LIST OF FIGURES

•

.

٠

.

y

Figure No.

.

1 1	Leastion man of the study gros	· c
1,1	Location map of the study area	3
3,1 0,0	Schematic drawing of the structure of beryl projected perpendicular to c-axis	19
3.2	Schematic drawing of the slice of beryl structure projected parallel	19
	to <i>c</i> -axis depicting presence of two types of water molecules, transition	
*	ion and carbon dioxide (modified after Wood and Nassau, 1968)	
3.3	Showing positive correlation between specific gravity and refractive index (ω)	29
41	Formation of apparent hexagonal looking growth features on prism faces of	38
	beryl crystal, due to the development of basal pinacoid and dipyramid of 2 nd ord	er
4.2	Line drawing of the above SEM photograph depicting screw dislocation	40
	on prism face	
51	Representation of the three normal vibrational modes of a water molecule	44
52	Schematic drawing of the structure of beryl projected parallel to the c-axis of	46
	a) indicating presence of two types of water molecules and	
	b) indicating presence of OH molecules associated with larger alkali ions	
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	47
	(after Wood and Nassau, 1968)	
5.5	Single crystal FT-IR spectra of a) colourless beryl, b) yellow beryl,	48
	c) blue beryl and d) green beryl	
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	53
	in intensity of asymmetrical mode of type-I water molecule on powdering	
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

I.

After/In page No.

	5.13	Fourier Self Deconvolution spectra in the range (760-600 cm ⁻¹) of,	59
	,	a) goshenite, b) aquamarine, c)heliodor and c) green beryl	
	5.14	Fourier Self Deconvolution spectra in the range (600-500 cm ⁻¹)	59
		of, a) goshenite, b) aquamarine, c)heliodor and c) green beryl	
	5.15	Infrared spectra of single crystal beryl at variable temperatures	61
		a) O-H stretching and b) H-O-H bending (after Aines and Rossman, 1984b)	•
ŗ	5 16	Unpolarised FT-IR spectra depicting heating experiments carried	62
		out at room temperature, 500 °C and 800 °C.	
	5.17	Single crystal FT-IR spectra depicting behaviour of bending mode on	62
		heating at variable temperatures	
	5.18a	Polarised Raman spectra of beryl along EIIc	64
с 3	5.18 b	Polarised Raman spectra of beryl along $E \perp c$	64
	5.19	Thermogravimetric (TG) and Differential Thermal Analysis (DTA)	67
		of powdered beryl sample	
	. 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) HIIc and b) H $\perp c$	81
	6.3	Single crystal angular variation study along a) HIIc and H $\perp c$ of the	82
	٠	3200 Gauss line	
	64 [´]	ESR spectra of light green beryl a) depicting absence of Fe^{3+} ion at 3200 G	83
		and its presence near 1500 and b) representing Fe^{3+} line at both 3200 and 1500 G	
	6.5	ESR spectra depicting presence of Mn^{2+} hyperfine lines along with Fe^{3+}	84
		line in green beryl	
	6.6	Graph depicting behaviour of variable temperature ESR line of Fe ³⁺	[.] 84
		at 3200 Gauss before and after irradiation	ŗ
	6.7	ESR spectra of irradiated colourless beryl along a) HIIc and b)H $\perp c$,	85
		depicting presence of new line at $g = 4.26$ produced only after irradiation	3 440 3
	68	ESR spectra of irradiated green beryl depicting presence of a new line at	87
		g= 4.26 on irradiation	
	6,9	ESR spectra representing presence of CH3 radical produced after irradiation	88

.

