Plate

Heavy Mineral Grains
Plate 1 Puri Beach

Magnification: (Photo. No. 7, 9, 12, 17, 18, 19, 21, 26: 24X; rest 50X)

Zircon

1. Colourless, angular
2. Colourless, sub-rounded
3. & 4 Colourless with yellow tint, sub-angular
5. & 6 Colourless with yellow tint, angular
6. Colourless with dark yellow tint, angular
7. Colourless with canary-yellow tint, tabular
8. Colourless with pale-yellow tint, prismatic
9. Colourless with lemon-yellow tint, prismatic
10. Colourless with orange-yellow tint
11. Brownish-yellow, euhedral crystal boundary
12. Colourless, well-rounded
13. Colourless, rounded
14. Colourless with dirty-grey tint, rounded
15. Orange-yellow, rounded with inclusions opaque mineral

Garnet

17. Purple, angular with conchoidal fractures
18. Purple, sub-rounded, conchoidal fractures
19. Purple, sub-rounded
20. Brown (crimson-red), sub-rounded
21. Brown, prismatic with developed crystal faces
22. Brownish, prismatic sub-rounded
23. Brown, well-rounded
24. Brown, sub-rounded
25. Orange red, prismatic
26. Orange red, prismatic
27. Orange red, sub-angular
28. Ruby pink, sub-rounded
Plate- 2 Puri Beach

Magnification: (Photo. No. 4, 8, 9, 10, 11, 20, 21, 27, 28, 29: 40X; 30: 25X; Rest 50X)

Tourmaline

1. Brown, prismatic
2. Yellowish-green, rounded
3. reddish-brown, prismatic
4. Pink, sub-rounded
5. Orange-yellow, prismatic
6. Orange, prismatic
7. Yellowish-brown, rounded

Other minerals

8. Anatase, indigo-blue, rounded
9. Rutile, orange-red
10. Rutile, orange-red, sub-angular
11. Epidote, pale-green, sub-rounded
12. Epidote, pistachio-green, rounded
13. Sphene, pale-violet, rounded
14. Rutile, orange, prismatic
15. Hornblende, semitransparent with brownish tint, prismatic
16. Andalusite, colourless with pink tint, sub-rounded
17. & 18 Andalusite, pink, angular
19. Garnet, pink with inclusions of magnetite
20. Ilmenite, brownish-purple, angular
21. Magnetite, bluish-black, angular
22. Magnetite, metallic-black with zonation of zircon
23. Magnetite, bluish-black, sub-rounded
24. Magnetite, bluish-black, prismatic
25. Magnetite, metallic-black, rounded with etch marks and pitted
26. Magnetite, bluish-black, sub-rounded with pitted
27. Magnetite, bluish-black, sub-rounded
28. Ilmenite, brownish-purple, sub-rounded
29. 28 & 30 Ilmenite, brown, well-rounded with purplish tint
31. Garnet, orange-yellow
Plate 3 Gopalpur Beach

Magnification: (Photo. No. 4: 40X; 17: 32X; Rest 50X)

1. **Zircon**, colourless to yellow, sub-rounded
2. **Garnet**, orange, sub-rounded
3. **Garnet**, brown, prismatic with well-developed crystal faces
4. **Tourmaline**, green, prismatic
5. **Tourmaline**, yellowish, prismatic
6. **Tourmaline**, yellowish brown, well-rounded
7. **Tourmaline**, colourless with pink tint, prismatic
8. **Tourmaline**, green, prismatic with well-developed crystal faces
9. & 10 **Epidote**, pale-green, sub-angular
11. **Epidote**, green, sub-angular, pitted
12. **Epidote**, green, prismatic, pitted
13. **Rutile**, deep-red, angular
14. **Staurolite**, reddish, sub-rounded
15. **Staurolite**, orange-yellow, angular
16. **Staurolite**, orange-yellow, well-rounded
17. **Biotite**, violet-blue, angular
18. **Kyanite**, bluish-green, bladed
19. **Hornblende**, dark green, prismatic
20. **Augite**, dirty-yellow, rounded
21. **Magnetite**, bluish-black, well-rounded
22. **Ilmenite**, brownish, sub-rounded, pitted
23. **Ilmenite**, brown, rounded, pitted
24. **Staurolite**, orange-yellow, well-rounded
Plate 4 Kalingapatnam Beach
Plate 4  Kalingapatnam Beach

