QUALITY OF STREAM WATERS OF THE WHITE CLOUD PEAKS AREA, IDAHO

Water quality in the White Cloud Peaks area of Idaho is depicted on a series of maps. Generally, stream waters are of excellent quality.

INTRODUCTION

The area described in this report lies in the upper drainage basin of the Salmon River, in south-central Idaho. In the center of this area are located the White Cloud Peaks, an aggregation of rugged mountains considered by many as part of the Sawtooth Mountain Range. The White Cloud Peaks are renowned for their scenic vistas and primitive character. Discovery in the late 1960's of vast quantities of low-grade molybdenum ore and subsequent proposals for open-pit mining led to an intensive effort by earth scientists to collect and evaluate resource data in this area of delicately balanced ecosystems so that judicious decisions regarding land use could be made. This report describes one aspect of the intensive study - the chemical and sediment quality of stream waters. All data incorporated in this report were collected in 1971.

LOCATION

The inset map of figure 1 shows the general location within Idaho of the 1,800 square mile study area. The larger map of figure 1 shows the location of 39 water-data sampling stations. Table 1 is a listing of the water-data stations and relates the map identification number to the U.S. Geological Survey gaging-station number and descriptive name. In addition, the drainage area for each water-data station is tabulated.

TOPOGRAPHY

Figure 2 is a topographic map of the upper Salmon River drainage area. Castle Peak, the highest of the White Cloud Peaks, has an altitude of 11,815 feet above mean sea level, and a number of other peaks in the group are well above 10,000 feet. At its exit from the study area, the Salmon River near Challis, Idaho is at about altitude 5,165 feet and the mean altitude of the drainage area above this water-data station is about 7,820 feet.

GEOLOGY

Figure 3 is a generalized geologic map of the study area. The area is underlain by a thick sequence of Paleozoic sedimentary rocks intruded on the west by the Idaho batholith and in large part overlain by Tertiary volcanic strata and associated sedimentary rocks. To a large extent, local water-quality characteristics are governed by the chemical composition of the local geologic units.

WATER-QUALITY SAMPLING PROGRAM

Each of the 39 water-data stations shown in figure 1 was visited at least three times during the period from late May to early October to determine water-quality conditions at times of low-, medium-, and high-water runoff. This determination included measurements of discharge and temperature and collection of water samples for analysis of dissolved chemical constituents and suspended sediment. Eight of the locations, stations 5, 8, 17, 19, 26, 29, 38, and 39, were visited at least five times and provided better definition of the low-, medium-, and high-water data. In addition, at the above listed eight stations and at four others, stations 27, 28, 30, and 31, supplemental water samples were collected at the time of each visit and analyzed for concentrations of 21 trace elements. All analytical work was done in laboratories of the U.S. Geological Survey.

Values of each water-quality parameter were plotted against corresponding values of the ratio of discharge to bankfull discharge. The plotting was done on log-log coordinate graph paper and for each stream, a straight line relation was established between ordinate and abscissa values. The technique is exemplified in figure 4 using specific-conductance data selected for several of the streams. The ordinate value or value of the water-quality parameter corresponding to an abscissa value or value of the discharge ratio of 0.25 is determined to be the value associated with average annual flow. For each water-quality parameter, the value of the parameter at average annual flow for each stream is plotted on an area map at the respective station location. As exemplified in figure 5 for specific conductance, isopleths of water-quality were assigned to the maps based on the plotted data points. As the isopleths trend away from data positions, the accuracy in locating the isopleths decreases; however, the relations established between the isopleths, topography, and geology in the better defined areas enable reasonable extrapolation of data. Sheets 3 to 5 of this report present a series of maps, each depicting water-quality parameter values corresponding to average annual flow.

