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**A COMPUTER-ORIENTED EDGE-PUNCH CARD FOR
STORAGE AND RETRIEVAL OF PETROGRAPHIC AND
GEOCHEMICAL DATA**

by

A.Y. Glikson and S. Henley

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FIGURES

- Fig. 1 Sample submission forms. (a) currently used form.
(b) computer-coded form.
- Fig. 2 Side A of the proposed edge-punch card: General information on specimen, petrography and mineralogy.
- Fig. 3 Side B of the proposed edge-punch card: Geochemical data, chemical calculations and notes.
- Fig. 4 Example of computer print-out of geochemical data.

SUMMARY

A computer-oriented edge-punch card for storage and retrieval of petrographical, mineralogical, and geochemical data and relevant notes has been designed. The card may be used manually in desk files, in a central file cabinet, or for the input, and in part, output of computer data; the computer data can be punched on 4 IBM cards. The combination of the various modes of application of the card make its usage possible for a wide range of purposes, including field mapping projects and specialized petrological and/or geochemical investigations. Keys for retrieval of data through edge punching are provided, as well as abbreviations of rock, mineral and texture names for computer coding. A computer program for print-out of chemical data in a format appropriate to the card has been written. The card is proposed for general usage by BMR geologists, and at this stage is undergoing a trial period.

INTRODUCTION

Systems for Storage and Retrieval of Petrographic and Geochemical Data

(a) Existing Systems

Walpole et al. (1964) made a comprehensive study of data storage problems as applied to geological samples, and put forward a set of valuable recommendations, as well as designing a series of forms for use in the laboratories: "Report Forms" for use in the fields of petrology, mineralogy, chemistry, and geochronology. These forms are of A4 size and designed in such a manner that some of the data included on them can be punched on to 80 column IBM cards.

A sample submission form was also proposed, with a similarly large (25 x 20 cm) format, and with boxes for coding the registered number and grid reference only. Current sample submission forms in the BMR include a 15 x 10 cm card and a recently introduced modified computer-coded sample submission form (Fig. 1) which are however of a much smaller format, than the edge-punch card proposed below. The modified sample submission form is designed such that 6 IBM cards may be punched from it, containing much of the basic data concerning the sample, and obviating the necessity for repetition of this information on every laboratory report form. This card does not allow for mineralogical, petrological and geochemical data.

There is at present no operational storage and retrieval system for petrological and geochemical data in the BMR, though a computer based storage system is in preparation. A number of different forms have been used for reporting chemical analyses, but there has been little consistency, and most analyses are recorded either on the AMDEL report forms (if carried out by AMDEL) or in the regular series of Laboratory Reports compiled into BMR records.

Furthermore, there is at present no recommended method for personal or project filing of petrographic and geochemical data.

The Geological Society of Australia recommends the use of 20 x 12 cm file cards for recording geochemical data, but there is little provision on these cards for detailed petrographic descriptions or for trace element analyses. These cards have no retrieval system affording the selective recovery of data.

Overseas, the United States Geological Survey and the Geological Survey of Canada both use petrological report forms similar in principle to that proposed by Walpole et al. (1964). Most other Geological Surveys

possess somewhat similar forms, but none, to the authors' knowledge, uses forms with the versatility of the proposed Edge-Punched Card; they are either for purely manual filing card systems, or are oriented entirely towards computer processing and make little allowance for uncodable data and/or notes.

(b) Aims and functions of the proposed card

It is intended that the card proposed in this report will be usable for four quite distinct and independent purposes, as follows:

- (1) The card will function as a medium for petrographic description and petrological notes, and will thus provide a convenient manual data storage system for items which are in any case difficult to code for computer storage. Additional notes, photographs and drawings can be stapled to the cards, if required.
- (2) The edge-punched system will allow rapid manual retrieval of data on samples from given localities, with given minerals, or with associated anomalies of particular chemical elements, etc., partly overcoming the normally long time involved in retrieval from manual filing systems, and avoiding the inconvenience of computer use for recovery of small amounts of data.
- (3) Coding spaces are provided for both chemical and basic petrographic data, so that IBM cards be punched from the card, if desired.
- (4) The card may be used partly as a computer output medium, in which chemical analyses, norms, and other petro-chemical values, are printed by the computer in a suitable format for cutting and pasting or stapling in the appropriate spaces on the card.

It is expected that the mode of application of the card in which its special features are maximally used will be as follows: The petrologist will fill in details of the petrography of each sample, and insert chemical data when available. If analyses have been carried out partly or wholly by the XRF unit within the BMR, these data will already be punched on IBM cards and the special output sheets may be pasted in the appropriate space on the card. The edges of the card are then punched in the appropriate positions, and the card added to the petrologist's manual file. At some time when this file is not in use, the cards will be delivered to a computer card-punch operator, who will prepare IBM cards from the petrographic data, and from chemical data that are not already computerized. The petrographic and geochemical IBM cards will subsequently be inserted

Bureau of Mineral Resources, Sample Submission Form											
Punchcard operator to repeat Reg'd No. on each card	Reg'd No.	Type	Zone	East ^s or Lat.	North ^s or Long.	Field book ref.	Air photo ref.	Hr	Day	Mth	
	Sc. Map name		Map no.		Depth	F/M Collector					
	F/P Strat. Unit										
	Geol. prov.			Geol. age			Sampling method				
	Rock name/Sample type										
	Location										
Type 6 continuation											
Date submitted / /											
Work required (continue on reverse if necessary)											
T.S./Petrog. ☐											
Minerag./Mineral ☐											
Sedimentology ☐											
Chem. analysis ☐											
Age det. ☐											
Palaeontology ☐											
								Originator			
								Supervisor			
								Daybook Entry			

Bureau of Mineral Resources, Geology, and Geophysics									
Formation						Regd No.			
Rock name/ Sample type						Airphoto ref			
1:250,000 } sheet						Fieldbook ref			
1:50,000 }									
Zone		Easting or Latitude		Northing or Longitude		Depth			
Sample Co-ordinates									
Location						Strat. Ht.			
Date Submitted / /						Work required			
T.S./Petrog. ☐									
Minerag./Mineral ☐									
Sedimentology ☐									
Chem anal ☐									
Age det ☐									
Micropal ☐									
Macropal ☐									
								Originator	
								Supervisors initials	
								Daybook entry	

FIG. 1

Sample submission forms. Currently used form (below) and computer coded form (above).

into a central file which is to be constructed, to be compatible with and complementary to the central sample submission data file, and available to all users for reference. Upon the completion of projects, the edge-punch cards should be stored in a central file, where the cards should be arranged according to their BMR serial number. This file can be located in the Petrological Laboratory.

The recording of both petrographic and geochemical information for any given specimen on either side of one and the same card, will be of assistance in studies where rapid correlation of this information is required, and where at present much time is spent matching sets of versatile descriptions and chemical data. The proposed card should prove a versatile facility as it can be used as a self-sufficient indexing system in remote localities where access to a computer is unavailable, e.g. base camps where a microscope is available, and resident geologist offices, as well as in conjunction with a central file and computer facilities.

In view of the above advantages, and in order to standardize the form of petrographic and chemical documentation in the BMR, both in the petrological laboratories and by field parties, it is suggested the proposed card be printed and recommended for general usage.

II DESCRIPTION AND USAGE OF THE CARD

General information (side A of card)

BMR Serial Number:- The first two digits refer to the year in which the sample was collected and documented (e.g. 71): the next two digits contain the project number, as allocated by the BMR transit office; the next four spaces contain the serial number of the particular specimen, and the last digit corresponds to the fraction of the specimen, if any (e.g. a, b etc). The number is computer-coded (Computer Card No. 1).

Card code (31):- A unique 2 digit code identifying the computer card as a petrographic data card.

Field Number:- The recommended type of field number is identical with the point-photo number denoting the Sheet, run, aerial photo, and point numbers as in the following example: N12-54-17. N-Napperby 1:250,000 Sheet area; 12-photo run 12; 54-the last two digits of the aerial photo number; 17-point number (each photo has a separate consecutive point numbering system, 1, 2 etc). This numbering system should enable the direct location of points on the photo from their numbers.

