
GEOLOGY OF
GOSSE PILE
0 0·5 1·0 MILES
0 0·5 1·0 KILOMETRES
A B C D E F G
129° 17' 129° 18' 129° 19' 129° 20' 129° 21' 129° 22'
1 2 3 4
26° 11' 26° 12' 26° 13'
NUMBUNJA PASS
OUTWASH PLAIN
MOUNT DAVIES INTRUSION
Alluvium and talus
Silcrete
GRANULITES
Quartz feldspar pyroxene granulite gneiss
Quartz feldspar granulite
Quartz feldspar garnet granulite
Amphibole pyroxene feldspar granulite
Anorthosite
Iron rich granulite
Calc silicates:
diopside scapolite mica rock
forsterite diopside marble
Foliation in the granulite (Ss)
Foliation in Gosse Pile (St)
Igneous layering (Si)
Fault orientation
GILES COMPLEX
Orthopyroxenite / olivine orthopyroxenite
Websterite
Norite / gabbro
Alternating bands of norite and pyroxenite
Serpentinite
Picrite
Later intrusive with noritic affinities
Olivine gabbro
Dolerite
mylonitic shear zones
CONTACT observed
inferred
FAULT observed
inferred
LOCALITY MAP
ALAN MOORE 1967

Fig. 1.3

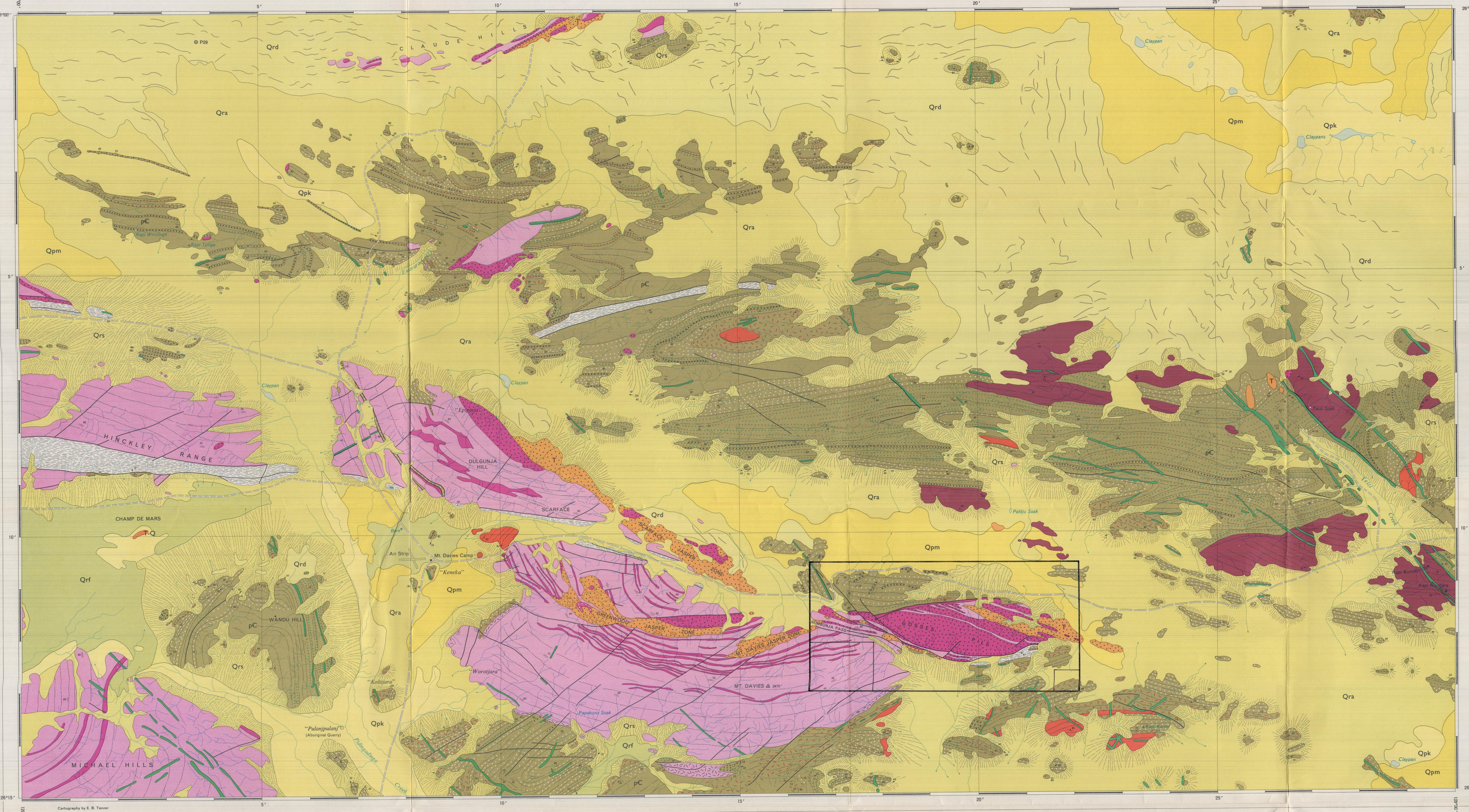
FIG.1.2

DAVIES

GEOLOGICAL SURVEY OF SOUTH AUSTRALIA
DEPARTMENT OF MINES ADELAIDE

FIRST EDITION 1964

GEOLOGICAL ATLAS 1 MILE SERIES
MAP REFERENCE No. 560 ZONE 4



REFERENCE

CAINOZOIC — QUATERNARY — RECENT

- Qra — Silt, sand and gravel of ephemeral streams.
- Qrs — Slope deposits, coarse talus grading to gravel and sand.
- Qrf — Clayey sand of alluvial flats.
- Qrd — Sand dunes and sand spreads.

PLEISTOCENE

- Qpm — Red sandy clay.
- Qpk — Kunkar: Calcareous crust on older stream deposits, in places replaced by chalcedony.

- T-Q — Siliceous duricrust: Overlying weathered bedrock.