Data of figure 4 indicate that for a given value of the discharge ratio, different water-data stations have different values of specific conductance and, as mentioned, these differences in values are related to the chemical composition of individual geologic units and such factors as their solubility. Figure 4 also shows a strong tendency toward parallelism of the individual specific conductance versus discharge relations. If the parallelism were exact, isopleths of water quality on maps such as figure 5 would, for any frequency of flow occurrence, be identically located on the map, but have different absolute values for the water-quality parameter. For the present data, as exemplified by slight non-parallelism of the data of figure 4, the configuration of isoplethic maps of water quality for any discharge would be similar, but not identical, to the configuration as presented for the average annual discharge.

Isoplethic maps of water quality for parameters other than specific conductance would be similar in appearance only to the extent that interrelationships of the data are similar. In figures 6 through 8, values of three water-quality parameters are plotted against values of specific conductance. In figure 6, dissolved solids have an expected well-defined relation to specific conductance. Thus, an isoplethic map of dissolved solids would be nearly identical in configuration to the map for specific conductance. Figure 7 shows a moderately-defined relationship between calcium and specific conductance. Figure 8 shows a poorly-defined relationship between chloride and specific conductance. For this latter example, significant difference may be expected between the configurations of isoplethic maps of chloride and specific conductance.

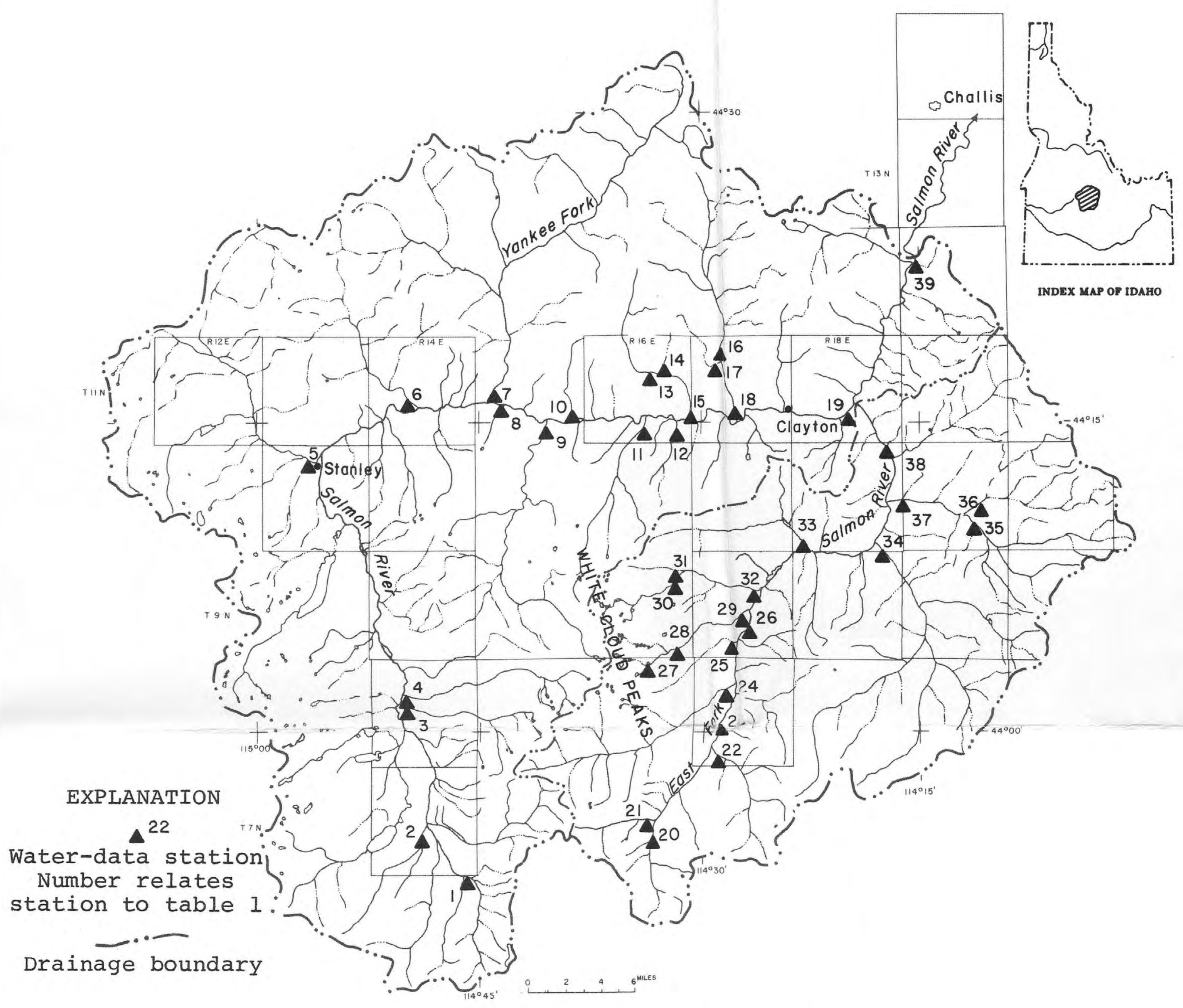

Figure 1.--Upper Salmon River drainage area, including White Cloud Peaks area, showing location of water-data stations.