Age:- Should be given in forms of era (e.g. Mesozoic), period (e.g. Jurassic), epoch (e.g. Lias), or years (e.g. 170 m.y.) depending on the available information. The era period or epoch are given as an up to six letters abbreviation, e.g. Cretaceous - CRETAC. The absolute age where known can be coded in a six-digit field as follows: Ages up to 999,999 years are denoted in the same form, e.g. 999999. Ages in million years are given as in the following examples: 4320 million years - 4230 MY; 5.4 million years 5.4 m.y.

Rock Name:- Should be as detailed as known and as space permits, including mineral qualifiers. The rock name can be computer-coded on computer card No. 1 according to standard four-character abbreviations listed in Appendix A.

Locality:- Given in terms of neighbourhood to a settlement or a geographic feature, and the name of the region (e.g. 7 miles north of Day Creek, Reynolds Range) and State,

1:250,000 Sheet area:- Name of Sheet (uncoded), and number of Sheet, coded as follows: First digit - S; second digit - latitude zone letter; next two digits - longitude zone number; last two digits - map number. Example: Napperby, SF5309.

Photo Number:- Includes first letter of 1:250,000 Sheet area, photo run number, and photo number. Example N12-2054.

Sampler: Surname and initials of sampler.

Date:- Month and year of sampling.

Reference:- Abbreviated reference to note book report or publication in which data relevant to the sample are recorded.

Mode of occurrence:- Derivation of specimen, e.g., from sedimentary unit, dyke, margin of batholith, or surface drift.

The mode of occurrence can be coded in a three-digit as follows:

First digit for the rock class: I-Igneous; S - sedimentary;
M - metamorphic.

Next 2 digits for the mode of occurrence, as follows:- Batholith - BA;
Stock - ST; Boss - BO; Plug - PL; Neck - NE; Cone Sheet - CS;
Vent - VE; Vein - VI; Dyke - DY; Apophyse - AP; Sheet - SH;
Sill - SI; Lopolith - LO; Layered basic complex - LB; Flow - FL;
Breccia - BR; Bed - BE; Conglomerate - CG; Surface drift - SD;
Diapir - DI, etc.

2 S 7 4 2 1	S 1 E C B A	S 7 4 2 1	2 S 8 7 4 2 1	2 S 23 8 7 4 2 1	CHEMICAL ANALYSIS	high low																						
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LOCALITY																												
IBM Card A						12 13 14 15 16 17																						
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28	29	30																										
Mode of occurrence _____ Rock unit _____						31 32 33 34																						
Hand specimen _____																												
Microscopic texture _____						35 36 37 38 39 40																						
MINERALOGY																												
Component	Code	%	Grain size	Crystallographic, optical, X-ray and texture data																								
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FIG. 2

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₂	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1291	1292	1293	1294	1295	1296	1297	1298	1299	1300	1301	1302	1303	1304	1305	1306	1307	1308	1309	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319	1320	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332	1333	1334	1335	1336	1337	1338	1339	1340	1341	1342	1343	1344	1345	1346	1347	1348	1349	1350	1351	1352	1353	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363	1364	1365	1366	1367	1368	1369	1370	1371	1372	1373	1374	1375	1376	1377	1378	1379	1380	1381	1382	1383	1384	1385	1386	1387	1388	1389	1390	1391	1392	1393	1394	1395	1396	1397	1398	1399	1400	1401	1402	1403	1404	1405	1406	1407	1408	1409	1410	1411	1412	1413	1414	1415	1416	1417	1418	1419	1420	1421	1422	1423	1424	1425	1426	1427	1428	1429	1430	143

Examples: Igneous breccia IBR

Volcanic neck - INE

Sedimentary bed - SBE

Metamorphosed sill - MSI

Rock unit:- Geological system, Group, Formation or Member. Coded rock unit, as used on BMR geological maps, example p g₁ (Precambrian granite). A list of map unit symbols is given in Appendix E.

Hand Specimen:- Short description of structure, texture, grainsize and colour of the hand specimen.

Micropic texture:- Classification of the original and/or metamorphic textures, e.g. ophitic, blastoporphyrific, even-grained granoblastic, etc. Six digits are provided for the coding of the texture, according to abbreviations given in Appendix C.

Mineralogy (side A of card)

This table affords the short description and coding of up to ten minerals in terms of their name ('Component'), abbreviated computer-coded name (punched on computer card no. 1), percentage in rock, grainsize, and crystallographic, optical, X-ray, textural and other data. A list of abbreviated mineral names is given in Appendix B.

The available space can be adjusted for the description of fewer than 10 minerals. Alternatively more than 10 phases can be described (but not coded) by stapling attachments on the card.

Petrological notes:- Under this section, the mineral paragenesis replacement relationships, alteration features etc. shown in the rock, as well as conclusions regarding physical conditions of crystallization or metamorphic grade, can be included.

Geochemistry (side B of card)

BMR Serial Number:- As for side A of card.

Analytical methods:- Abbreviated instrument names, such as XRF (X-ray, fluorescence spectroscopy), DRS (direct reading spectrograph), AA (atomic absorption), Col. (colorimetric), Grav. (gravimetric), FP (flame photometry), Tit. (titrimetric), and the elements determined by each method. Example: DRS (Ni, Cr, Co) FP (K, Na, Sr) XRF (Si, Al, Fe).

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Accuracy and precision: Standard deviations for individual elements of the analysed rock suite, where applicable.

Laboratory:- Name of organization or firm which carried out the analysis, and of analyst.

Major element table:- Four digits can be computer coded for each of the following oxides: SiO_2 , TiO_2 , Al_2O_3 , Fe_2O_3 , FeO , MgO , CaO , Na_2O , K_2O , P_2O_5 , H_2O^+ , H_2O^- , and CO_2 . Five digits are coded for the total. The last two digits in each case are the first and second digits after the decimal point. A special computer punch card (No. 2) accommodates the major element data and the BMR serial number.

Minor elements:- A total of 20 elements can be coded in this table, all of which can be computer coded either in ppm (up to 9999 ppm) or in decimal numbers of percent (in the range 0.01 - 99.9); each trace element is allotted six digits for its symbol and concentration (e.g. CuO124 ; Ni0014 , etc). A computer punch card (No. 3) accommodates the trace element data for the first 10 elements and another card (no. 4) accommodates data for a further 10 elements. Trace element symbols were not listed in the table, to facilitate its flexible usage; however, it is suggested that they be listed according to their alphabetical order.

Norms:- Spaces in this table are left open for alternative usage of the various norm types, e.g. CIPW norm, equivalent molecular CIPW norm, Niggli norm, Barth mesonorm, or various modified epinorms.

Miscellaneous chemical values:- In this table, various chemical ratios, triangular-plot values (e.g. ACF, AKF, FMA etc.), Niggli values, differentiation indices, etc., can be listed.

Chemical classification:- The chemical classification of the analysis without reference to the texture of the rock, e.g. high-alumina tholeiite, sodic acid rock, intermediate rock, pelitic composition etc.

Petrochemical affinity:- Combines the chemical, mineralogical and textural information in a rock name, e.g. high-alumina tholeiitic basalt, sodic granite, porphyritic andesite etc.

Chemical affinities and anomalies:- Observations on the characteristics of the particular analysis, including the chemical series (cf. calc-alkaline), and relative levels of oxides and elements as compared to the studied suite and to averages of interest.

Petrological implications:- Notes on the origin of the rock as suggested by the chemical data, as well as by other data, should be summarized in this section.

References:- Publications in which similar and related rock types, similar chemical data, and similar conclusions are referred to, should be cited here.

NOTE: In so far as space is not available for any particular item/s on this card, attachment or enclosures with the additional information can be stapled on it. Photographs and drawings can be attached as well, if required.