TERTIARY

- T — Ferruginous laterite: Overlying weathered kaolinized metasediment.
- Jasper: Ferruginous chalcedonic bodies in weathered ultramafic rock, in places coloured green by nickel silicates.
- Ochre: Nickeliferous yellow-brown cellular goethite bodies derived from ultramafic rock by deep weathering.

PRECAMBRIAN — ARCHEAN

MUSGRAVE-MANN METAMORPHICS

METAQUARTZITES: Coarse-grained, glassy with relict sedimentary banding.
- Quartz, microperthite quartzite.
- Garnet, quartz, microperthite quartzite.

MARBLE: Coarse-grained lenses.
- Calcite, fosterite, diopside, spinel marble.

GRANULITES: Even to medium-grained rocks with relict sedimentary banding.
- Quartz, potassium felspar, plagioclase, hypersthene (?), garnet granulite, light coloured.
- Quartz, plagioclase, pyroxene, garnet granulite.
- Plagioclase, pyroxene, garnet (?) granulite, dark coloured.

GNEISSES: Medium to coarse-grained with coarser felspar augen.
- pC — Plagioclase, pyroxene, quartz gneiss.
- Potassium felspar, plagioclase, quartz hypersthene gneiss. (Includes charnockitic varieties.)

GRANITOID AND ANORTHOSITIC ROCKS

HYPERSTHENE-ADAMELLITE (CHARNOCKITE): Medium to coarse-grained, generally massive or poorly foliated with occasional xenoliths of metasediments.
- Potassium felspar, plagioclase, quartz, pyroxene, garnet rock.

ANORTHOSITE: Coase-grained, massive or weakly foliated with streaks of pyroxenes, in places interfingered with metasediments.
- Dominantly andesine or alkali labradorite with hypersthene.