Magnification: (Photo. No. 1, 2, 11, 14 & 20: 32X; 5: 25X; 4: 20X; 8 & 15: 50X and Rest: 40X)

1. **Zircon**, colourless with yellow tint and well-developed crystal faces
2. **Zircon**, canary yellow
3. **Zircon**, colourless, angular
4. **Zircon**, colourless, angular
5. **Zircon**, colourless, sub-angular
6. **Zircon**, colourless to pale-yellow, tabular and pitted
7. **Zircon**, dark-yellow, angular with fringe of magnetite
8. **Zircon**, (detrital grains) yellow, sub-rounded with inclusions
9. **Garnet**, orange-red, sub-angular
10. **Garnet**, pink, angular
11. **Garnet**, orange-red, angular
12. **Garnet**, pink, angular with inclusion of zircon
13. **Garnet**, pink, angular with inclusions of zircon
14. **Garnet**, dark brown, sub-rounded with inclusions of magnetite
15. **Sillimanite**, pale-brown, acicular
16. **Tourmaline**, brown, sub-angular
17. **Magnetite**, bluish-black, angular
18. **Magnetite**, greenish-black, angular with interfringing magnetite of hematite
19. **Ilmenite**, brownish-purple, sub-angular
20. **Ilmenite**, brownish-purple, sub-angular, elongated
Plate 5 Vishakhapatnam Beach

Magnification: (Photo. No. 1, 5, 13, 15, 18: 25X; 2, 6, 7, 16, 17 32X; 3, 4, 8, 12, 19, 21, 22, 23, 24: 50X; 9, 10, 11, 14, 20: 40X)

1. **Zircon**, grey-yellow, sub-angular
2. **Zircon**, colourless to greyish white, sub rounded (? Diamond)
3. **Zircon**, colourless to brown, tabular
4. **Zircon**, showing play of colour (yellow, green, pink), prismatic, zonation
5. 6 & 7 **Garnet**, red, sub-rounded to rounded
8. **Garnet**, pink, rounded
9. **Garnet**, reddish-brown, sub-angular
10. **Garnet**, brownish, sub-angular
11. **Cryptolite**, wine-yellow, well-rounded (Variety of Monazite)
12. **Tourmaline**, brown, prismatic with well-developed crystal faces
13. **Ilmenite**, brownish to purplish-black, rounded, pitted
14. **Ilmenite**, brownish to purplish-black, well-rounded, pitted
15. **Magnetite**, bluish-black, angular
16. **Magnetite**, bluish-black, angular with inclusions of zircon
17. **Ilmenite**, light-brown, well-rounded
18. **Staurolite**, orange red prismatic with developed crystal faces
19. **Biotite**, dark brown, sub-rounded
20. **Epidote**, pale-green, sub-rounded
21. **Tourmaline**, brown, rounded
22. **Cassiterite**, orange, sub-angular
23. **Leucaxon**, dirty-white, sub-rounded
24. **Hornblende**, green, prismatic with cleavages
Plate 6 Kakinada Beach
Magnification: (50X)

1. Zircon, colourless, sub-rounded, pitted
2 & 3 Zircon, colourless, bright with yellow tint, with well developed crystal faces
4. Zircon, pale-orange, tabular with inclusions of magnetite
5. Zircon, colourless to yellow, pyramidal
6. Zircon, colourless, sub-angular
7. Zircon, sea-green, sub rounded
8. Zircon, colourless, tabular with well-developed crystal faces
9. Garnet, brown, sub-rounded
10. Garnet, colourless to violet tint, sub-rounded
11. Garnet, brownish-black, sub-rounded
12. Garnet, reddish-brown, sub-rounded
13. Tourmaline, brown, sub-angular
14. Tourmaline, green, sub-rounded
15. Tourmaline, colourless with yellow tint, sub-angular
16. Hornblende, pale-green prismatic
17. Magnetite, bluish-black, angular
18. Magnetite, bluish-black, rounded
19. Magnetite, bluish-black, sub-rounded
20. Andalusite, colourless to pinkish, sub-rounded
21. Rutile, deep-red, rounded
22. Rutile, deep-red, rounded
23. Epidote, pale-greenish- yellow, rounded
24. Olivine, yellow, rounded
Plate 7 Chirala Beach
Plate 7 Chirala Beach
Magnification: (50X)