III USE OF THE CARD IN A COMPUTER STORAGE AND RETRIEVAL SYSTEM

It is envisaged that geological sample data will be stored in a computer system in a number of separate but inter-linked files. There is a central sample submission file, already in existence, and there will eventually be ancillary chemical, petrographic, geochronological, palaeontological, and other files as required. The proposed petrological edge-punch card will interface with the petrological and chemical files.

On the petrographic side of the card, boxes are available for insertion of summary data on the rock type and its constituent minerals: this is designed as the main input medium for a petrographic data storage system. The coded information is deliberately limited to mineral names, as petrographic descriptions are usually long and detailed, and vary greatly in content and format. Automatic retrieval of, for example, all rocks with given sample submission data and containing or not containing a given mineral, would be possible under this system by use of a computer programme which simultaneously reads the magnetic tape file of sample submission data (geographic, type of sample, formation name etc.) and a file of petrographic data.

The geochemical side of the card is so designed that it can be used in three ways: Analytical data can be inserted manually into the spaces provided, and subsequently computer cards may or may not be punched; once computer cards are punched, a special program EDGPUNCH (Appendix D) can be employed to print analyses in a suitable format for cutting and pasting in the appropriate space (Fig. 4). A similar facility is being designed for printing of norms and of other petrochemical parameters.

Trace element data may be coded in any desired order, though it is recommended that elements be inserted in alphabetical order, as this is the order in which they will be stored under the geochemical data storage system at present being designed.

IV THE EDGE-PUNCH SYSTEM

When used in a desk file or a central file cabinet, the proposed cards can be retrieved using an edge-punch system according to following parameters:

- (1) Location: State, latitude, longitude, 1:250,000 map.
- (2) Rock name: Volcanic, plutonic and metamorphic.
- (3) Mineralogy: Orthosilicates, ring silicates, chain silicates, sheet silicate, framework silicates, non-silicates and other minerals.
- (4) Geochemistry: Silicate analysis, elements of the periodic system. Because of the limitation in the number of holes, no more than a few elements can be punched on any particular card; rather, the chemical punch code is used to draw attention to particular elements (e.g. of anomalous concentration or economic importance) rather than to code all elements analysed.
- (5) Availability of a chemical analysis.
- (6) High or low economic significance.
- (7) Age.

The main drawback of the edge-punch system is the superposition of punched holes where more than a few values are to be inserted under any particular parameter: for example, the coding of more than a few chemical elements. For mineralogy, this problem is partly overcome by dividing the edge-punch system into several mineralogical subgroups. In cases of overlap, only the more significant or diagnostic minerals should be punched. In the following, the usage of the edge punch system and index lists and keys for the coding of the various parameters are given.

71099876					
OXIDES			TRACE ELEMENTS PPM		
SiO2	74.03	S	36	ZR	91
TiO2	0.20	CL	99	SN	19
AL2O3	14.48	SC	2	CS	43
FE2O3	1.97	CR	21	BA	212
FeO	0.00	CO	5	CE	55
MNO	0.02	NI	9	PB	92
MGO	0.10	CU	6	TH	41
CAO	0.34	ZN	74	U	34
NA2O	0.16	GA	30		
K2O	7.48	GE	5		
P2O5	0.27	AS	0		
H2O+	0.00	RB	924		
H2O-	0.00	SR	23		
CO2	0.00	Y	46		
TOTAL			99.85		

Fig. 4. - Example of computer print-out of geochemical data, to be pasted in the appropriate space on side B of the proposed edge punch card.

KEY FOR EDGE-PUNCH CARD FOR PETROLOGICAL AND GEOCHEMICAL DATA

(1) Method of Punching

For numbers:	1	-	punch	s/f	and	1		
	2	-	"	s/f	and	2		
	3	-	"	2/f	and	2	and	1
	4	-	"	s/f	and	4		
	5	-	"	2/f	and	4	and	1
	6	-	"	2/f	and	4	and	2
	7	-	"	s/f	and	7		
	8	-	"	s/f	and	8		
	9	-	"	2/f	and	8	and	1
	10	-	"	2/f	and	8	and	2
	11	-	"	8	and	2	and	1
	12	-	"	2/f	and	8	and	4
	13	-	"	8	and	4	and	1
	14	-	"	8	and	4	and	2
	15	-	"	2/f	and	8	and	7
	16	-	"	8	and	7	and	1
	17	-	"	8	and	7	and	2
	18	-	"	8	and	7	and	2 and 1
	19	-	"	8	and	7	and	4
	20	-	"	8	and	7	and	4 and 1
	21	-	"	8	and	7	and	4 and 2
	22	-	"	8	and	7	and	4 and 2
	23	-	"	s/f	and	23		
	24	-	"	2/f	and	23	and	1

etc.

s/f - single punching

2/f - double punching

The above symbols are not used when more than 2 holes are punched.

(2) Locality index

N.S.W.	punch:	1
N.T.		2
P. - N.G.		3
Qld.		4
S.A.		5

Tas.	6
Vic.	7
W.A.	8
Antarctica	9
A.C.T.	10
Other countries	11-22

Latitude			Longitude		
Zone A	punch	A & s/f	Zone 49	punch	1
B	"	B & s/f	50	"	2
C	"	C & s/f	51		3
D	"	C & A	52		4
E	"	E & s/f	53		5
F	"	E & A	54		6
G	"	E & B	55		7
H	"	E & C	56		8
I	"	I & s/f			
J	"	I & A			
K	"	I & B			

4 mile sheet number - 16 number within each zone

for sheet no. 1 punch 1
2 2

etc.

(3) Age

Quaternary	punch	1	1000 - 1100 m.y.	punch	26
Tertiary		2	1100 - 1200 m.y.		27
Pliocene		3	1200 - 1300 m.y.		28
Miocene		4	1300 - 1400 m.y.		29
Oligocene		5	1400 - 1500 m.y.		30
Eocene		6	1500 - 1600 m.y.		31
Paleocene		7	1600 - 1700 m.y.		32
Mesozoic		8	1700 - 1800 m.y.		33
Cretaceous		9	1800 - 1900 m.y.		34
Upper Cretaceous		10	1900 - 2000 m.y.		35
Lower Cretaceous		11	2000 - 2100 m.y.		36

Jurassic	12	2100 - 2200 m.y.	37
Triassic	13	2200 - 2300 m.y.	38
Palaeozoic	14	2300 - 2400 m.y.	39
Permian	15	2400 - 2500 m.y.	40
Carboniferous	16	2500 - 2600 m.y.	41
Devonian	17	2600 - 2700 m.y.	42
Silurian	18	2700 - 2800 m.y.	43
Ordovician	19	2800 - 2900 m.y.	44
Cambrian	20	2900 - 3000 m.y.	45
Precambrian	21		
600 - 700 m.y.	22		
700 - 800 m.y.	23		
800 - 900 m.y.	24		
900 - 1000 m.y.	25		

(4) Rock-forming minerals

In order to code the mineralogical information, punch for each mineral occurring in the rock in the appropriate group spacing on the card and according to the number accompanying each of the minerals as listed below:

Orthosilicates and Ring Silicates

Olivine group (1), Olivine (2), Forsterite (3), Fayalite (4), Tephroite-knebelite (5), monticellite (6)
 Humite group (7)
 Zircon (8)
 Sphene (9)
 Garnet group (10), Vesuvianite (idocrase) (11)
 Sillimanite (12), Mullite (13), Andalusite (14), Kyanite (15)
 Topaz (16)
 Staurolite (17), Chloritoid (18)
 Datolite (19), Sapphirine (20)
 Epidote group (21), Epidote (22), Clinozoisite (23), Zoisite (24)
 Piedmontite (25)
 Lawsonite (26), Pumpellyite (27)
 Melilite group (28)
 Beryl (29), Cordierite (30), Tourmaline (31)
 Axinite (32)

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Chain Silicates

Pyroxene group (1), Enstatite-Orthoferrosilite (2), Diopside-Hedenbergite (3), Johannsenite (4), Augite-Ferroaugite (5), Pigeonite (6), Aegirine (7), Aegirine augite (7), Spodumene (9), Jadeite (10).
Wollastonite (11), Pectolite (12), Rhodonite (13), Bustamite (14), Pyroxmangite (15).
Amphibole group (16), Anthophyllite-gedrite (17), Cummingtonite-grunerite (18), Tremolite (19), Actinolite (20), Ferroactinolite (21), Hornblende (22), Basaltic hornblende (23), Kaersutite (24), Barkevikite (25), Glaucophane-riebeckite (26), Richterite (27), Katophorite (28), Eckermannite-arfvedsonite (29).
Aenigmatite (30), Astrophyllite (31).