iv

at higher temperatures 90 5.11 ESR spectral characteristics of a) NO3 radical in Maxixe beryl and 90 b) CO3' radical in Maxixe type beryl 94 f.12 Principal features of a typical absorption spectrum in the range from UV 94 f.13 Composite spectrum of beryl 96 6.13 Composite spectrum of beryl 96 6.14 Polarised optical absorption spectra of colourless beryl along o-ray and e-ray 97 6.15 Faye (1972) figure illustrating relationship barycentre energy and bond distance 98 o-ray in the UV-VIS-NIR range and b)UV-VIS range depicting presence 98 of Maxixe type colour centre. 617 Optical absorption spectra of irradiated colourless beryl along e-ray 98 depicting presence of Fe ³⁺ at octahedral Al site 618 OA spectra of Orissan yellow beryl along o-ray 100 6.18 OA spectra of Siberian yellow beryl along o-ray 100 619 OA spectra of Orissan blue beryl along o-ray 100 6.19 OA spectra of Orissan blue beryl along o-ray 100 620 Distinguishing between aquamarine and Maxixe beryls by observing 100 6.214 OA spectra of Orissan blue beryl along o-ray 100 6.22a	6.10	Thermal decay behaviour of atomic hydrogen and methyl radical on heating	89
5.11 ESR spectral characteristics of a) NO3 radical in Maxixe beryl and 90 b) CO3 ⁺ radical in Maxixe type beryl 94 through near IR 96 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 98 <i>o</i> -ray in the UV-VIS-NIR range and b)UV-VIS range depicting presence of Maxixe type colour centre. 90 6.17 Optical absorption spectra of irradiated colourless beryl along <i>e</i> -ray 98 depicting presence of Fe ³⁺ at octahedral Al site 91 90 6.18 OA spectra of Orissan yellow beryl along <i>e</i> -ray 102 6.19 OA spectra of Siberian yellow beryl along <i>e</i> -ray 102 6.18 OA spectra of Siberian yellow beryl along <i>e</i> -ray 102 6.19 OA spectra of Orissan blue beryl along <i>e</i> -ray 102 6.19 OA spectra of Orissan blue beryl along <i>e</i> -ray 102 6.20 Distinguishing between aquamarine and Maxixe beryls by observing 102 <tr< td=""><td></td><td>at higher temperatures</td><td></td></tr<>		at higher temperatures	
b) CO ₃ radical in Maxixe type beryl 94 6 12 Principal features of a typical absorption spectrum in the range from UV 94 through near IR 96 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 98 <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 98 depicting presence of Fe ³⁺ at octahedral AI site 98 6.18 OA spectra of Orissan yellow beryl along <i>e</i> -ray 100 6.19a OA spectra of Siberian yellow beryl along <i>e</i> -ray 100 6.19b OA spectra of Siberian yellow beryl along <i>e</i> -ray 100 6.19b OA spectra of Orissan blue beryl along <i>e</i> -ray 100 6.21a OA spectra of Orissan blue beryl along <i>e</i> -ray 100 6.21b OA spectra of Tamil Nadu blue beryl along <i>e</i> -ray 100 6.22b	6.11	ESR spectral characteristics of a) NO_3 radical in Maxixe beryl and	90
6 12 Principal features of a typical absorption spectrum in the range from UV 94 through near IR 6.13 Composite spectrum of beryl 96 6.14 Polarised optical absorption spectra of colourless beryl along o-ray and e-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 98 o-ray in the UV-VIS-NIR range and b)UV-VIS range depicting presence 97 6.17 Optical absorption spectra of irradiated colourless beryl along e-ray 98 depicting presence of Fe ^{3*} at octahedral AI site 618 OA spectra of Orissan yellow beryl along o-ray 102 6.18a OA spectra of Siberian yellow beryl along o-ray 102 104 6.19b OA spectra of Siberian yellow beryl along o-ray 102 6.19c OA spectra of Orissan blue beryl along o-ray 104 6.19b OA spectra of Orissan blue beryl along o-ray 104 6.19c OA spectra of Siberian yellow beryl along o-ray 104 6.19b OA spectra of Orissan blue beryl along o-ray 104 6.211 OA spectra of Orissan blue beryl along o-ray 104	P	b) CO3 ⁻ radical in Maxixe type beryl	