1. Garnet, orange-brown, sub-rounded
2. Tourmaline, brown, prismatic with well-developed crystal faces
3. Garnet brown, sub-angular with inclusions magnetite
4. Tourmaline, elongated, brown, sub-rounded
5. Garnet, dark-green, sub-angular (Uvarovite)
6. Tourmaline (?), grey, rounded
7. Tourmaline, dark-green, sub-rounded
8. Garnet, brown, sub-rounded
9. Magnetite, bluish-black, sub-angular
10. Magnetite, bluish-black, rounded
11. Ilmenite, brownish-purplish-black, sub-rounded
12. Ilmenite, brownish purplish black, sub-rounded
13. Riebeckite (bluish-green variety of hornblende), prismatic
14. Ilmenite, brown-purplish-black, angular
15. Diopside, pale-green, platy/sub-rounded
16. Epidote, pale-green, rounded
Plate 8 Chennai Beach
Plate 8 Chennai Beach
Magnification: (Photo. No. 1: 40X; rest 50X)

1. Zircon, colourless to light-yellow, angular
2. Zircon, yellow, angular
3. Garnet, colourless, well-rounded
4. Garnet, brown, sub-rounded
5. Garnet, pink, sub-angular
6. Garnet, pink, prismatic (broken)
7. Tourmaline, brown, prismatic
8. Tourmaline, green, prismatic
9. Tourmaline, reddish-brown, well-rounded with inclusions magnetite
10. Tourmaline, reddish-brownish-black, Prismatic
11. Tourmaline, golden-brown, prismatic
12. Tourmaline, golden brown, prismatic
13. Tourmaline, reddish-brownish-black, accicular
14. Tourmaline pink, prismatic with etch marks
15. Tourmaline, greenishgrey, prismatic
16. Tourmaline pink, prismatic (garnet)
17. Riebeckite (bluish-green variety of hornblende), prismatic,
18. Hornblende, green, rounded
19. Hornblende, green, sub-rounded
20. Chloritoid, dark-green, sub-rounded
Plate 9 Chennai Beach
Plate 9 Chennai Beach

Magnification: (50X)

1. Hypersthene, green, sub-rounded (chloritoid)
2. Hypersthene, pale-green, sub-rounded
3. Hypersthene, dirty-green, sub-rounded
4. Hypersthene, dirty-green, sub-rounded
5. Spinel, dark green, cube-shaped with developed crystal faces
6. Rutille, orange red, angular
7. Rutille, deep red, prismatic with well-developed crystal faces
8. Staurolite, reddish-brown, sub-rounded
9. Magnetite, bluish-black, sub-angular
10. Magnetite, bluish-black, sub-rounded
11. Ilmenite, brownish to purplish-black, sub-angular, pitted
12. Ilmenite, brownish to purplish-black, sub-rounded
13. Epidote, pale-greenish-yellow, sub-rounded
14. Epidote, pale-greenish-yellow, sub-rounded
15. Augite, dirty-greenish-grey, sub-rounded
16. Epidote, pistachio-green-yellow, sub-rounded
17. Monazite, greenish-brown to violet, well rounded
Plate 10  Nagapatinam Beach
Plate 10 Nagapattinam Beach
Magnification: (50X)