Sheet Silicates

Mica group (1), Muscovite (2), Paragonite (3), Glauconite (4), Phologopite (5), Biotite (6), Lepidolite (7), Zinnwaldite (8), Margarite (9), Clintonite-xanthophyllite (10).
Stilpnomelane (11)
Pyrophyllite (12), Talc (13)
Chlorite (14)
Serpentine (15)
Clay minerals (16), Kaolinite group (17), Illite (18), Montmorillonite group (19), Vermiculite (20)
Apophyllite (21)
Prehnite (22)

Framework Silicates

Feldspar group (1), Alkali feldspars (2), Orthoclase (3), Microcline (4), Anorthoclase (5), Perthite (6), Plagioclase (7), Albite (8), Oligoclase (9), Andesine (10), Labradorite (11), Bytownite (12), Anorthite (13), Barium feldspars (14).
Silica minerals (15), Quartz (16), Tridymite (17), Cristobalite (18), Nepheline group (19), Nepheline (20), Kalsilite (21).
Petalite (22), Leucite (23).
Sodalite Group (24), Scapolite (24).
Analcite (25), Zeolite group (26).

Non-silicates

Oxides (1), Periclase (2), Cassiterite (3), Corundum (4), Haematite (5),
Ilmenite (6), Rutile (7), Anatase (8), Brookite (9), Perovskite (10),
Spinel Group (11), Spinel (12), Magnetite (13), Chromite (14).
Hydroxides (15), Brucite (16), Gibbsite (17), Diaspore (18), Boehmite (19),
Goethite (20), Lepidocrocite (21), Limonite (22).
Sulphides (23), Pyrite (24), Pyrrhotite (25), Chalcopyrite (26), Sphalerite (27),
Galena (28).
Sulphates (29), Baryte (30), Celestine (31), Gypsum (32), Anhydrite (33).
Carbonates (34), Calcite (35), Rhodochrosite (36), Siderite (37), Dolomite (38),
Ankerite (39), Huntite (40), Aragonite (41), Strontianite (42), Witherite (43).
Phosphates (44), Apatite (45), Monazite (46),
Halides (47), Fluorite (48), Halite (49).

(5) Rock Name

Punch the appropriate rock name according to the group and the numbers listed in the following code.

Volcanic rocks

Basalt family (1), Olivine basalt (2), Olivine diabase (3), Picrite basalt (4),
Ankaramite (5),
Tholeiitic basalt (6), Dolerite (7).
Trachybasalt (8), Mugearite (9)
Spilite (10), Albite diabase (11).
Nepheline basalt family (12), Nephelinite (13), Nepheline basalt (14),
Nepheline basanite (15), Nepheline tephrite (16).
Leucitite (17), Leucite basalt (18), Leucite basanite, (19),
Leucite tephrite (20).
Melilite basalt (21),
Limburgite (22),
Lamprophyre family (23)
Trachyte phonolite family (24), Trachyte (25), Porphyry (26), Keratophyre (27),
Phonolite (28), Tinguaita (29).
Andesine-rhyolite family (30), Andesite (31), Porphyrite (32),
Lactite (33), Trachyandesite (34),
Dacite (35),
Rhyolite (36), Quartz porphyry (37), obsidian (38).
Pyroclastic rocks (39),
Tuff (40), Lithic tuff (41), Vitric tuff (42), Crystal tuff (43),
Lapilli tuff (44), Volcanic agglomerate (45), Volcanic breccia
(46), Flow breccia (47), Ignimbrite (48), Welded tuff (49).

Plutonic rocks

Gabbro family (1), Olivine gabbro (2), Olivine norite (3), Gabbro (4),
 Norite (5), Anorthosite (6), Pyroxenite (7), Troctolite (8).
 Peridotite (9), Dunite (10)
 Alkali gabbro family (11), Teschenite (12), Theralite (13), Essexite (14)
 Picrite (15), Shonkinite (16), Kentellenite (17).
 Diorite family (18), Augite diorite (19), Quartz diorite (20).
 Granite-granodiorite family (21), Granite (22), Sodagranite (23),
 Granophyre (24), Quartz monzonite (adamellite) (25), Granodiorite (26),
 Granitic vein rocks (27), Pegmatite (28), Aplite (29).
 Syenite family (30), Syenite (31), Monzonite (32), Nepheline syenite (33)
 Vein rocks and other rocks (carbonate, tourmaline rocks etc.) (34-91).

Metamorphic rocks

Hornfels	1	Meta-sediment	18
Buchite	2	Meta-argillite	19
Slate	3	Meta-siltstone	20
Phyllite	4	Meta-sandstone	21
Schist	5	Meta-quartzite	22
Semischist	6	Meta-greywacke	23
Gneiss	7	Meta-gritstone	24
Granulite	8	Meta-conglomerate	25
Charnockite	9	Meta-chert	26
Migmatite	10	Meta-jaspilite	27
Eclogite	11	Meta-(punch appropriate rock name from	
Mylonite	12	the earlier sections)	28
Cataclasite	13		
Phyllonite	14		
Marble	15	Pelitic	29
Amphibolite	16	Quartzo-feldspathic	30
Serpentinite	17	Calcareous	31
		Calc-silicate	32
		Basic	33
		Magnesian	34
		Ferruginous	35
		Siliceous	36

(6) GEOCHEMISTRY

Chemical analysis. - punch if chemical analysis is available.

Major elements. - punch any one of the following elements if desired to

call attention to its particularly high or low content:

Si (1), Ti (2), Al (3), Fe''' (4), Fe'' (5), Mn (6), Mg (7), Ca (8),
Na (9), K (10), H₂O+ (11), H₂O- (12), P (13), C (14).

Elements:- Punch for any element you want to draw attention to because of its quantitative anomaly, rare occurrence, economical significance etc.

Actinium	1	Holmium	30	Rhenium	58
Aluminium	2	Hydrogen	31	Rhodium	59
Antimony	3	Indium	32	Rubidium	60
Argon	4	Iodine	33	Ruthenium	61
Arsenic	5	Iridium	34	Samarium	62
Barium	6	Iron	35	Scandium	63
Beryllium	7	Krypton	36	Selenium	64
Bismuth	8	Lanthanum	37	Silicon	65
Boron	9	Lead	38	Silver	66
Bromine	10	Lithium	39	Sodium	67
Cadmium	11	Lutecium	40	Strontium	68
Calcium	12	Magnesium	41	Sulphur	69
Carbon	13	Manganese	42	Tantalum	70
Cerium	14	Mercury	43	Tellurium	71
Cesium	15	Molybdenum	44	Terbium	72
Chlorine	16	Neodymium	45	Thallium	73
Chromium	17	Neon	46	Thorium	74
Cobalt	18	Nickel	47	Thulium	75
Copper	19	Niobium	48	Tin	76
Dysprosium	20	Nitrogen	49	Titanium	77
Erbium	21	Osmium	50	Tungsten	78
Europium	22	Oxygen	51	Uranium	79
Fluorine	23	Palladium	52	Vanadium	80
Gadolinium	24	Phosphorous	53	Xenon	81
Gallium	25	Platinum	54	Ytterbium	82
Germanium	26	Polonium	55	Yttrium	83
Gold	27	Potassium	56	Zinc	84
Hafnium	28	Praseodymium	57	Zirconium	85
Helium	29				

(7) Chemical affinities

Alkali (1), Alkali-calcic (2), Calc-alkali (3), Calcic (4).
Silica-rich (5), Silica-poor (6), Undersaturated (7)
High-alumina (8), Low-alumina (9), peralkaline (10)
Sodic (11), Potassic (12), Spilitic (13), Tholeiitic (14).