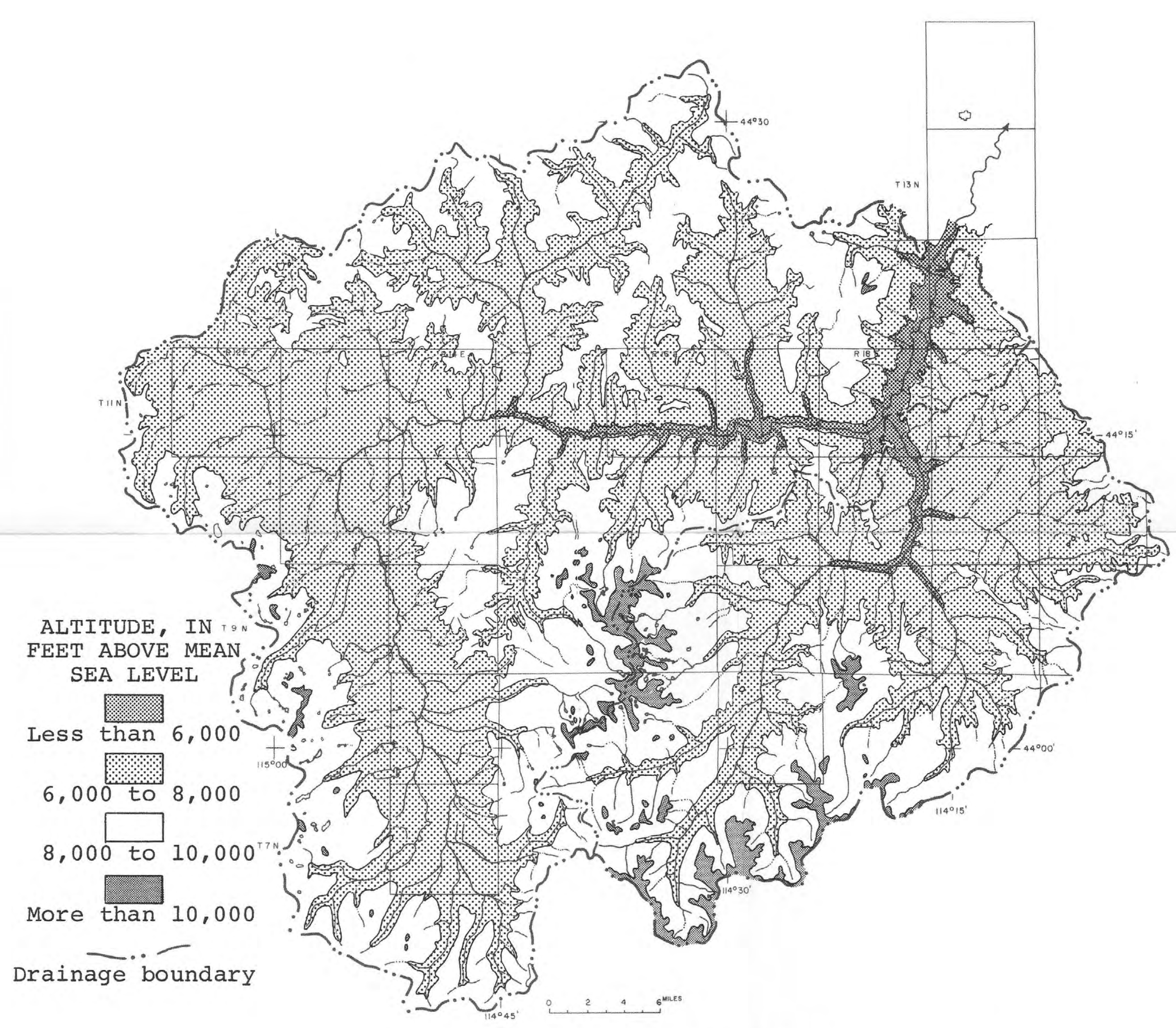

Figure 2.--Topography of study area.

Table 1. Identification number and name of water-data stations.

Map identification number	U.S.G.S. gaging station number	Descriptive name	Drainage area (square miles)
1	13292200	Salmon River near Galena Summit	17.5
2	13292400	Beaver Creek near mouth	15.5
3	13293200	Champion Creek near mouth	17.5
4	13293400	Fourth of July Creek near mouth	18.5
5	13295000	Valley Creek near mouth	147
6	13295650	Basin Creek near mouth	51.0
7	13296000	Yankee Fork near mouth	195
8	13296500	Salmon River below Yankee Fork	802
9	13297000	Warm Springs Creek near mouth	79.0
10	13297100	Peach Creek near mouth	8.0
11	13297250	Slate Creek near mouth	31.0
12	13297300	Holman Creek near mouth	6.0
13	13297310	Thompson Creek above Pat Hughes Creek	22.5
14	13297320	Pat Hughes Creek near mouth	2.5
15	13297330	Thompson Creek near mouth	30.0
16	13297340	Squaw Creek above Bruno Creek	60.0
17	13297350	Bruno Creek near mouth	6.0
18	13297360	Squaw Creek near mouth	80.0