1. Zircon, colourless with bluish-brown tint, tabular
2. Zircon, pale-yellowish-green, sub-rounded
3. Corundum, colourless with brownish-blue tint, elongated (beryl shaped)
4. Zircon, golden-brown, sub-rounded
5. Garnet, pinkish, rhomdodecahedran with equidimensional crystal faces
6. Garnet, dark-orange-red, sub-rounded with developed crystal faces
7. Garnet, orange-red, sub-rounded
8. Tourmaline, reddish-brown, prismatic
9. Tourmaline, reddish-brown, prismatic
10. Tourmaline, orange-red, prismatic
11. Tourmaline, orange-red, prismatic
12. Tourmaline, pale-orange, prismatic
13. Diamond, colourless, adamantine, well-developed octahedron
14. Diamond, colourless, adamantine, well-developed octahedron
15. Diamond, colourless, adamantine, well-developed octahedron
16. Diamond, colourless, adamantine, cleaved
17. Chloritoid, dark-green, sub-rounded
18. Epidote, pistachio-green, sub-rounded
19. Epidote, pale-green, rounded
20. Augite, greenish-grey, sub-rounded
21. Hornblende, green, prismatic
22. Hornblende, green, sub-rounded
23. Diopside, pale-green, prismatic
24. Augite, dull-green, sub-rounded
25. Hypersthene, pale-green, sub-rounded
26. Hypersthene, green, sub-rounded
27. Riebeckite (blue variety of hornblende), prismatic
28. Spinel, dark-green, sub-angular with well-developed crystal faces
29. Hypersthene, pale-brown, sub-rounded
30. Magnetite, bluish-black, prismatic
31. Ilmenite, light-brownish to purplish-black, sub-angular
32. Ilmenite, brownish to purple, sub-angular
Plate 11 Vedaranniyum Beach
Plate 11 Vedaranniyum Beach

Magnification: (50X)

1. **Zircon**, brownish-yellow, pyramidal crystal boundary
2. **Diamond**, adamantine, colourless, well-rounded, cleaved fragment
3. **Diamond**, adamantine, colourless with pale yellow tint with developed octahedron
4. **Garnet**, colourless with pink tint, sub-rounded
5. **Garnet**, colourless with pink tint, prismatic with well-developed crystal faces
6. **Tourmaline**, colourless with yellow-green tint, prismatic
7. **Tourmaline**, golden-yellow, prismatic
8. **Tourmaline**, greenish-grey, prismatic
9. **Tourmaline**, greenish-brown, prismatic
10. **Rutile**, deep-red, prismatic with well-developed crystal faces
11. **Rutile**, deep red, prismatic with well-developed crystal faces
12. **Ilmenite**, brownish to purple, well-rounded
13. **Sphene**, bluish-black, sub-angular
14. **Sillimanite**, pale-brown, accicular
15. **Epidote**, yellow-green, rounded
16. **Hornblende**, green, sub-rounded
17. **Epidote**, pale-green, sub-rounded
18. **Spinel**, dark-green, cubic, with well-developed crystal faces
19. **Magnetite**, bluish-black, sub-angular
20. **Magnetite**, bluish-black, sub-rounded lath
Plate 12 Kottipattinam Beach

Magnification: (Photo. Nos. 1, 2, 3, 4, 5, 7, 9: 32X; 6, 26 40X; rest 50X)

Zircon

1. Bluish to sea-green with blue tint, sub-angular
2. Golden-yellow, angular with inclusions of magnetite
3. Golden-yellow, angular
4. Colourless, angular
5. Lemon-yellow, prismatic with inclusions of magnetite
6. Brownish-yellow, sub-rounded with inclusions of magnetite
7. Ash-green-white, angular
8. Yellow, sub-angular
9. Pale-yellow, sub-rounded
10. Bluish colourless, sub-rounded with blue and yellow tints
11. Yellow, tabular
12. Lemon yellow, tabular
13. Yellowish-colourless, tabular
14. Colourless with yellow tint, sub-rounded
15. Orange-yellow, rounded
16. Colourless with yellow tint, well-developed crystal faces
17. Colourless with yellow tint, sub-angular
18. Colourless with yellow tint, elongated
19. Yellow, sub-angular
20. Yellow, prismatic
21. Orange-yellow, well-rounded
22. Brownish to blue, angular
23. Colourless, rounded with inclusions of magnetite
24. Yellow, accicular
25. Pale-yellow, sub-rounded
26. Yellowish-blue, sub-rounded
27. Bluish-colourless, angular
28. Colourless, well-developed crystal faces
Plate 13 Kottipattinam Beach