(8) Economical significance

High- punch in conjunction with the elements considered of economical significance.

Low - punch if no economical significance is apparent.

APPENDIX A

PROPOSED ABBREVIATIONS OF ROCK NAMES FOR COMPUTER CODING.

After Whitmore, 1968. The coding is that recommended for use by the Geological Survey of Canada.

AVCC	ACID VOLCANIC	BGNS	BIOTITE*GNEISS
ADML	ADAMELLITE	BLMP	BIOTITE*LAMPHROPHYRE
AGLM	AGGLOMERATE	BSCS	BIOTITE*SCHIST
ALSK	ALASKITE	BKSH	BLACK SHALE
ALBT	ALBITITE	BONE	BONE
AKBL	ALKALI*BASALT	BSNT	BOSTONITE
AKGB	ALKALI*GABBRO	BRCC	BRECCIA
AKPC	AKLALI*PICRITE	BCMB	BRUCITE*MARBLE
AKPX	ALKALI*PYROXENITE	CAMP	CALCAREOUS*AMPHIBOLITE
AKLS	ALKALI*SYENITE	CCGC	CALCAREOUS*GREENSCHIST
AKDB	ALKALINE*DIABASE	CCHF	CALCAREOUS*HORNFELS
ALLV	ALLUVIA	CLCL	CALCSILICATE
AMBL	ALUMINOUS*BASALT	CLCR	CALCARENITE
AMBG	AMBLYGONITE	CCSL	CALCAREOUS*SHALE
AMPH	AMPHIBOLITE	CCCH	CALCSILICATE*HORNFELS
APBG	AMPHIBOLITE*GNEISS	CLCH	CALICHE
APBS	AMPHIBOLITE*SCHIST	CMPN	CAMPIONITE
ADCS	ANDALUSITE*CORDIERITE* SCHIST	CPBT	CARBONATITE
ANDS	ANDESITE	CRCM	CARBONACEOUS*MATERIAL
ADBL	ANDESITE*BASALT	CRBN	CARBONATE
ADPP	ANDESITE*PORPHYRY	CHCS	CARBONACEOUS*SHALE
ANRS	ANORTHOSITE	CHLR	CHALK
ACGB	ANORTHOSITIC*GABBRO	CHST	CHARDSITE
APCG	APLITIC*GRANITE	CRCL	CHARCOAL
APLT	APLITE	CRCK	CHARNOCKITE
ARNT	ARENITE	CHRT	CHERT
ACSL	ARENACEOUS*SHALE	CRLM	CHERTY*LIMESTONE
ARGL	ARGILLITE	CLSC	CHLORITE*SCHIST
AGCL	ARGILLACEOUS*LIMESTONE	CRMI	CHROMITITE
AGCS	ARGILLACEOUS*SANDSTONE	CLSN	CLAY STONE
ARKS	ARKOSE	CLAY	CLAY
AGGS	AUGEN*GNEISS	CLML	CLAY*MINERALS
AGPP	AUGITE*PORPHYRY	CLPX	CLINOPYROXENITE
BSLT	BASALT	CLAS	COAL ASH
BLPP	BASALT*PORPHYRY	COAL	COAL
BCAD	BASIC*ANDESITE	CMPS	COMPOSITE SAMPLE
BCGL	BASIC*GRANULITE	CMPX	COMPLEX*PEGMATITE
BSHF	BASIC*HORNFELS	CGLM	CONGLOMERATE
BCLV	BASIC*LAVA	CQUN	COQUINA
BCSC	BASIC*SCHIST	CARK	CORDIERITE*ANTHOPHYLLITE* ROCK
BCGL	BASIC*GRANULITE	CORK	CORDIERITE*HORNFELS
BCHF	BASIC*HORNFELS	CDSC	CORDIERITE*SCHIST
BNSL	BENTONITIC*SHALE	CORN	CORN

CLIF	CRYSTAL*TUFF	GPCM	GRANITE*PEGMATITE
DCIT	DACITE	GRDR	GRANODIORITE
DCPP	DACITE*PORPHYRY	GRPR	GRANOPHYRE
DIBS	DIABASE	GRNL	GRANULITE
DMND	DIAMOND	GRGS	GRANITE*GNEISS
DSPR	DIASPORE	GPPR	GRANITE*PORPHYRY
DTMT	DIATOMITE	GDPP	GRANODIORITE*PORPHYRY
DPDG	DIOPSIDE*GNEISS	GPGB	GRANOPHYRE*GABBRO
DORT	DIORITE	GRPR	GRANOPHYRE
DRGS	DIORITE*GNEISS	GPCG	GRAPHIC*GRANITE
DLRT	DOLERITE	GPSC	GRAPHITE*SCHIST
DLMT	DOLOMITE	GRSC	GREENSCHIST
DMCL	DOLOMITIC*LIMESTONE	GRSN	GREENSTONE
DUNT	DUNITE	GRSN	GREISEN
ECLG	ECLOGITE	GRCK	GREYWACKE
ENST	ENSTATITE	GCKF	GREYWACKE*FELDSPATHIC
EPDS	EPIDOSITE	GPSM	GYP SUM
ESXT	ESSEXITE	GYTJ	GYTTJA
FCES	FECES	HZBG	HARZBURGITE
FPCA	FELDSPATHIC ARENITE	GSMN	HAUSMANNITE
FPCP	FELDSPATHIC PERIDOTITE	HWIT	HAWAITE
FSPF	FELDSPAR PORPHYRY	HSST	HESSITE
FPPP	FELDSPAR*PORPHYRY	HBLD	HORNBLENDITE
FLST	FELSITE	HRFL	HORNFELS
FNIT	FENITE	HBDD	HORNBLLENDE*DIORITE
FRBR	FERBERITE	HBDG	HORNBLLENDE*GNEISS
FLBC	BLOW*BRECCIA	HBLM	HORNBLLENDE*LAMPROP HYRE
FFLM	FOSSILIFEROUS*LIMESTONE	HMUS	HUMUS
FOYT	FOYALITE	HBGS	HYBRID GNEISS
FBRG	FREIBERGITE	IGMB	IGNIMBRITE
FRST	FRIESEITE	IJLT	IJOLITE
GBBR	GABBRO	ILMN	ILMENITE
GBCA	GABBROIC*ANORHOSITE	IFMC	INTRAFORMATIONAL* CONGLOMERATE
GBCD	GABBROIC*DIORITE	IRFM	IRON*FORMATION
GBCP	GABBROIC*PERIDOTITE	JDIT	JADEITE
GBPP	GABBRO*PORPHYRY	KRPR	KERATOPHYRE
GRGS	GARNET GNEISS	KRSN	KERSANTITE
GRSC	GARNET*SCHIST	KMBL	KIMBERLITE
GLSS	GLASS	KPFC	KIPFERSCHIEFFER
GGAV	GLOWING*AVALANCHE	LMPP	LAMPROP HYRE
GNSS	GNEISS	LPTF	LAPILLI*TUFF
GSSN	GOSSAN	LIRT	LATERITE
GOUG	GOUGE	LTIT	LATITE
GRNT	GRANITE		