GILES COMPLEX

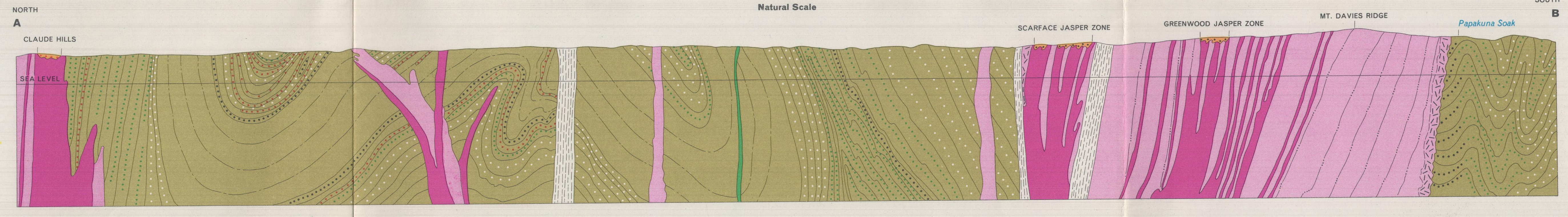
ULTRAMAFIC AND RELATED ROCKS:
- Picrite, troctolite, mela-olivine gabbro, minor peridotite.
- Pyroxenite.
- Serpentinite.

MAFIC AND RELATED ROCKS:
- Norite, gabbro, leuconorite, leucogabbro, olivine gabbro, troctolitic gabbro, anorthosite.
- Contact zone with metasediments, coarse-grained and anorthositic.

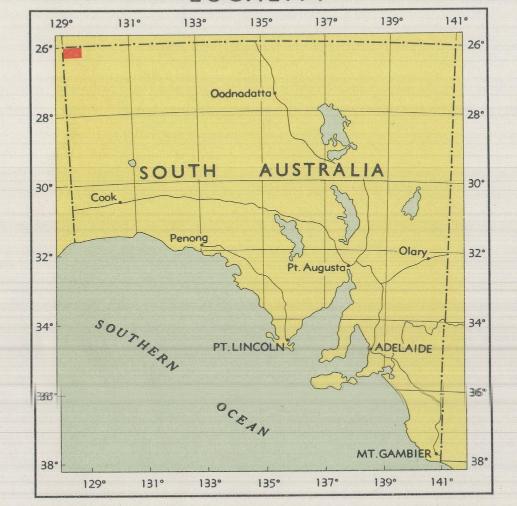
BASIC ROCKS
- Dolerites of noritic or gabbroic composition.
- Massive magnetite bodies.
- Mylonite and cataclasite of shear zones.

GEOLOGICAL BOUNDARIES
OBSERVED
APPROXIMATE
FAULTS
OBSERVED
FOLDS
PLUNGE OF MINOR FOLD
BEDDING
INCLINED
VERTICAL
TREND OF BEDDING
TOP OF BED, CROSS BEDDING
FOLIATION
INCLINED
TREND OF FOLIATION
LAYERING IN GILES COMPLEX
INCLINED
VERTICAL
TREND OF LAYERING
LINEATION
INCLINED
EROSIONAL SCARP
ROAD
TRACK
ABORIGINAL LOCALITY .... "Kolitjara"
TRIANGULATION STATIONS
HORIZONTAL CONTROL .... △
ASTRONOMICAL STATION .... ⊕
EPHEMERAL STREAM