Magnification: (Photo. Nos. 1, 2, 5, 6, 23: 32X; 4, 20, 21: 40X; rest 50X)

Garnet

1. Crimson-red, angular
2. Orange-yellow, angular
3. Purple, prismatic with well-developed crystal faces
4. Pink, sub-rounded
5. Orange-yellow, sub-angular with inclusions of magnetite
6. Pink, angular
7. Pink, prismatic
8. Pink, sub-angular
9. Brown-yellow, angular
10. Colourless with pink tint, sub-rounded
12. Pink, prismatic
14. Brown, prismatic
15. Brown, prismatic
16. Brown, sub-rounded

Tourmaline

17. Pink, prismatic
18. Pinkish-yellow prismatic
19. Gray, sub-rounded
20. Gray, sub-rounded

Anatase

11. Indigo blue, sub-angular
13. Biotite, brownish-yellow, sub-angular
Plate 14 Kottipattinam Beach
Plate 14 Kottipattinam Beach

Magnification: (Photo. No. 1, 3, 19, 26: 32X; 13, 15: 40X; 50X)

1. Rutile, deep-reddish-brown, angular with pitted
2. Rutile, deep-reddish-brown, sub-angular
3. Rutile, orange red, sub-angular?
4. Rutile, deep red, sub-angular with well-developed crystal faces, serriated
5. Hornblende, brown, prismatic (broken)
6. Hornblende, green, prismatic
7. Hornblende, brown, prismatic (broken)
8. Epidote, colourless with yellow tint, sub-rounded
9. Biotite, dark-brownish-yellow, platy
10. Biotite, dark-brownish-yellow, platy (angular)
11. Ilmenite, brownish- to purplish-black, rounded
12. Chloritoid, dark-green, angular
13. Leucoxene, colourless, sub-rounded
14. Kyanite, bluish-green, accicular
15. Ilmenite, brownish to purplish black, angular
16. Andalusite, colourless to pink, rounded
17. Magnetite, bluish-black, sub-rounded
18. Magnetite, bluish-black, sub-angular
19. Magnetite, bluish-black, sub-angular
20. Anatase, reddish-indigo-blue, sub-angular
Plate 15 Rameshwaram Beach

[Image of various rocks and minerals]
Plate 15 Rameshwaram Beach

Magnification: (50X)

1. Zircon, colourless, rounded
2. Zircon, colourless, well-rounded (diamond with adamantine lustre?)
3. Garnet, amber-red, angular
4. Garnet, brown, sub-rounded
5. Tourmaline, brownish-red, prismatic, well-developed crystal faces, pitted
6. Tourmaline, green, acicular
7. Tourmaline, pinkish-brown, sub-rounded
8. Hornblende, green, lathlike with cleavage (2- sets)
9. Rutile, crimson red, prismatic, well-developed crystal faces
10. Rutile, deep red, sub-rounded with well-developed crystal faces
11. Staurolite, golden brown, sub-rounded
12. Chloritoid, greenish-grey, well-rounded
13. Cassiterite, orange, sub-angular
14. Magnetite, bluish black, sub-rounded
15. Magnetite, bluish-black, sub-rounded
16. Ilmenite, brownish-purplish-black, sub-angular
Plate 16 Kanniyakumari Beach I

Magnification: (Photo. No. 5, 7, 8, 9, 10, 12, 15, 16, 17, 28, 30, 31, 34, 38, 39, 40, 41, 42, 43: 32X; 2, 18, 23: 25X; 21: 50X; rest 40X)

