

LIST OF FIGURES

Figure No.		After/In page No.
1.1	Location map of the study area	5
3.1	Schematic drawing of the structure of beryl projected perpendicular to <i>c</i> -axis	19
3.2	Schematic drawing of the slice of beryl structure projected parallel to <i>c</i> -axis depicting presence of two types of water molecules, transition ion and carbon dioxide (modified after Wood and Nassau, 1968)	19
3.3	Showing positive correlation between specific gravity and refractive index (ω)	29
4.1	Formation of apparent hexagonal looking growth features on prism faces of beryl crystal, due to the development of basal pinacoid and dipyrmaid of 2 nd order	38
4.2	Line drawing of the above SEM photograph depicting screw dislocation on prism face	40
5.1	Representation of the three normal vibrational modes of a water molecule	44
5.2	Schematic drawing of the structure of beryl projected parallel to the <i>c</i> -axis of a) indicating presence of two types of water molecules and b) indicating presence of OH molecules associated with larger alkali ions	46
5.3	Polarised FT-IR spectra of beryl in two directions	47
5.4	Infrared Absorption spectra of a) Flux grown beryl and b) hydrothermal beryl (after Wood and Nassau, 1968)	47
5.5	Single crystal FT-IR spectra of a) colourless beryl, b) yellow beryl, c) blue beryl and d) green beryl	48
5.6	Single crystal FT-IR spectra of blue aquamarine (Karur) and b) Kerala green beryl	48
5.7	Powder FT-IR spectra of a) colourless and b) yellow beryl indicating increase in intensity of asymmetrical mode of type-I water molecule on powdering	53
5.8	Powder FT-IR spectra of beryl in the range 1400-400 cm^{-1}	55
5.9	FT-IR spectra of colourless beryl. a) normal FT-IR and b) FSD trace of it	56
5.10	FT-IR spectra of yellow beryl. a) normal FT-IR and b) FSD trace of it	56
5.11	FT-IR spectra of blue beryl. a) normal FT-IR and b) FSD trace of it	56
5.12	FT-IR spectra of green beryl. a) normal FT-IR and b) FSD trace of it	56

5.13	Fourier Self Deconvolution spectra in the range (760-600 cm^{-1}) of, a) goshenite, b) aquamarine, c) heliodor and c) green beryl	59
5.14	Fourier Self Deconvolution spectra in the range (600-500 cm^{-1}) of, a) goshenite, b) aquamarine, c) heliodor and c) green beryl	59
5.15	Infrared spectra of single crystal beryl at variable temperatures a) O-H stretching and b) H-O-H bending (after Aines and Rossman, 1984b)	61
5.16	Unpolarised FT-IR spectra depicting heating experiments carried out at room temperature, 500 °C and 800 °C.	62
5.17	Single crystal FT-IR spectra depicting behaviour of bending mode on heating at variable temperatures	62
5.18a	Polarised Raman spectra of beryl along E c	64
5.18b	Polarised Raman spectra of beryl along E⊥c	64
5.19	Thermogravimetric (TG) and Differential Thermal Analysis (DTA) of powdered beryl sample	67
6.1	Splitting of degenerate electronic level ($\pm 1/2$) by a magnetic field	78
6.2	ESR spectra of colourless beryl along two directions, a) H c and b) H⊥c	81
6.3	Single crystal angular variation study along a) H c and H⊥c of the 3200 Gauss line	82
6.4	ESR spectra of light green beryl a) depicting absence of Fe^{3+} ion at 3200 G and its presence near 1500 and b) representing Fe^{3+} line at both 3200 and 1500 G	83
6.5	ESR spectra depicting presence of Mn^{2+} hyperfine lines along with Fe^{3+} line in green beryl	84
6.6	Graph depicting behaviour of variable temperature ESR line of Fe^{3+} at 3200 Gauss before and after irradiation	84
6.7	ESR spectra of irradiated colourless beryl along a) H c and b) H⊥c, depicting presence of new line at $g = 4.26$ produced only after irradiation	85
6.8	ESR spectra of irradiated green beryl depicting presence of a new line at $g = 4.26$ on irradiation	87
6.9	ESR spectra representing presence of CH_3 radical produced after irradiation	88

6.10	Thermal decay behaviour of atomic hydrogen and methyl radical on heating at higher temperatures	89
6.11	ESR spectral characteristics of a) NO ₃ radical in Maxixe beryl and b) CO ₃ ⁻ radical in Maxixe type beryl	90
6.12	Principal features of a typical absorption spectrum in the range from UV through near IR	94
6.13	Composite spectrum of beryl	96
6.14	Polarised optical absorption spectra of colourless beryl along <i>o</i> -ray and <i>e</i> -ray	97
6.15	Faye (1972) figure illustrating relationship barycentre energy and bond distance	98
6.16	Optical absorption spectra of irradiated colourless beryl, a) OA along <i>o</i> -ray in the UV-VIS-NIR range and b)UV-VIS range depicting presence of Maxixe type colour centre.	98
6.17	Optical absorption spectra of irradiated colourless beryl along <i>e</i> -ray depicting presence of Fe ³⁺ at octahedral Al site	98
6.18a	OA spectra of Orissan yellow beryl along <i>o</i> -ray	102
6.18b	OA spectra of Orissan yellow beryl along <i>e</i> -ray	102
6.19a	OA spectra of Siberian yellow beryl along <i>o</i> -ray	104
6.19b	OA spectra of Siberian yellow beryl along <i>e</i> -ray	104
6.20	Distinguishing between aquamarine and Maxixe beryls by observing dichroism while rotating the specimen above a polariser	107
6.21a	OA spectra of Orissan blue beryl along <i>o</i> -ray	107
6.21b	OA spectra of Orissan blue beryl along <i>e</i> -ray	107
6.22a	OA spectra of Tamil Nadu blue beryl along <i>o</i> -ray	108
6.22b	OA spectra of Tamil Nadu blue beryl along <i>o</i> -ray	108
6.23	Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993)	110
6.24	Unpolarised OA spectra of Orissan green beryl	110
6.25	Radioactive decay scheme of ⁵⁷ Co to an excited state of ⁵⁷ Fe	112
6.26 a)	Mössbauer resonance when the ⁵⁷ Fe in the source has the same ground state as the excited state and b) when the sample has slightly higher energy difference	113

6.27	Mössbauer resonance when the excited state in the sample is split into two energy levels by the presence of non cubic symmetry	114
6.28	Mössbauer spectra of colourless beryl (Powder)	115
6.29	Mössbauer spectra of single crystal blue beryl	118
6.30	Mössbauer spectra of single crystal green beryl	119
6.31	Mössbauer spectra of single crystal Siberian yellow beryl	120