through near IR 96 6.13 Composite spectrum of beryl 96 6.14 Polarised optical absorption spectra of colourless beryl along o-ray and e-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 98 o-ray in the UV-VIS-NIR range and b)UV-VIS range depicting presence of Maxixe type colour centre. 6.17 Optical absorption spectra of irradiated colourless beryl along e-ray 98 depicting presence of Fe ³⁺ at octahedral Al site 98 6.18a OA spectra of Orissan yellow beryl along e-ray 102 6.19a OA spectra of Siberian yellow beryl along e-ray 102 6.19b OA spectra of Siberian yellow beryl along e-ray 102 6.19b OA spectra of Orissan below beryl along e-ray 102 6.19b OA spectra of Orissan blue beryl along e-ray 102 6.19b OA spectra of Orissan blue beryl along e-ray 102 6.19c OA spectra of Orissan blue beryl along e-ray 102 6.211 OA spectra of Orissan blue beryl along e-ray 102 6.2121 OA spectra of Tamil Nadu	6 12	Principal features of a typical absorption spectrum in the range from UV	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 98 <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 98 depicting presence of Fe ³⁺ at octahedral AI site 98 6.18a OA spectra of Orissan yellow beryl along <i>o</i> -ray 102 6.19a OA spectra of Siberian yellow beryl along <i>o</i> -ray 102 6.19b OA spectra of Siberian yellow beryl along <i>o</i> -ray 102 6.19b OA spectra of Orissan blue beryl along <i>o</i> -ray 102 6.20 Distinguishing between aquamarine and Maxixe beryls by observing 103 6.21b OA spectra of Orissan blue beryl along <i>o</i> -ray 104 6.21c OA spectra of Orissan blue beryl along <i>o</i> -ray 104 6.21c OA spectra of Orissan blue beryl along <i>o</i> -ray 104 6.21c OA spectra of Orissan blue beryl alo		through near IR	
6.14 Polarised optical absorption spectra of colourless beryl along o-ray and e-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 98 o-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 e-ray 98 depicting presence of Fe ³⁺ at octahedral Al site 98 6.18a OA spectra of Orissan yellow beryl along e-ray 100 6.19a OA spectra of Siberian yellow beryl along e-ray 100 6.19b OA spectra of Siberian yellow beryl along e-ray 100 6.19b OA spectra of Siberian yellow beryl along e-ray 100 6.19b OA spectra of Orissan blue beryl along e-ray 100 6.19b OA spectra of Orissan blue beryl along e-ray 100 6.19b OA spectra of Orissan blue beryl along e-ray 100 6.20c Distinguishing between aquamarine and Maxixe beryls by observing 100 6.21a OA spectra of Orissan blue beryl along e-ray 100 6.21b OA spectra of Orissan blue beryl al	6.13	Composite spectrum of beryl	96
 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. 6.17 Optical absorption spectra of irradiated colourless beryl along <i>e</i>-ray depicting presence of Fe³⁺ at octahedral Al site 6.18a OA spectra of Orissan yellow beryl along <i>o</i>-ray 6.19b OA spectra of Orissan yellow beryl along <i>e</i>-ray 6.19b OA spectra of Siberian yellow beryl along <i>e</i>-ray 6.20 Distinguishing between aquamarine and Maxixe beryls by observing dichroism while rotating the specimen above a polariser 6.21a OA spectra of Orissan blue beryl along <i>e</i>-ray 6.22a OA spectra of Orissan blue beryl along <i>e</i>-ray 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.23 Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993) 6.24 Unpolarised OA spectra of Orissan green beryl 111 6.25 Radioactive decay scheme of ⁵⁷Co to an excited state of ⁵⁷ Fe 	6.14	Polarised optical absorption spectra of colourless beryl along o-ray and e-ray	97