LRVK	LAURVIKITE	NPBL	NEPHELINE*BASALT
LAVA	LAVA	NPGB	NEPHELINE*GABBRO
LSNT	LAWSONITE	NPLG	NEPHELINE*GNEISS
LEVS	LEAVES	NPLS	NEPHELINE*SYENITE
LCGR	LEUCO GRANITE	NPPG	NEPHELINE*PEGMATITE
LBZL	LBERZOLITE	NDMK	NORDMARKITE
LGNI	LIGNITE	NORT	NORITE
LMSN	LIMESTONE	OBCG	OBICULAR*GRANITE
LMNT	LIMONITE	OBSD	OBSIDIAN
LMOM	LIMY*DOLOMITE	OLSL	OIL*SHALE
LNNT	LINNAETITE	OGMC	OLIGOMICTIC*CONGLOMERATE
LCAR	LITHIC ARENITE	OLVA	OLIVINE*ANORTHOSITE
LMMC	LITHIUM*MICA	OVBL	OLIVINE*BASALT
LCIF	LITHIC*TUFF	OLVD	OLIVINE*DIORITE
LGPC	LITHOGRAPHIC*LIMESTONE	OVDB	OLIVINE*DIABASE
LPLG	LITPARLIT*GNEISS	OVGB	OLIVINE*GABBRO
LISS	LOESS	OLVN	OLIVINE*NORITE
MCKN	MACKINAWITE	OMPC	OMPHACITE
MCLV	MAFIC LAVA	OCLM	OOLITIC*LIMESTONE
MGGC	MAGNESIAN*GREENSCHIST	OPRX	ORTHOPYROXENITE
MLGN	MALIGNITE	OORZ	ORTHOQUARTZITE
MRBL	MARBLE	OTHR	OTHER
MARL	MARL	PRGS	PARAGNEISS
MARK	META ARKOSE	PEAT	PEAT
MDBS	METADIABASE	PGMT	PEGMATITE
MTDR	METADIORITE	PLIT	PELITE
MGCK	META GREYWACKE	PCGL	PELITIC*GRANULITE
MSDM	METASEDIMENT	PCHF	PELITIC*HORNFELS
MVCC	METAVOLCANIC	PCSC	PELITIC*SCHIST
MCBR	METACINNABAR	PRDT	PERIDOTITE
MSBN	METASTIBNITE	PRKN	PERKNITE
MDRT	METADIORITE	PNLT	PHONOLITE
MGBR	METAGABBRO	PHLT	PHYLLITE
MTRT	METEORITE	PCRT	PICRITE
MCSC	MICA*SCHIST	PCCT	PICRITIC*THOLEIITE
MGMT	MIGMATITE	PLLV	PILLOW*LAVA
MNTT	MINETTE	PSNT	PISANITE
MNZN	MONZONITE	PCSN	PITCHSTONE
MVPP	MONZONITE*PORPHYRY	PLDR	PLANT DETRITUS
MDSN	MUDSTONE	PLFB	PLANT FIBRE
MGRI	MUGEARITE	PLLT	POLYHALITE
MCVS	MUSCOVITE*SCHIST	PMCC	POLYMICTIC*CONGLOMERATE
MLNT	MYLONITE	PRCL	PORCELLANITE
MRMK	MYRMEKITE	PRPR	PORPHYRY

PRPR	PORPHYRITE	SILT	SILT
PXDR	PYROXENE*DIORITE	SKRN	SKARN
QZBL	QUARTZ*BASALT	SLT	SLATE
QRZD	QUARTZ*DIORITE	SPSN	SOAPSTONE
QZGB	QUARTZ*GABBRO	SOCD	SODIC*GRANITE
QRTZ	QUARTZITE	SPLT	SPILITE
QRZL	QUARTZ-LATITE	SPSC	SPOTTED*SCHIST
QZMZ	QUARTZ*MONZONITE	SPDS	SPOTTED*SLATE
QZPP	QUARTZ*PORPHYRY	SLSC	STAUROLITE*SCHIST
QZSC	QUARTZ*SCHIST	SRGC	SUBGREYWACKE
QZDR	QUARTZ*DIORITE	SENT	SYENITE
QZAR	QUARTZ*ANORTHOSITE	SYDR	SYENODIORITE
QZDB	QUARTZ*DIABASE	SGNS	SYENITE*GNEISS
QZDP	QUARTZ*DIORITE*PORPHYRY	SPGM	SYENITE*PEGMATITE
QZFP	QUARTZ*FELDSPAR*	SPPR	SYENITE*PORPHYRY
	PORPHYRY	SGBR	SYENOGABBRO
QZMP	QUARTZ*MONZONITE*	TCNT	TACONITE
	PORPHYRY	TCTT	TACTITE
QZNR	QUARTZ*NORITE	TCSC	TALC*SCHIST
QZPC	QUARTZ*PEBBLE*CONGLOM-	TSCN	TESCHEMITE
	ERATE	THRL	THERALITE
QZSS	QUARTZ*SERICITE*SCHIST	THLT	THOLEITE
AAAA	RESERVED	TCBL	THOLEITIC*BASALT
ZZZZ	RESERVED END OF SYSTEM	THRT	THORITE
RBBP	RHOMB*PORPHYRY	TMNT	THIEMANNITE
RDCT	RHYODACITE	TILL	TILL
RYLT	RHYOLITE	TLLT	TILLITE
RLPP	RHYOLITE*PORPHYRY	TNGT	TINGUAITE
ROTS	ROOTS	TFAR	TITANIFEROUS*ANORTHOSITE
SNDS	SANDSTONE	TNLT	TONALITE
SAND	SAND	TRCD	TRACHYANDESITE
SCLT	SCHEELITE	TCBL	TRACHYBASALT
SCST	SCHIST	TRCT	TRACHYTE
SCOR	SCORIA	TCBC	TRACHYTE BRECCIA
SCSL	SELEMITIC SHALE	TCPP	TRACHYTE*PORPHYRY
SCSC	SERICITE*SCHIST	TRAP	TRAP
SRPN	SERPENTINITE	TRVR	TRAVERTINE
SBRT	SEYBERTITE	TRCL	TROCTOLITE
SHLE	SHALE	TUFF	TUFF
SHLS	SHELLS	UNSP	UNSPECIFIED
SNKN	SHONKINITE	VVDC	VARVED*CLAY
SCMB	SILICATE*MARBLE	VCLV	VESICULAR*LAVA
SLMG	SILLIMANITE*GNEISS	VRPR	VITROPHYRE
SLSN	SILTSTONE	VLCC	VOLCANICS

VCCB VOLCANIC*BRECCIA
VCCC VOLCANIC*CONGLOMERATE
VCCF VOLCANIC*FLOW
WCKE WACKE
WBSR WEBSTERITE
WDTF WELDED*TUFF
WRCK WHOLE ROCK
WOOD WOOD

APPENDIX B

PROPOSED ABBREVIATIONS OF MINERAL NAMES FOR COMPUTER CODING.

After Whitmore, 1968. The coding is that recommended for use by the Geological Survey of Canada.

ACMT	ACMITE	BTHT	BOOTHITE
ACNL	ACTINOLITE	BORC	BORACITE
ADLR	ADULARIA	BORX	BORAX
AKRT	AKERITE	BRNT	BORNITE
AKRM	AKERMANITE	BLGR	BOULANGERITE
ALBD	ALABANUITE	BRNN	BOURNONITE
ALBR	ALBERTITE	BRNR	BRANNERIYE
ALBT	ALBITE	BRUN	BRAUNITE
ALNT	ALLANITE	BRVT	BRAVOITE
ALIT	ALTAITE	BRPT	BREITHAUPITITE
ADOV	ALTERED*OLIVINE	BRLT	BRITHOLITE
APGC	ALTERED*PLAGIOCLASE	BRNZ	BRONZITE
ADPX	ALTERED*PYROXENE	BRCT	BRUCITE
AMMS	ALUMINUM*SILICATE	CLVR	CALAVERITE
AMBG	AMBLYGONITE	CLCT	CALCITE
AMP*	AMPHIBOLE	CNCR	CANCRINITE
ANLC	ANALCITE	CRB*	CARBONATE
ADLS	ANDALUSITE	CRNT	CARNOTITE
ADRD	ANDRADITE	CSRI	CASSITERITE
AGLS	ANGLESITE	CLSI	CELESTITE
ADN*	ANHYDRITE	CRST	CERUSSITE
ANKR	ANKERITE	CRVN	CERVANTITE
ANRT	ANORTHITE	CLCD	CHALCEDONY
ANPL	ANTHOPHYLLITE	CLCC	CHALCOCITE
APTT	APATITE	CLCP	CHALCOPYRITE
AFVD	ARFVEDSONITE	CLCB	CHALCOSTIBITE
ARGN	ARGENTITE	CMST	CHAMOSITE
ARSD	ARSENIDE	CHR*	CHERT
ARPR	ARSENOPYRITE	CLRT	CHLORITE
ABSS	ASBESTOS	CLRU	CHLORITOID
AUGT	AUGITE	CLNT	CHLOANTHITE
ACLC	AURICHALCITE	CLRD	CHLORIDE
AXNT	AXINITE	CRMT	CHROMITE
AZRT	AZURITE	CRSL	CHRYSOTILE
BRIT	BARITE	CNBR	CINNABAR
BUXT	BAUXITE	CLSL	CLAUSTHALITE
BNNT	BENTONITE	CLA*	CLAY
BRRT	BERTHIERITE	CLP*	CLINOPYROXENE
BRYL	BERYL	CBLT	COBALTITE
BNDM	BINDHEIMITE	CLPN	COLOPHANE
BOTT	BIOTITE	CLRO	COLORADOITE
BSMN	BISMUTHINITE	CLMB	COLUMBITE
BSMT	BISMUTITE	CPPR	COPPER
BXBT	BIXBYITE	CRDT	CORDIERITE