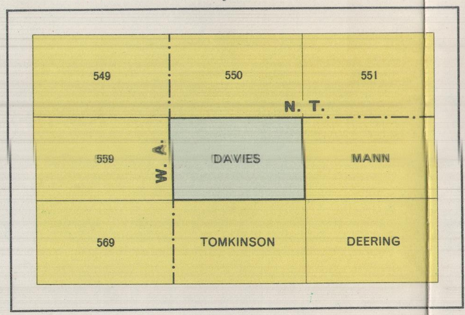
SECTION A-B
Natural Scale



LOCALITY



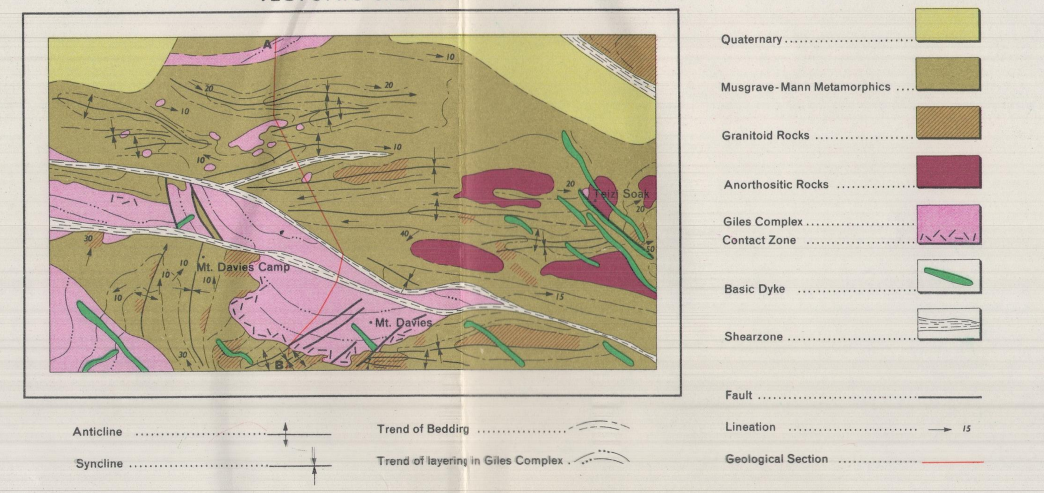
INDEX TO ADJOINING SHEETS



SCALE: 1 : 63,360 — 1 INCH TO 1 MILE

CHAINS — MILES
METRES — KILOMETRES

TECTONIC SKETCH



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DAVIES

Table 3.10 Chemical analyses of orthopyroxenes and their structural formulas on the basis of 6 oxygens.