1. Zircon, colourless with yellow tint, rounded
2. Zircon, dark-yellow, rounded
3. Zircon, yellow, tabular with well-developed crystal faces
4. Zircon, colourless (diamond showing adamantine lustre ?)
5. Zircon, colourless, sub-rounded
6. Zircon, yellow, well-rounded
7. Garnet, orange red, sub-angular
8. Garnet, red, lath-shaped
9. Garnet, pinkish red, sub-rounded
10. Garnet, brown, angular
11. Garnet, orange-red, sub-rounded with etch marks and well-developed crystal faces
12. Garnet, red, rounded
13. Garnet, light-pink, well-rounded
14. Garnet, pinkish-brown, rounded
15. Garnet, brown, angular
16. Garnet, pinkish purple, sub-rounded
17. Rutile, deep red, sub-rounded with violet tint and developed crystal faces
18. Tourmaline, brown, angular
19. Apatite, brownish-green, elongated
20. Apatite, brownish-green, angular
21. Monazite, pale-green, well-rounded
22. Monazite, pale-green, well-rounded
23. Monazite, bluish-black, well-rounded
24. Monazite, orange-yellow, well-rounded
25. Magnetite, bluish-black, well-rounded
26. Magnetite, bluish-black, sub-angular with octahedral faces
27. Magnetite, bluish-black (?)
28. Magnetite, bluish-black, angular with well-developed crystal faces
29. Ilmenite, brownish to purplish-black, sub-rounded (pea-shaped)
30. Magnetite, bluish-black, rounded, showing a core material with cone in cone structure
31. Magnetite, bluish-black, angular
32. Magnetite, bluish-black, sub-angular with inclusions of zircon
33. Biotite, dark brown, flaky
34. Biotite, light brown, flaky
35. Sphene, violet-black, well rounded
36. Apatite, brownish-green, angular
37. Epidote, pale-green (pistachio green), angular
38. Leucoxene, bluish-white, sub-rounded
39. Magnetite, metallic black, angular
40. Ilmenite, brownish to purple-black, rounded with etch marks
41. Magnetite and garnet, rounded
42. Magnetite, rounded and zircon, rounded
43. Zircon, colourless; garnet, colourless; magnetite, colourless, rounded
44. Magnetite, bluish-black, sub-rounded with inclusions of zircon
Plate 17 Kanniyakumari Beach II
Magnification: (50X)

1. Zircon, brown yellow, sub-rounded
2. Zircon, lemon Yellow, tabular
3. Garnet, brownish yellow, well-rounded
4. Zircon, dirty white, tabular, showing zoning
5. Garnet, amber red, angular
6. Garnet, pink, sub-angular
7. Tourmaline, pink, acicular
8. Hornblende, brown, lathlike, 2 sets cleavage
9. Rutile, deep red, sub-angular
10. Biotite, dark brownish-black, flaky
11. Biotite, dark brownish-black, flaky
12. Chlorite, dark-green, sub-angular
13. Magnetite, bluish-black, angular
14. Magnetite, bluish-black, sub-rounded
15. Zircon, yellow, rounded with inclusions of Magnetite
16. Ilmenite, brownish to purple, rounded
17. Cassiterite, orange white, sub-rounded
Plate

Mounted Grains
Plate 1 Mounted Grains
Plate 1 Mounted Grains of Heavy Minerals (5X)

(OL: Ordinary Light an XN: Between Cross-Nicols)

1. **Zircon**, transparent (OL) showing colour zones (XN)
2. **Zircon**, dirty brown, (OL showing colour-zones (XN)
3 & 4. **Zircon**, transparent, (OL) high relief showing colour-zones (XN)
5. **Zircon**, transparent, brown, different colour-zones
6. **Garnet**, brown, moderately pleochroic
7. **Garnet**, amber red, moderately pleochroic, isotropic (XN)
8. **Garnet**, brown, moderately pleochroic
9. **Garnet**, colourless, moderately pleochroic
10. **Garnet**, transparent WITH brownish tint, moderately pleochroic (XN),
11. **Tourmaline**, pink-brown, pleochroic, straight extinction, striations, Irregular terminations
12. **Tourmaline**, blue, pleochroic, straight extinction
13 & 14. **Hornblende**, green, variable pleochroism, oblique extinction
15 & 16. **Tourmaline**, brown, pleochroic, straight extinction
17 & 18. **Staurolite**, golden-yellow, highly pleochroic, haphazard boundaries
Plate 2 Mounted Grains
Plate 2 Mounted Grains of Heavy Minerals (5X)

