporates all of the features of Interrogatory No. 96 (except possibly 96(g) and combines the following:

a) the magnetic trends of Figure 14
b) the magnetic contact positions of Figure 16
c) the lines of the profiles shown on Figures 19, 21A, and any other lines of profiles on other maps,
d) the anomalies plotted on Figure 24
e) the position of the hypothetical "B and B" fault of Figure 25.

Unless the plotting of features mentioned in (a) to (e) becomes too confusing on a single map, this single map could replace Figures 14, 16, 24, and 25 of Appendix A.

ANSWER:

INTERROGATORY NO. 98: In the interests of clarity, the anomalies and areas that are plotted on Figure 24 are requested to be shown on Figures 1-12, 3.1-18, and 3.3-3 (wherever these figures overlap with Figure 24).

ANSWER:

1269 159

INTERROGATORY NO. 99: Page 15 of Appendix A states that Bechtel geologists chose the outcrops for Dr. Beck to sample. Please provide the following:

(a) the names of geologists who selected the outcrops, and

(b) the exerptise these geologists have in designing and evaluating aeromagnetic surveys.

ANSWER:

INTERROGATORY NO. 100: Please explain why magnetic susceptibilities of greater than 4000 x 10^{-6} were routeinely used to test or describe anomalies in Figures 20A, 20F, 20G, 22B, 22C, 23C, 24, etc.; whereas, with the single exception of sample BCH-087, the susceptibilities of all rocks in Appendix 1 of Appendix are less than 4000 x 10^{-6}.

ANSWER:

1269 160

INTERROGATORY NO. 101: Page A-7 states that flight line profiles were presented at a scale of 1:24,000. Please have these profiles available for inspection at the offices of Perkins, Cole, Stone, Olsen & Williams, attorneys for the Applicants.

ANSWER:

INTERROGATORY NO. 102: Please explain whether any aeromagnetic lineaments or anomalies within the areas of Figures 8 and 15 of Appendix A are known to be caused by the following:

a) cultural features, including pipelines and transmission lines, and
b) survey specifications such as those mentioned on page A-24.

ANSWER:

1269 161

INTERROGATORY NO. 103: With regard to the aeromagnetic anomaly on Little Haystack Moutain that is described on page 35 and successive pages, please explain the following:

a) why Figure 6 with E-W flight lines and variable ground clearance instead of Figures 3 or 5 was chosen to represent this northwesterly trending anomaly,
b) the differences that could be expected in the profiles of Figure 20A to 20G if the observed magnetic profile were taken from Figures 3, 5, or 19 which show different shapes of the anomaly than Figure 6 does,
c) why a different location and azimuth were chosen for the magnetic cross section through Little Haystack Mountain than for the geological cross section through the same mountain shown in Figure 3.1-15,
d) why the width of the serpentine body is not shown on Figure 19,
e) why lower susceptibilities than those modeled in Figures 20E and 20G might not show a better fit between the height and width of the calculated fields than the susceptibilities that were assumed, and
f) what data preclude the possiblity that the Little Haystack anomaly is caused by a serpentinite body that dips approximately 45°SW, has a susceptibility similar to one of the four values listed for site 1 in Appendix A, and which is confined to the northeastern part of the outcrop belt (with smaller discrete bodies making up the southwestern portion of the belt, as might be inferred from the surface geology shown on Profile A-A of Figure 3.1-15).

ANSWER:

INTERROGATORY NO. 104: The first paragraph of page A-25 discused the evaluation of magnetic linears and concludes with the following statement:

> However, EDCON would not assign a fault-related origin to these (northwest trending magnetic) lineaments without other evidence in addition to the magnetic expression above.

Please explain, in light of this exemplary statement, whether strongly negative conclusions A, B, and E of pages A-54 and A-55 should be modified.

ANSWER:

INTERROGATORY NO. 105: Although no LKB data sheets have been submitted that include the area of the Devil's Mountain fault, Page 25 notes that the magnetic lineament as continuous, straight, and undisturbed as the Devil's Mountain fault shown on the Aero Service survey (Figure 8) do not occur on the LKB data sheets.

ANSWER:

INTERROGATORY NO. 106: Section iii of Page A-31 appears to use the terms "areas" and "provinces" interchangeably. Is this the intent, or does "province" have a different connotation than "Area"?

ANSWER:

INTERROGATORY NO. 107: Section iii of Page A-31 alleges that the two different magnetic provinces or areas on Figures 14, 15, and 16 correspond to the Church Mountain/Decatur Plate and to the Shuksan Plate. Please explain how this correlation can be seen without the contact between the two plates being shown on Figures 14, 15, 16 or on a transparent overlay.

ANSWER:

1269 164

INTERROGATORY NO. 108: In order to determine the location of the anomalies shown on Figure 17 please provide the following:

a) the fiducial marks on the ends of each profile and at the ends of the segments of each profile shown on Figure 17,
b) the position of the flight lines on Figures 5, 6, and 7 as is done on Figures 2, 3, and 4, and

ANSWER:

INTERROGATORY NO. 109: Please explain the cause of the following anomalies on Figure 17:

a) the 20 to 30 gamma anomaly approximately 1/2 mile east of Gilligan Creek on flight line 124, and
b) all other anomalies with a contrast of more than 50 gammas above background (the traces of many of which are discontinuous on Figure 17 between Day and Gilligan Creeks).

ANSWER:

1269 165

INTERROGATORY NO. 110: Page 32 states that "No evidence can be seen of any through-going magnetic response that is associated with the location or direction of either Giligan or Day Creek." Please define "through-going," taking into consideration that if faults do exist along Gilligan and Day Creeks, Darrington phyllite is faulted against Darrington phyllite along the southern side of the Skagit Valley.