CRND CORONADITE
CRDM CORUNDUM
CSLT COSALITE
DVLТ COVELLITE
CCDL CROCIDOLITE
CRLT CRYOLITE
CPML CRYPTOMELANE
CBNT CUBANITE
CMNG CUMMINGTONITE
CPRT CUPRITE
DTLT DATOLITE
DMND DIAMOND
DSPR DIASPORE
DPSD DIOPSIDE
DLM* DOLOMITE
DMRR DUMORTIERITE
DRCS DYSCRASITE
ELCM ELECTRUM
EMRY EMERY
ENRG ENARGITE
ENST ENSTATITE
EPDT EPIDOTE
EXNT EUXENITE
EVPS EVAPORITE SALTS
FMNT FAMATINITE
FYLT FAYALITE
FLDR FELDSPAR
FRBR BERBERITE
FLRP FLUORSPAR
FLRT FLUORITE
FRSR FORSTERITE
FBRG FREIBERGITE
FRST FRIESEITE
GDLN GADOLINITE
GLEN GALENA
GRN* GARNET
GRNI GARNIERITE
GSPT GASPEITE
GCRN GEOCRONITE
GDRF GERSDORFITE
GBST GIBBSITE
GLS* GLASS
GLCD GLAUCODOT
GLCN GLAUCONITE

GTHT GOETHITE
GRPT GRAPHITE
GRNL GREENALITE
GRCK GREENOCKITE
GRSL GROSSULARITE
GRNR GRUNERITE
GUNO GUANO
GDMD GUDMUNDITE
HLIT HALITE
HSMN HAUSMANNITE
HMTT HEMATITE
HDBG HEDENBERGITE
HRCN HERCYNITE
HLND HEULANDITE
HBL* HORNBLLENDE
HBNR HUBNERITE
HDCB HYDROCARBON
HPRS HYPERSTHENE
ILMN ILMENITE
IRDM IRIIDIUM
IRDN IRIDOSMINE
IOXD IRON*OXIDE
JCBS JACOBSITE
JMSN JAMESONITE
JRSI JAROSITE
JSPR JASPER
JRUN JORDANITE
KNIT KAINITE
KOLN KAOLIN
KLNT KAOLINITE
KRMS KERMESITE
KRNR KRENNERITE
KYNT KYANITE
LBDR LABRADORITE
LRNT LARNITE
LMNT LAUMONTITE
LPDL LEPIDOLITE
LPCC LEPIDOCROCITE
LPDL LEPIDOLITE
LUCT LEUCITE
LMMC LITHIUM MICA
LLNG LOELLINGITE
LLNG LOLLINGITE
LXLN LUXULLIANITE

MGMT	MAGHEMITE	ORCL	ORTHOCLASE
MGNS	MAGNESITE	OTH*	OTHER
MGNT	MAGNETITE	PRGN	PARAGONITE
MLCT	MALACHITE	PMBG	PARARAMMELSBERITE
MNGN	MANGANITE	PRCT	PEARCITE
MRCS	MARCASITE	PNLD	PENTLANDITE
MRPS	MARIPOSITE	PRCL	PERICLASE
MCRT	MAUCHERITE	PRVK	PEROVSKITE
MRCM	MEERSCHAUM	PRTH	PERTHITE
MGCR	MEGACRYSTS	PLGP	PHLOGOPITE
MLLT	MELILITE	PSPT	PHOSPHATE
MRNT	MERWINITE	PCBD	PITCHBLEND
MCBR	METACINNABAR	PLGC	PLAGIOCLASE
MSBN	METASTIBNITE	PCQZ	PLAGIOCLASE-QUARTZ CON.
MRGR	MIARGYRITE	PLNM	PLATINUM
MICA	MICA	PMGP	PLATINUM*GROUP
MCCL	MICROCLINE	PLCT	POLLUCITE
MLRT	MILLERITE	PLBS	POLYBASITE
MLBN	MOLYBDENITE	PFDP	POTASH*FELDSPAR
MLBD	MOLYBDITE	PFDM	POTASH*FELDSPAR MEGACRS.
MNZN	MONAZITE	PRNT	PREHNITE
MNCL	MONTICELLITE	PRST	PROUSTITE
MMRL	MONTMORILLONITE	PLML	PSILOMELANE
MSCV	MUSCOVITE	PMPL	PUMPELLYITE
NVAM	NATIVE*ANTIMONY	PRGR	PYRARGYRITE
NVAC	NATIVE*ARSENIC	PYRT	PYRITE
NVBM	NATIVE*BISMUTH	PRLS	PYROLUSITE
VNCP	NATIVE*COPPER	PYRP	PYROPE
NVGD	NATIVE*GOLD	PRPL	PYROPHYLLITE
NVMC	NATIVE*MERCURY	PYXN	PYROXENE
NVPM	NATIVE*PLATINUM	PRTT	PYRRHOTITE
NVSV	NATIVE*SILVER	QRT*	QUARTZ
NVSP	NATIVE*SULPHUR	RMBG	RAMMELSBERGITE
NMNT	NAUMANNITE	RNKN	RANKINITE
NDGN	NEODIGENITE	RLGR	REALGAR
NPLN	NEPHELINE	RDCR	RHODOCHROSITE
NCLT	NICCOLITE	RBCK	RIEBECKITE
NPQA	NONOPAQUE*ACCESSORY	RBSV	RUBY*SILVER
OCHR	OCHER	RUTL	TURUTILE
OLVN	OLIVINE	SFLR	SAFFLORITE
OPAL	OPAL	SMRK	SAMARSKITE
OQAC	OPAQUE ACCESSORY	SNDN	SANIDINE
ORPM	ORPIMENT	SPRN	SAPPHIRINE
OPR*	ORTHOPYROXENE	SSRT	SAUSSURITE