 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. 6.17 Optical absorption spectra of irradiated colourless beryl along <i>e</i>-ray depicting presence of Fe³⁺ at octahedral AI site 6.18a OA spectra of Orissan yellow beryl along <i>o</i>-ray 6.19b OA spectra of Siberian yellow beryl along <i>e</i>-ray 10c 6.19a OA spectra of Siberian yellow beryl along <i>e</i>-ray 6.19a OA spectra of Siberian yellow beryl along <i>e</i>-ray 6.19b OA spectra of Siberian yellow beryl along <i>e</i>-ray 6.20 Distinguishing between aquamarine and Maxixe beryls by observing dichroism while rotating the specimen above a polariser 6.21a OA spectra of Orissan blue beryl along <i>o</i>-ray 6.21b OA spectra of Orissan blue beryl along <i>o</i>-ray 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.23 Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993) 6.24 Unpolarised OA spectra of Orissan green beryl 111 6.25 Radioactive decay scheme of ⁵⁷Co to an excited state of ⁵⁷Fe 	6 15	Faye (1972) figure illustrating relationship barycentre energy and bond distance	98
o-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 e-ray depicting presence of Fe ³⁺ at octahedral AI site 98 6.18a OA spectra of Orissan yellow beryl along o-ray 107 6.18b OA spectra of Orissan yellow beryl along o-ray 107 6.19a OA spectra of Siberian yellow beryl along o-ray 107 6.19b OA spectra of Siberian yellow beryl along o-ray 106 6.19b OA spectra of Siberian yellow beryl along o-ray 107 6.19b OA spectra of Siberian yellow beryl along o-ray 106 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 o-ray 107 6.21a OA spectra of Orissan blue beryl along o-ray 107 6.22a OA spectra of Tamil Nadu blue beryl along o-ray 107 6.22b OA spectra of Tamil Nadu blue beryl along o-ray 107 6.22b OA spectra of Tamil Nadu blue beryl along o-ray 107 6.23 Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova,	6.16	Optical absorption spectra of irradiated colourless beryl, a) OA along	98
of Maxixe type colour centre.6.17Optical absorption spectra of irradiated colourless beryl along e-ray depicting presence of Fe ³⁺ at octahedral AI site6.18aOA spectra of Orissan yellow beryl along o-ray1026.18bOA spectra of Orissan yellow beryl along o-ray1026.19aOA spectra of Siberian yellow beryl along o-ray1026.19aOA spectra of Siberian yellow beryl along o-ray1026.19bOA spectra of Siberian yellow beryl along o-ray1026.19bOA spectra of Siberian yellow beryl along o-ray1026.20Distinguishing between aquamarine and Maxixe beryls by observing dichroism while rotating the specimen above a polariser1026.21aOA spectra of Orissan blue beryl along o-ray1036.22bOA spectra of Tamil Nadu blue beryl along o-ray1036.22bOA spectra of Tamil Nadu blue beryl along o-ray1036.23Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993)1146.24Unpolarised OA spectra of Orissan green beryl1146.25Radioactive decay scheme of 571146.25Radioactive decay scheme of 57114		o-ray in the UV-VIS-NIR range and b)UV-VIS range depicting presence	
 6.17 Optical absorption spectra of irradiated colourless beryl along <i>e</i>-ray depicting presence of Fe³⁺ at octahedral Al site 6.18a OA spectra of Orissan yellow beryl along <i>o</i>-ray 6.18b OA spectra of Orissan yellow beryl along <i>o</i>-ray 6.19a OA spectra of Siberian yellow beryl along <i>o</i>-ray 6.19b OA spectra of Siberian yellow beryl along <i>e</i>-ray 6.19b OA spectra of Siberian yellow beryl along <i>e</i>-ray 6.19b OA spectra of Siberian yellow beryl along <i>e</i>-ray 6.19b OA spectra of Siberian yellow beryl along <i>e</i>-ray 6.20 Distinguishing between aquamarine and Maxixe beryls by observing dichroism while rotating the specimen above a polariser 6.21a OA spectra of Orissan blue beryl along <i>e</i>-ray 6.21b OA spectra of Orissan blue beryl along <i>e</i>-ray 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.23 Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993) 6.24 Unpolarised OA spectra of Orissan green beryl 6.25 Radioactive decay scheme of ⁵⁷Co to an excited state of ⁵⁷ Fe 		of Maxixe type colour centre.	