Analysis	1	2	3	4	5	6	7	8	9	10	11
Sample No. A313/-	11	12*	13	14	15	25	39B	44	48	49	49m
SiO_2	54.59	55.97	54.34	54.08	54.81	54.38	54.56	54.89	54.54	55.58	54.97
Al_2O_3	3.74	4.31	4.01	3.03	4.00	3.15	3.76	3.33	3.15	3.40	3.70
Fe_2O_3	1.76	0.45	2.18	1.42	1.52	1.25	1.23	0.88	1.26	0.82	1.35
Cr_2O_3	0.63	0.30	0.32	0.67	0.74	0.41	0.78	0.76	0.79	0.75	0.76
FeO	7.95	7.83	7.36	8.53	8.26	8.33	7.53	9.94	7.62	7.87	7.49
MgO	28.84	24.53	28.55	29.38	27.60	29.43	29.10	28.47	30.28	29.30	29.08
CaO	1.74	6.37	2.17	2.48	2.23	2.00	1.80	1.43	1.64	1.64	1.93
Na_2O	0.10	0.16	0.10	0.11	0.14	0.17	0.15	0.12	0.09	0.07	0.07
K_2O	0.02	0.00	0.00	0.00	0.00	0.00[3]	0.04	0.00	0.00	0.00	0.00
TiO_2	0.11	0.12	0.10	0.08	0.10	0.08	0.11	0.08	0.10	0.10	0.11
MnO	0.20	0.17	0.19	0.21	0.19	0.20	0.18	0.21	0.17	0.17	0.17
NiO	0.09	0.07	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.11	0.11
P_2O_5	0.00[6]	n.a.	n.a.	0.00[5]	0.00	0.00[6]	n.a.	n.a.	n.a.	n.a.	n.a.
TOTAL	99.78	100.28	99.41	100.09	99.68	99.50	99.33	100.21	99.74	99.81	99.74
Trace elements (in p.p.m.)											
Cr	4368	2016	2157	4596	5030	2822	5363	5232	5421	5116	5184
Ni	718	580	681	739	718	729	742	759	810	853	865
Cu	<20	n.a.	<20	n.a.	n.a.	<20	n.a.	n.a.	n.a.	n.a.	n.a.
Sr	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.a.	n.a.	n.a.	n.a.
Structural formulae of orthopyroxenes (on the basis of 6 oxygens).											
Si	1.9217	1.9657	1.9141	1.9105	1.9321	1.9226	1.9212	1.9343	1.9173	1.9456	1.9289
Al^{IV}	0.0783	0.0343	0.0859	0.0895	0.0679	0.0774	0.0788	0.0657	0.0827	0.0544	0.0711
Al^{VI}	0.0765	0.1438	0.0804	0.0366	0.0981	0.0539	0.0769	0.0723	0.0478	0.0856	0.0815
Fe^{3+}	0.0465	0.0118	0.0575	0.0373	0.0402	0.0331	0.0162	0.0232	0.0329	0.0214	0.0354
Cr^{3+}	0.0173	0.0080	0.0088	0.0186	0.0203	0.0110	0.0215	0.0207	0.0215	0.0206	0.0206
Fe^{2+}	0.2339	0.2298	0.2167	0.2520	0.2434	0.2462	0.2217	0.2928	0.2239	0.2303	0.2197
Mg	1.5130	1.2838	1.4986	1.5468	1.4500	1.5508	1.5271	1.4942	1.5863	1.5284	1.5208
Ca	0.0655	0.2395	0.0817	0.0938	0.0841	0.0756	0.0677	0.0537	0.0616	0.0614	0.0725
Na	0.0067	0.0105	0.0067	0.0072	0.0093	0.0114	0.0101	0.0080	0.0059	0.0046	0.0046
K	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0000	0.0000	0.0000	0.0000
Ti	0.0027	0.0031	0.0025	0.0002	0.0025	0.0021	0.0027	0.0021	0.0025	0.0025	0.0027
Mn	0.0059	0.0048	0.0055	0.0061	0.0055	0.0059	0.0052	0.0061	0.0048	0.0048	0.0048
Ni	0.0025	0.0018	0.0025	0.0025	0.0025	0.0025	0.0025	0.0027	0.0027	0.0029	0.0029
P	0.0002	-	-	0.0002	0.0000	0.0002	-	-	-	-	-
Z	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000
WXY	1.9715	1.9369	1.9609	2.0013	1.9559	1.9902	1.9540	1.9758	1.9899	1.9625	1.9655
Fs	16.45	16.39	16.24	15.59	17.32	15.57	14.45	18.15	14.38	15.29	15.34
En	79.83	70.61	79.21	79.29	77.83	80.02	81.51	78.68	82.18	81.30	80.68
Wo	3.72	13.00	4.55	5.12	4.85	4.41	4.05	3.17	3.44	3.41	3.98
Mg	81.39	72.74	80.81	80.15	79.77	81.38	83.33	80.17	83.28	83.00	82.28
Σ Fe	15.09	13.69	14.79	14.99	15.60	14.66	12.98	16.95	13.48	13.67	13.80
Ca	3.52	13.57	4.40	4.86	4.63	3.96	3.69	2.88	3.24	3.33	3.92
Σ Fe as FeO	9.91	8.23	9.32	9.81	9.63	9.46	8.64	10.73	8.75	8.61	8.71
MgO/Σ FeO	3.03	2.98	3.06	3.00	2.87	3.11	3.37	2.86	3.46	3.40	3.34
%Al in Z	3.92	1.72	4.30	4.48	3.40	3.87	3.94	3.29	4.14	2.72	3.56
%Al in WXY	3.99	7.42	4.10	1.83	5.02	2.71	3.94	3.66	2.40	4.36	4.15
mg	84.1	83.9	84.3	84.0	83.4	84.5	83.1	82.3	85.8	85.6	85.4

* Poor analyses, probably due to incomplete separation of orthopyroxene and clinopyroxene. All are from rocks in which the two pyroxenes are intimately intergrown.

The rocks from which these pyroxenes have been separated are named and briefly described in Appendix 5.

CONTINUED

Table 3.10 (continued) Chemical analyses of orthopyroxenes and their structural formulae on the basis of 6 oxygens.