ANSWER:

INTERROGATORY NO. 111: One method of determining whether the lineaments along Day Creek and Gilligan Creek are faults or not would be to compare the magnetic patterns on each side of the lineation to see if similar magnetic patterns have been offset. This is not done in Volume #2, therefore, explain the evidence for the dissimilarity (or similarity) of the following:

(a) The magnetic patterns of the alleged Church Mountain/ Decatur Plate southeast of the Gilligan Creek lineament with that on the northeastern side, and

(b) the same for the Day Creek lineament.

ANSWER:

INTERROGATORY NO. 112: Figures 3, 5, and 6 of Appendix A show essentially the same area. Please explain the following:

a) which of these three maps best displays the magnetic anomalies of the area, and
b) what characteristics of the chosen map make it superior to the other two.

ANSWER:

INTERROGATORY NO. 113: Page 34 of Appendix A states that there is no evidence for a fault between Butler Hill and anomaly A. Please explain what party or authority sugguested that a fault existed in this location.

ANSWER:

1269 168

INTERROGATORY NO. 114: Page 34 states that no evidence of an easterly trending fault exists south of anomaly A. Please explain the aeromagnetic evidence that precludes the possibility of a fault striking approximately N 70° E passing south of anomaly A.

ANSWER:

INTERROGATORY NO. 115: Page 37 states that a three dimensional model is available for the Little Haystack Mountain aeromagnetic anomaly. Please provide this model and the specific limitations and parameters upon which it is based.

ANSWER:

1269 169

INTERROGATORY NO. 116: With regard to the modeling of the thrust plane on Cultus Mountain in Figures 21A and 21B, please explain the following:

a) why on Figure 21A the "Inferred Location of the Thrust from Bechtel Geologic Map" appears to be different than the location of the thrust on Appendix H,
b) why the "Inferred Position of Main Thrust from Magnetic Data on Figure 21 is shown only for profile C-C' and not for A-A' and B-B',
c) whether the location of any of the magnetic profiles of Figure 21A are coincident with the geological cross sections depicted in Figure 3.1-13 and 3.1-14, and if not, wny not,
d) why the Applicants prefer either the geophysically determined position of the main thrust on profile C-C' of Figure 21A or the geologically determined determined position shown in Appendix H,
e) the basis for stating on page 39 that a comparison of the modeled profiles should be based primarily upon the northeastern parts of the profiles, rather than including the strong positive anomalies on the southwest was omitted from Figure 21,
f) what could cause the strong positive anomalies on the southwestern portions of A-A' and B-B',
g) why a model of a southwestward dipping thrust shallower than Model A and incorporating the strong positive anomalies on the southwest was omitted from Figure 21,
h) why the model of a gently northeasterly dipping thrust is accepted even though none of the observed profiles in Figure 21B match the calculated profiles, and
i) why some combinations of a shallow southwesterly dipping thrust fault and a higher angle fault in the general vicinity of the "B & B" fault was not modeled.

ANSWER:

INTERROGATORY NO. 117: With regard to Figure 24, please explain the following:

a) whether the "determined dip of the body" (shown in the legend and on the map) is a geological measurement or a geophysical inference,
b) if (a) above is a geophysical inferrence, please explain this determination
c) the lithological equivalents of typical ranges of k values used,
d) whether the dip of the body (as mentioned on page 43) refers to its geological dip or could be caused by differential erosion of the upper portion of the original body (so that present body is a tapering prism)

ANSWER:

INTERROGATORY NO. 118: With respect to the Goat Moutain anomaly discussed on pages 43 and 44, please explain the following:

a) the basis for EDCON's interpretation,
b) the significance that the different shape of the anomaly as measured by Thompson (1973) and by LKB has in the geological interpretation of the shape, orientation, and composition of the causitive body,
c) where the profile data and limited modeling (page 43) would place the inferred position of the contact of the ultramatic body, and
d) how (c) above coincides with the mapped location of the ultramatic body on Appendix H.

ANSWER:

INTERROGATORY NO. 119: With regard to the modeling of the South Chuckanut Mountain aeromagnetic anomaly discussed on page A-44 to A-48 and shown on Figures 23B to 23D please show the best two alternative calculated models for a two part body consisting of the following:

a) an east-west striking portion similar to that shown in Appendix A, Figure 23B, and
b) a steeply dipping portion of similar composition that strikes about N 30° W, is tangent to the southwestern corner of the portion described in (a), and has a K value of less than $<4000 \times 10^{-6}$.

ANSWER:

INTERROGATORY NO. 120: With regard to the discussion of Anomaly 2 on page 51, please explain the following:

a) does the Applicant concur with EDCON's interpretation that Anomaly 2 may represent the average position of the Shuksan thrust,
b) if so, please explain why the position of the thrust is shown farther to the northeast on Appendix H.

ANSWER:

RELATED CORRESPONDENCE

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

In the Matter of	)	
	)	
PUGET SOUND POWER & LIGHT COMPANY, et al.,	)	DOCKET NOS. STN 50-522 50-523
	)	
	)	
(Skagit Nuclear Power Project, Units 1 and 2)	)	
	)	September ~~13~~ 14, 1979
	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of:

INTERVENOR SCANP'S INTERROGATORIES AND REQUESTS FOR PRODUCTION TO APPLICANT

dated September ~~13~~ 14, 1979 have been served on the following by depositing the same in the United States mail, postage prepaid, on this ~~13~~ 14 (PT)th day of September, 1979.

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By _____