19	13297380	Salmon River above East Fork Salmon River	1,170
20	13297384	South Fork East Fork Salmon River near mouth	18.1
21	13297388	West Fork East Fork Salmon River near mouth	8.6
22	13297396	West Pass Creek near mouth	26.1
23	13297400	East Fork Salmon River below West Pass Creek	75.6
24	13297404	Germania Creek near mouth	48.9
25	13297418	Wickiup Creek near mouth	6.5
26	13297425	East Fork Salmon River below Wickiup Creek	63.6
27	13297440	Little Boulder Creek above Baker Lake	2.8
28	13297445	Little Boulder Creek below Boulder Chain Lakes	9.9
29	13297450	Little Boulder Creek near mouth	18.1
30	13297480	Big Boulder Creek above Jim Creek	12.7
31	13297485	Jim Creek near mouth	3.4
32	13297500	Big Boulder Creek near mouth	27.4
33	13297530	Big Lake Creek near mouth	26.5
34	13297600	Herd Creek near mouth	113
35	13297670	Road Creek above Horse Basin Creek	37.9
36	13297680	Horse Basin Creek near mouth	32.6
37	13297700	Road Creek near mouth	85.0
38	13298000	East Fork Salmon River near mouth	532
39	13298500	Salmon River near Challis	1,800