Analysis	12	13	14	15	16	17	18	19	20	21	22	23
Sample No. A313/-	50	51	53*	54	55	56	60	116*	116m*	273p	273	387
SiO_2	54.43	54.39	56.66	54.95	55.85	55.36	53.98	53.78	53.80	56.01	54.46	55.52
Al_2O_3	3.67	3.82	4.00	3.34	3.19	3.47	3.70	3.92	3.86	3.49	3.57	2.56
Fe_2O_3	1.24	0.60	0.46	0.95	1.32	1.06	1.25	1.36	1.33	1.41	0.93	1.47
Cr_2O_3	0.77	0.74	0.34	0.80	0.86	0.95	0.63	0.66	0.66	0.61	0.56	0.67
FeO	8.77	9.05	7.59	6.93	7.68	7.41	9.11	8.34	8.63	8.61	8.61	7.38
MgO	28.76	28.18	22.48	30.13	28.93	28.28	28.68	27.30	27.84	27.64	29.05	29.70
CaO	1.61	2.30	8.77	1.89	1.53	2.33	1.69	3.15	2.62	1.98	2.02	1.78
Na_2O	0.05	0.08	0.23	0.03	0.02	0.06	0.12	0.23	0.19	0.10	0.27	0.11
K_2O	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.03	0.03	0.00	0.00	0.01
TiO_2	0.10	0.10	0.11	0.11	0.11	0.11	0.17	0.25	0.25	0.12	0.14	0.10
MnO	0.19	0.19	0.16	0.18	0.17	0.17	0.19	0.20	0.19	0.20	0.20	0.17
NiO	0.10	0.09	0.07	0.09	0.10	0.10	0.08	0.09	0.09	0.09	0.08	0.11
P_2O_5	n.a.	n.a.	n.a.	n.a.	0.00	0.00	0.005	n.a.	n.a.	n.a.	n.a.	0.00
TOTAL	99.64	99.54	100.89	99.40	99.76	99.30	99.61	99.31	99.49	99.65	99.89	99.58
Trace elements (in p.p.m.)												
Cr	5293	5051	2253	5493	5913	6474	4288	4515	4514	4137	3851	4578
Ni	810	734	550	711	757	747	648	686	689	690	655	823
Cu	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	< 20	n.a.	n.a.	n.a.	n.a.	n.a.
Sr	n.a.	n.d.	n.d.	n.d.	n.a.	n.a.	n.d.	n.a.	n.a.	n.a.	n.a.	n.d.
Structural formulae of orthopyroxenes (on the basis of 6 oxygens).												
Si	1.9206	1.9264	1.9867	1.9162	1.9553	1.9490	1.9120	1.9111	1.9100	1.9592	1.9196	1.9498
Al^{IV}	0.0794	0.0736	0.0133	0.0838	0.0447	0.0510	0.0880	0.0889	0.0900	0.0408	0.0804	0.0502
Al^{VI}	0.0734	0.0856	0.1519	0.0532	0.0865	0.0928	0.0661	0.0751	0.0712	0.1029	0.0678	0.0557
Fe^{3+}	0.0326	0.0157	0.0117	0.0511	0.0345	0.0279	0.0332	0.0363	0.0354	0.0369	0.0245	0.0388
Cr^{3+}	0.0212	0.0204	0.0092	0.0217	0.0235	0.0262	0.0174	0.0183	0.0183	0.0168	0.0152	0.0185
Fe^{2+}	0.2589	0.2679	0.2225	0.2020	0.2246	0.2181	0.2696	0.2477	0.2562	0.2518	0.2537	0.2167
Mg	1.5136	1.4875	1.1747	1.5658	1.5096	1.4838	1.5140	1.4458	1.4728	1.4409	1.5258	1.5545
Ca	0.0609	0.0872	0.3293	0.0706	0.0572	0.0878	0.0640	0.1198	0.0996	0.0742	0.0762	0.0669
Na	0.0033	0.0051	0.0155	0.0016	0.0012	0.0038	0.0080	0.0158	0.0128	0.0067	0.0182	0.0071
K	0.0000	0.0000	0.0008	0.0000	0.0000	0.0000	0.0004	0.0012	0.0013	0.0000	0.0000	0.0004
Ti	0.0025	0.0025	0.0027	0.0027	0.0027	0.0027	0.0044	0.0066	0.0066	0.0031	0.0036	0.0025
Mn	0.0055	0.0055	0.0046	0.0052	0.0048	0.0048	0.0055	0.0059	0.0055	0.0058	0.0059	0.0048
Ni	0.0027	0.0025	0.0018	0.0025	0.0027	0.0027	0.0021	0.0025	0.0025	0.0025	0.0021	0.0029
P	-	-	-	-	-	-	0.0002	-	-	-	-	0.0000
Z	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000	2.0000
WXY	1.9746	1.9799	1.9247	1.9712	1.9472	1.9506	1.9849	1.9750	1.9822	1.9416	1.9930	1.9659
Fs	16.94	16.79	17.05	14.43	15.85	15.32	17.25	16.68	16.91	17.83	15.94	14.65
En	79.76	78.48	65.27	81.86	81.10	79.90	79.07	76.35	77.34	77.95	79.27	81.54
Wo	3.30	4.73	17.68	3.71	3.05	4.78	3.68	6.97	5.75	4.22	4.79	3.81
Mg	81.12	80.05	67.58	82.87	82.68	81.64	80.50	78.17	79.01	79.88	81.15	82.82
Σ Fe	15.62	15.26	13.47	13.40	14.19	13.53	16.10	15.35	15.64	16.01	14.80	13.61
Ca	3.26	4.69	18.95	3.73	3.13	4.83	3.40	6.48	5.35	4.11	4.05	3.56
Σ Fe as FeO	9.89	9.59	8.00	7.79	8.87	8.36	10.24	9.56	9.83	9.88	9.45	8.70
MgO/Σ FeO	2.91	2.94	2.81	3.81	3.26	3.38	2.90	2.86	2.83	2.80	3.07	3.41
%Al in Z	3.97	3.68	(0.67)*	4.19	2.24	2.55	4.40	4.45	4.50	2.04	4.02	2.51
%Al in WXY	3.72	4.32	(7.89)*	2.70	4.44	4.76	3.33	3.80	3.59	5.30	3.40	2.83
mg	83.6	79.8	83.1	85.8	85.1	85.5	83.1	77.9	78.8	83.0	84.3	85.7