depicting presence of Fe ³⁺ at octahedral Al site6.18aOA spectra of Orissan yellow beryl along o-ray1026.18bOA spectra of Orissan yellow beryl along e-ray1026.19aOA spectra of Siberian yellow beryl along o-ray1046.19bOA spectra of Siberian yellow beryl along e-ray1046.19bOA spectra of Siberian yellow beryl along e-ray1046.20Distinguishing between aquamarine and Maxixe beryls by observing dichroism while rotating the specimen above a polariser1076.21aOA spectra of Orissan blue beryl along o-ray1076.21bOA spectra of Orissan blue beryl along o-ray1076.22aOA spectra of Orissan blue beryl along o-ray1076.22bOA spectra of Tamil Nadu blue beryl along o-ray1076.22bOA spectra of Tamil Nadu blue beryl along o-ray1076.23Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993)1146.24Unpolarised OA spectra of Orissan green beryl1146.25Radioactive decay scheme of ⁵⁷ Co to an excited state of ⁵⁷ Fe115	6.17	Optical absorption spectra of irradiated colourless beryl along e-ray	98
6.18a OA spectra of Orissan yellow beryl along o-ray 102 6.18b OA spectra of Orissan yellow beryl along e-ray 102 6.19a OA spectra of Siberian yellow beryl along o-ray 102 6.19b OA spectra of Siberian yellow beryl along o-ray 102 6.19b OA spectra of Siberian yellow beryl along o-ray 102 6.19b OA spectra of Siberian yellow beryl along e-ray 103 6.20 Distinguishing between aquamarine and Maxixe beryls by observing dichroism while rotating the specimen above a polariser 103 6.21a OA spectra of Orissan blue beryl along o-ray 103 6.21b OA spectra of Orissan blue beryl along o-ray 104 6.22a OA spectra of Tamil Nadu blue beryl along o-ray 104 6.22b OA spectra of Tamil Nadu blue beryl along o-ray 104 6.23 Site preference energy for octahedral co-ordination of transition 114 metal ions with oxygen as ligands (after Vassilikou-Dova, 1993) 114 6.24 Unpolarised OA spectra of Orissan green beryl 114 6.25 Radioactive decay scheme of ⁵⁷ Co to an excited state of ⁵⁷ Fe 115		depicting presence of Fe ³⁺ at octahedral Al site	
 6.18b OA spectra of Orissan yellow beryl along <i>e</i>-ray 6.19a OA spectra of Siberian yellow beryl along <i>o</i>-ray 6.19b OA spectra of Siberian yellow beryl along <i>e</i>-ray 6.20 Distinguishing between aquamarine and Maxixe beryls by observing dichroism while rotating the specimen above a polariser 6.21a OA spectra of Orissan blue beryl along <i>o</i>-ray 6.21b OA spectra of Orissan blue beryl along <i>e</i>-ray 6.22a OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.23 Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993) 6.24 Unpolarised OA spectra of Orissan green beryl 6.25 Radioactive decay scheme of ⁵⁷Co to an excited state of ⁵⁷ Fe 	6.18a	OA spectra of Orissan yellow beryl along o-ray	102
 6.19a OA spectra of Siberian yellow beryl along <i>o</i>-ray 6.19b OA spectra of Siberian yellow beryl along <i>e</i>-ray 6.20 Distinguishing between aquamarine and Maxixe beryls by observing dichroism while rotating the specimen above a polariser 6.21a OA spectra of Orissan blue beryl along <i>o</i>-ray 6.21b OA spectra of Orissan blue beryl along <i>e</i>-ray 6.22a OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.23 Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993) 6.24 Unpolarised OA spectra of Orissan green beryl 6.25 Radioactive decay scheme of ⁵⁷Co to an excited state of ⁵⁷Fe 	6. 18 b	OA spectra of Orissan yellow beryl along e-ray	102
 6.19b OA spectra of Siberian yellow beryl along <i>e</i>-ray 6.20 Distinguishing between aquamarine and Maxixe beryls by observing dichroism while rotating the specimen above a polariser 6.21a OA spectra of Orissan blue beryl along <i>o</i>-ray 6.21b OA spectra of Orissan blue beryl along <i>e</i>-ray 6.22a OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.23 Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993) 6.24 Unpolarised OA spectra of Orissan green beryl 6.25 Radioactive decay scheme of ⁵⁷Co to an excited state of ⁵⁷Fe 	6.19a	OA spectra of Siberian yellow beryl along o-ray	104