1. **Epidote**, pale green, moderately pleochroic
2. **Pyrite**, Brass yellow, isotropic
3. **Monazite**, Brownish with dark boundary and fracture
4. **Tourmaline**, Dark-brownish, tabular
5. **Epidote**, pale green, moderately pleochroic
6. **Epidote**, pale green, moderately pleochroic
7. **Tourmaline**, green, pleochroic and acicular
8. **Garnet**, Brownish
9. **Staurolite**, golden-yellow, highly pleochroic
10. **Tourmaline**, green, pleochroic
11. **Hornblende**, green, pleochroism variable and extinction angle
12&13. **Monazite**, Dup brownish with dark border, uneven fracture, well rounded grain
14. **Monazite**, colourless with dark border, uneven fracture
15. **Magnetite**, bluish black
16. **Ilmenite**, brownish to purplish black
Plate 3 Mounted Grains
Plate 3 Mounted Grains of Heavy Minerals (5X)

1 & 2. **Zircon**, Brownish with dark boundary and fracture, zoning
3. **Pyrite**, Brass yellow, isotropic
4. **Garnet**, Dark-red, rounded
5. **Garnet**, Pink, moderately pleochroic, it is optically isotropic.
7. **Garnet**, colourless, moderately pleochroic, sub angular
8. **Garnet**, colourless, moderately pleochroic, sub angular
9. **Garnet**, colourless, moderately pleochroic, sub angular
10 & 11. **Tourmaline**, Brown, pleochroic, acicular
12. **Epidote**, Pale green, moderately pleochroic
13. **Zircon**, colourless, showing zoning (X N)
14. **Zircon**, colourless, showing zoning (X N)
15. **Zircon**, green, showing zoning (X N)
16. **Garnet**, colourless slightly anisotrophic (X N)
17. **Monazite**, colourless, dark border (O L)
Plate 4 Mounted Grains
Plate 4 Mounted Grains of Heavy Minerals (5X)

1 & 2    **Garnet**, colourless, moderately pleochroic
3.     **Tourmaline**, colourless to white, pleochroic, straight extinction, Vertical striations, irregular terminations
4, 5, 6 & 7. **Garnet**, pink, moderately pleochroic
8.     **Tourmaline**, colourless to white, pleochroic, straight extinction, Vertical striations, irregular terminations
9.     **Tourmaline**, green, pleochroic, straight extinction, Vertical striations, irregular terminations
10.    **Hornblende**, brown, pleochroism variable, diagnosed chiefly by form, oblique extinction
11 & 12. **Epidote**, pale green, moderately pleochroic
13.    **Staurolite**, golden-yellow, highly pleochroic, haphazard boundaries and cruciform grain
14.    **Monazite**, Colourless with dark border, uneven fracture, well-rounded grain
15,16 & 17. **Staurolite**, golden-yellow, highly pleochroic, haphazard boundaries and cruciform grain
18.    **Tourmaline**, brownish yellow, pleochroic, straight extinction, Vertical striations, irregular terminations
Plate 5 Mounted Grains
Plate 5 Mounted Grains of Heavy Minerals (5X)

(OL: Ordinary Light an XN: Between Cross-Nicols)

1. Zircon, transparent (OL) showing colour zones (XN)
2. Garnet, brown, moderately pleochroic (OL)
3. Diamond, colourless (OL)
4. Zircon, transparent (OL) showing colour zones (XN)
5. Zircon, transparent, (OL) showing colour-zones(XN)
6. Monazite, colourless, dark border
7. Hornblende, blue, moderately pleochroic, (OL) oblique extinction (XN)
8. Zircon, Greyish-green (OL) showing colour zones (XN),
9. Tourmaline, Green, pleochroic, (OL) straight extinction, striations, Irregular terminations (XN)
10. Garnet, Pink, moderately pleochroic (OL)
11. Tourmaline. White, pleochroic, straight extinction,
12&13. Staurolite. Yellow, highly pleochroic,
14 &15. Monazite, colourless, dark border