* Poor analyses, probably due to incomplete separation of orthopyroxene and clinopyroxene. All are from rocks in which the two pyroxenes are intimately intergrown.

The rocks from which these pyroxenes have been separated are named and briefly described in Appendix 5.

Z: The trivalent and quadrivalent cations in tetrahedral co-ordination (Si^{4+}, Al^{3+}).

WXY: The bi-, tri-, and quadri-valent cations in octahedral co-ordination (Al^{3+}, Fe^{3+}, Ti^{4+}?, Mg^{2+}, Mn^{2+}, Fe^{2+}) and mono-, and bi-valent cations in hexahedral co-ordination (K^+, Na^+ and Ca^+).

En: Molecular % enstatite = Mg + $\frac{1}{2}Al^{IV}$ + $\frac{1}{2}$Ti; Fs = molecular % ferrosilite = Fe^{2+} + Fe^{3+} + $\frac{1}{2}Al^{IV}$ + $\frac{1}{2}$Ti; Wo molecular % wollastonite = Ca + Na.

Mg: Molecular % Mg^{2+}. Σ Fe: molecular % (Fe^{2+} + Fe^{3+}). Ca = molecular % Ca^{2+}.

mg: 100Mg/Mg + Fe^{2+} + Fe^{3+} + Mn.

Analyses of orthopyroxenes with well developed rutile exsolution: 1, 5, 7, 8, 10, 12, 15, 17, 18, 19 (and 20), 21 and 22.

LOCATION OF SPECIMENS AND OBSERVATION STATIONS

SPECIMENS OR LOCATIONS REFERRED TO IN THE TEXT ARE "BOXED" E.G. 218

"R" — E.G. R45, INDICATES A253/- OTHERS—INDICATES A313/-