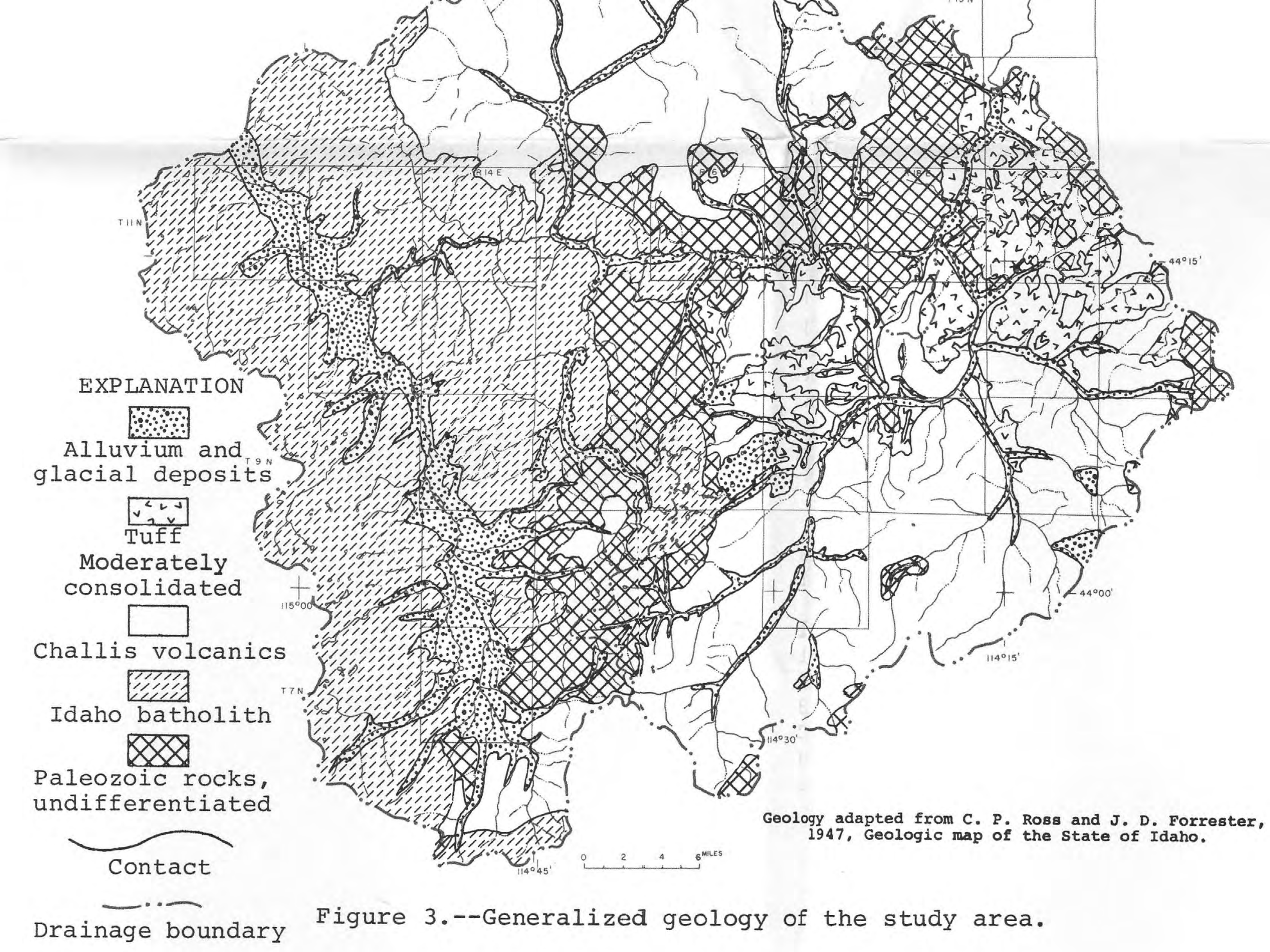

Figure 3.--Generalized geology of the study area.

Base from U.S. Geological Survey 1:250,000 Maps

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