SCPL	SCAPOLITE	TALC	TALC
SCTT	SCAWTITE	TNLT	TANTALITE
SCLT	SCHEELITE	TLRD	TELLURIDE
SCMG	SECONDARY*MAGNETITE	TNNT	TENNANTITE
SLND	SELENIDE	TNRT	TENORITE
SBRT	SEYBERTITE	TPHR	TEPHRITE
SRMN	SENARMONTITE	TRDR	TETRAHEDRITE
SRCT	SERICITE	TRDM	TETRADYMIT
SRP*	SERPENTINE	TMSN	THOMSONITE
SDRT	SIDERITE	THRT	THORITE
SGNT	SIEGENITE	TMNT	TIEMANNITE
SLIC	SILICA	TLLT	TILLEYITE
SLMN	SILLIMANITE	TFMG	TITANIFEROUS*MAGNETITE
SLVR	SILVER	TTNT	TITANITE
SKRD	SKUTTERUDITE	TOPZ	TOPAZ
SMLT	SMALTITE	TLAC	TOTAL*ACCESSORIES
SDLT	SODALITE	TRMN	TOURMALINE
SPCL	SPECULARITE	TRML	TREMOLITE
SPCH	SPECULAR*HEMATITE	TRYM	TRIDYMIT
SPRL	SPERRYLITE	ULMN	ULLMANITE
SPSR	SPESSARITE	UNS*	UNSPECIFIED
SPLR	SPHALERITE	URNN	URANINITE
SPHN	SPHENE	VLNN	VALENTINITE
SPNL	SPINEL	VLRI	VALLERITE
SPDM	SPODUMENE	VNDN	VANADINITE
SPRT	SPURRITE	VSVN	VESUVIANITE
SLGM	STALAGMITE	VLRT	VIOLARITE
STNT	STANNITE	WAD*	WAD
SRLT	STAUROLITE	WLFM	WOLFRAMITE
SPNT	STEPHANITE	WLSN	WOLLASTONITE
SBRG	STERNBERGITE	WRZT	WURTZITE
SBCN	STIBICONITE	YKNT	YUKONITE
SBNT	STIBNITE	ZOLT	ZEOLITE
SPML	STILPNOMELANE	ZNCT	ZINCITE
SRNN	STRONTIANITE	ZMKN	ZINKENITE
SRMR	STROMEYERITE	ZRCN	ZIRCON
SRNN	STRONTIANITE	ZOST	ZOISITE
SLPD	SULPHIDES		
SPAD	SULPH*ARSENIDE		
SPMD	SULPHANTIMONIDE		
SLPT	SULPHATE		
SLPH	SULPHITE		
SLPL	SULPHOSALT		
SLVN	SYLVANITE		
SLVT	SYLVITE		

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APPENDIX C

PROPOSED ABBREVIATIONS OF TEXTURAL TERMS FOR COMPUTER CODING

Aa structure - AA	Mesh structure - MESH
Allotrimorphic - ALLOTR	Mesostasis - MESOST
Allotriomorphic-granular - ALLOTG	Miarolitic caves - MIAROL
Amygdale - AMYDGL	Microcrystalline - MICROC
Aphanitic - APHAN	Microgranitic - MICGR
Aphyric - APHYR	Micrographic - MICGPH
Aplitic - APLIT	Microlite - MICROL
Axiolith - AXIOL	Microperthitic - MICPER
Consertal - CONSER	Microporphyritic - MICPOR
Corona-structure - CORONA	Microspherulitic - MICSPR
Cryptocrystalline - CRYPTO	Myrmekitic - MYRMEK
Crystallite - CRYST	Ocellar - OCELL
Cumulate - CUMUL	Ophitic - OPHITE
Dactylitic intergrowth - DACTYL	Orbicular - ORBIC
Doleritic - DOLER	Orthophyric - ORTPHR
Enclaves - ENCLAV	Pahoehoe structure - PAHOEH
Equigranular - EQUIGR	Panidiomorphic granular - PANGR
Euhedral - EUHEDR	Pegmatitic - PEGMAT
Eutaxitic-structure - EUTAX	Perlitic - PERLIT
Drusy - DRUSY	Perthitic - PERTH
Felted - FELTED	Phanerocrystalline - PHANER
Fluidal - FLUIDL	Pillow structure - PILLOW
Globulite - GLOBUL	Pilotaxitic - PILTAX
Glomeroporphyritic - GLOMER	Poikilitic - POIKIL
Granitoid - GRANIT	Porphyritic - PORPH
Granophyric - GRANOP	Pumiceous - PUMICE
Granular - GRANUL	Pyroclastic - PYROCL
Granulitic - GRANLI	Replacement - REPLAC
Graphic - GRAPH	Schiller structure - SCHILL
Holocrystalline - HOLCR	Shards - SHARDS
Holohyaline - HOLOHY	Sheaf structure - SHEAF
Hourglass structure - HOURGL	Spherulitic - SPHERL
Hyaline - HYAL	Speruloid - SPHERU
Hyallo-ophitic - HYALOP	Subidiomorphic - SUBIDI
Hypidiomorphic-granular - HYPGR	Subophitic - SUBOPH
Hypocrystalline - HYPOCR	Subtrachytic - SUBTR
Hypohyaline - HYPOHY	Symplectite - SYMPL
Idiomorphic - IDIOM	Trachytic - TRACH
Intercumulus - INTCUM	Variolitic - VARIOL
Intergranular - INTGR	Veined - VEINED
Intersertal - INTSER	Vermicular structure - VERMIC
Lamprophyric - LAMPRO	Vesicle - VESIC
Longulites - LONGUL	Vesicular - VESCU

Vitrophyric - VITRO
Vitroclastic - VITCL
Vugh - VUGH
Xenocryst - XENOC
Xenolith - XENOL

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APPENDIX D

COMPUTER PROGRAMME FOR CHEMICAL DATA PRINT-OUT

```
PROGRAM EDGPUNCH
DIMENSION VAL(90),IT(757),ID(2),OXIDE(15)
DIMENSION FMT(10)
DATA (OXIDE=5HSIO2,5MTIO2,5HAL2O3,5HFE2O3,5HPEO,5HMNO,5HMG0
*,5HCAO,5HNA2O,5HK2O,5HP2O5,5HH2O,5HH2O,5HCO2,5HTOTAL)
READ 1,LUN
1 FORMAT (I2)
READ 10,N,(IT(I),I=1,N)
10 FORMAT (I2,8X,35A2/40A2)
READ 20,FMT
20 FORMAT(10A8)
30 READ (LUN,40) ID,(VAL(IT,I=1,14)
IF(EOF,LUN) 999,31
40 FORMAT(A8,A3,14F4;2)
31 VAL(15)=0.0
DO 50 I=1,14
50 VAL(15)=VAL(15)+VAL(I)
PRINT 60,ID
60 FORMAT(1H1,A8,A3/1X7H OXIDES,6X,18HTRACE ELEMENTS RPM)
IF (N,LT,1) GO TO 100
NN=N+15
READ (LUN,FMT) (VAL(IT,I=16,NN)
IF(N,LT,15) GO TO 80
M=N+14
PRINT 70,(OXIDE(I),VAL(I),IT(I),VAL(I+15),IT(I+14),VAL(I+29)
*,I=1,M)
M=M+1 $ MM=14
GO TO 81
80 M=1 $ MM=N
81 PRINT 90,(OXIDE(I),VAL(I),IT(I),VAL(I+15),I=M,MM)
M=MM+1 $ MM=15
100 PRINT 110,(OXIDE(I),VAL(IT,I=M,MM)
GO TO 30
999 CALL EXIT
70 FORMAT (1H,A5,F6,2,1X,A2,E6,0,1X,A2,F6,0)
90 FORMAT (1H ,A5,F6;2,1X,A2;F6,0)
110 FORMAT (1H ,A5,F6;2)
END
```

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APPENDIX E

STANDARD STRATIGRAPHIC UNIT SYMBOLS

Four spaces are provided for this information. The first box or first two boxes stand for the geological Era or Period, according to the following symbols:

Cainozoic	(	Quaternary	(	Recent	-	QR
	(	Q	(	Pleistocene	-	QP
	(					
	(		(	Pliocene	-	TP
	(	Tertiary	(	Miocene	-	TM
	(	T	(	Oligocene	-	TO
			(	Eocene	-	TE
Mesozoic M	(	Cretaceous	)			
	(	K	)			
	(	Jurassic	)			
	(	J	)			
	(	Triassic	)			
	(	R	)			
			)			
Palaeozoic PZ	(	Permian -	)	Upper	-	U
	(	P	)	Middle	-	M
	(	Carboniferous	)	Lower	-	L
	(	C	)			
	(	Devonian	)			
	(	D	)			
	(	Silurian	)			
	(	S	)			
	(	Ordovician	)			
	(	O	)			
	(	Cambrian	)			
	(	E	)			
Precambrian PE	(	Proterozoic				
	(	Z				
	(	Archaean				
	(	A				

The next two or three spaces are intended for abbreviations of the formation name (usually giving the first letter/s of the name, e.g. Heavitree Quartzite - HQ, and/or lithological names, e.g. limestone - L; sandstone - S; shale - H, etc.). An example for an abbreviated unit name is: ZHQS (Proterozoic, Heavitree Quartzite, sandstone).