6 20Distinguishing between aquamarine and Maxixe beryls by observing dichroism while rotating the specimen above a polariser106.21aOA spectra of Orissan blue beryl along o-ray106.21bOA spectra of Orissan blue beryl along e-ray106.22aOA spectra of Tamil Nadu blue beryl along o-ray106.22bOA spectra of Tamil Nadu blue beryl along o-ray106.22bOA spectra of Tamil Nadu blue beryl along o-ray106.22bOA spectra of Tamil Nadu blue beryl along o-ray106.23Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993)116.24Unpolarised OA spectra of Orissan green beryl116.25Radioactive decay scheme of 5711	6.19b	OA spectra of Siberian yellow beryl along e-ray	104
dichroism while rotating the specimen above a polariser6.21aOA spectra of Orissan blue beryl along o-ray1076.21bOA spectra of Orissan blue beryl along e-ray1076.22aOA spectra of Tamil Nadu blue beryl along o-ray1086.22bOA spectra of Tamil Nadu blue beryl along o-ray1086.22bOA spectra of Tamil Nadu blue beryl along o-ray1086.23Site preference energy for octahedral co-ordination of transition119metal ions with oxygen as ligands (after Vassilikou-Dova, 1993)1196.24Unpolarised OA spectra of Orissan green beryl1196.25Radioactive decay scheme of 57 Co to an excited state of 57 Fe112	6 20	Distinguishing between aquamarine and Maxixe beryls by observing	107
 6.21a OA spectra of Orissan blue beryl along <i>o</i>-ray 6.21b OA spectra of Orissan blue beryl along <i>e</i>-ray 6.22a OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.23 Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993) 6.24 Unpolarised OA spectra of Orissan green beryl 116 6.25 Radioactive decay scheme of ⁵⁷Co to an excited state of ⁵⁷Fe 		dichroism while rotating the specimen above a polariser	
 6.21b OA spectra of Orissan blue beryl along <i>e</i>-ray 6.22a OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.23 Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993) 6.24 Unpolarised OA spectra of Orissan green beryl 6.25 Radioactive decay scheme of ⁵⁷Co to an excited state of ⁵⁷Fe 	6.21a	OA spectra of Orissan blue beryl along o-ray	107
 6.22a OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.23 Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993) 6.24 Unpolarised OA spectra of Orissan green beryl 6.25 Radioactive decay scheme of ⁵⁷Co to an excited state of ⁵⁷Fe 	6.21b	OA spectra of Orissan blue beryl along e-ray	107
 6.22b OA spectra of Tamil Nadu blue beryl along <i>o</i>-ray 6.23 Site preference energy for octahedral co-ordination of transition metal ions with oxygen as ligands (after Vassilikou-Dova, 1993) 6.24 Unpolarised OA spectra of Orissan green beryl 6.25 Radioactive decay scheme of ⁵⁷Co to an excited state of ⁵⁷Fe 	6.22a	OA spectra of Tamil Nadu blue beryl along o-ray	108
 6 23 Site preference energy for octahedral co-ordination of transition 110 metal ions with oxygen as ligands (after Vassilikou-Dova, 1993) 6.24 Unpolarised OA spectra of Orissan green beryl 110 6.25 Radioactive decay scheme of ⁵⁷Co to an excited state of ⁵⁷Fe 111 	6.22b	OA spectra of Tamil Nadu blue beryl along o-ray	108
metal ions with oxygen as ligands (after Vassilikou-Dova, 1993)6.24Unpolarised OA spectra of Orissan green beryl116.25Radioactive decay scheme of ⁵⁷ Co to an excited state of ⁵⁷ Fe11	6 23	Site preference energy for octahedral co-ordination of transition	110
6.24Unpolarised OA spectra of Orissan green beryl1106.25Radioactive decay scheme of 57 Co to an excited state of 57 Fe111		metal ions with oxygen as ligands (after Vassilikou-Dova, 1993)	
6.25 Radioactive decay scheme of 57 Co to an excited state of 57 Fe 111	6.24	Unpolarised OA spectra of Orissan green beryl	110
	6.25 R	adioactive decay scheme of ⁵⁷ Co to an excited state of ⁵⁷ Fe	112

.

`____

.

6 27	Mossbauer resonance when the excited state in the sample is split into	114
ı	two energy levels by the presence of non cubic symmetry	
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

• 1

,

.

.

.

.

.

. .

.

.

:

a

·

.

.

·

.