*Kodaikanal Obs. Bull. Ser. A (1977) 2, 85-88*

# A SURVEY OF RED STARS IN THE DIRECTION OF THE LARGE MAGELLANIC CLOUD

## 1. The 30 Doradus Region

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ABSTRACT

We have commenced a survey of red stars in the direction of the Large Magellanic Cloud using the technique of ultra-low dispersion spectroscopy. This first paper is a listing of the red stars in the 30 Doradus region for which finding charts and coordinates on the Hodge-Wright Atlas charts are provided.

Key Words : low dispersion spectroscopy—red star survey—Large Magellanic Cloud

The close proximity of the Magellanic Clouds to our galaxy makes the detailed study of the stellar population of these galaxies quite feasible. In recent years, with the increasing availability of large aperture telescopes, it seems very possible that stars in the Clouds, of intrinsic brightness comparable to that of our Sun, are within reach of our spectroscopic instruments. The brighter objects that indicate the effects of evolution are easy of access to detailed study and in the near future will provide the observational means of study of evolutionary differences amongst the galaxies. The red stars play an important role in such assessments and much effort of the future is likely to be made in this area. Surveys of such objects are therefore of much interest.

There have been many surveys made of both the blue and red objects of the Large Cloud. The earliest infrared survey has been that of Westerlund (1960) with the 50/65-cm Uppsala Schmidt at Mount Stromlo, and which covered about eleven square degrees centered on the Bar of the Large Cloud. A study by Mendoza and Gomez (1973) that employed an ultraviolet-infrared colour index technique for the discovery of red stars, has yielded several red objects. The plates taken for this survey cover an area of 1.25 square degrees in the vicinity of the 30 Doradus nebula. Many of these red objects undoubtedly are members of the LMC and in particular those that have large values of (U-I) must be very late supergiants or carbon stars. More specific surveys for the latter have been attempted by Sanduleak and Philip (1976) and Westerlund (1964). In an earlier account of the capabilities of ultra-low dispersion spectroscopy Bappu and Parthasarathy (1977) have shown the great ease with which the technique enables the detection of red objects. We have, therefore, commenced a survey for red objects in the LMC with the aid of microspectra taken with the Kavalur 102-cm Ritchey-Chretien reflector.

The spectra are obtained with the f/2 Cassegrain slitless spectrograph and cover a field of 40 minutes of arc diameter. Eastman 103a-E emulsion and the quartz three degree prism combine to give spectra from 3500 Å to 6600 Å that are 250 microns in length. The spectra are unwidened and suffice to portray the energy distribution in the stellar spectrum. Exposures on the Large Cloud have seldom exceeded 20 minutes duration.

In this first listing of red objects, we survey the region of the 30 Doradus nebula. Subsequent lists will contain the stars in the Bar and some of the Shapley constellations. We have not made any attempt to provide I magnitudes for the stars in our list. We estimate that all red stars brighter than I = 13.0 are certainly covered in our list. Such a conclusion is based on the I magnitudes given by Mendoza and Gomez. The limiting magnitude threshold can be variable, for it depends on the seeing

Table 1. List of red stars in the direction of the Large Cloud. The X and Y coordinates refer to the left hand bottom corner of the Hodge - Wright Atlas as origin. Kavalur star numbers 1 to 102 are on chart 53V and numbers 103 to 288 are to be located on Hodge - Wright Chart 54V.

| Kavalur No. | Mendoza Gomez No. | X cms | Y cms | Identification on figure |
|---|---|---|---|---|
| 1 | — | 11.88 | 9 38 | 1 |
| 2 | — | 8.88 | 8.94 | 1 |
| 3 | — | 22.73 | 8.57 | 2 |
| 4 | — | 12.33 | 8.12 | 1 |
| 5 | — | 11.62 | 7.50 | 1 |
| 6 | — | 10 69 | 7.31 | 1 |
| 7 | — | 11.00 | 7.21 | 1 |
| 8 | 15 | 22.59 | 6.78 | 2 |
| 9 | — | 9.00 | 6.63 | 1 |
| 10 | — | 9.19 | 6.62 | 1 |
| 11 | — | 9 60 | 6.53 | 1 |
| 12 | — | 12.11 | 6.48 | 1 |
| 13 | — | 20.01 | 6.43 | 2 |
| 14 | — | 13.43 | 6.28 | 1 |
| 15 | — | 7.60 | 6.18 | 1 |
| 16 | 200 | 7 11 | 6.17 | 1 |
| 17 | — | 24.11 | 5.99 | 2 |
| 18 | — | 20.53 | 5.80 | 2 |
| 19 | — | 13.80 | 5.83 | 1 |
| 20 | — | 7.33 | 5.70 | 1 |
| 21 | — | 9.02 | 5.68 | 1 |
| 22 | — | 6.18 | 5.43 | 1 |
| 23 | 151 | 10 30 | 5.05 | 1 |
| 24 | — | 6.79 | 5.04 | 1 |
| 25 | 131 | 11.88 | 5.02 | 1 |
| 26 | 63 | 16.58 | 4.98 | 2 |
| 27 | — | 14 29 | 4.93 | 1 |
| 28 | — | 13.32 | 4.81 | 1 |
| 29 | 28 | 21.82 | 4.76 | 2 |
| 30 | — | 10.25 | 4.71 | 1 |
| 31 | — | 8.97 | 4.70 | 1 |
| 32 | 121 | 12.23 | 4.68 | 1 |
| 33 | — | 25.20 | 4.60 | 2 |
| 34 | 74 | 17.21 | 4.50 | 2 |
| 35 | — | 7.44 | 4.43 | 1 |
| 36 | — | 24.08 | 4.43 | 2 |
| 37 | — | 11.12 | 4.42 | 1 |
| 38 | — | 9.78 | 4.32 | 1 |
| 39 | — | 9.50 | 4 30 | 1 |
| 40 | — | 20.98 | 4.22 | 2 |
| 41 | 133 | 11.50 | 4.17 | 1 |
| 42 | — | 11 40 | 4.12 | 1 |
| 43 | — | 18.83 | 4.11 | 2 |
| 44 | — | 17.60 | 3.99 | 2 |
| 45 | 205 | 6.11 | 3 96 | 1 |
| 46 | 155 | 9.99 | 3.86 | 1 |
| 47 | — | 19.80 | 3.82 | 2 |
| 48 | — | 17.51 | 3.80 | 2 |
| 49 | — | 7.01 | 3.63 | 1 |
| 50 | — | 6.28 | 3 60 | 1 |
| 51 | — | 12.04 | 3.52 | 1 |
| 52 | 60 | 19.11 | 3.52 | 2,3 |
| 53 | — | 6.61 | 3.48 | 1 |
| 54 | — | 22.57 | 3.46 | 2 |
| 55 | 44 | 20 30 | 3.19 | 2,3 |
| 56 | — | 12.92 | 3.01 | 1,6 |
| 57 | 8 | 23.38 | 2.99 | 2 |
| 58 | 173 | 9 11 | 2.97 | 1,6 |
| 59 | — | 7.05 | 2.96 | 1 |
| 60 | — | 10.05 | 2.89 | 1,6 |
| 61 | 159 | 9.88 | 2.80 | 1,6 |
| 62 | — | 9 62 | 2.70 | 1,6 |
| 63 | — | 19 02 | 2.67 | 2,3 |
| 64 | — | 24.86 | 2.52 | 2 |
| 65 | — | 18.13 | 2.51 | 2 3 |
| 66 | — | 15.59 | 2.50 | 1,3,4 |
| 67 | — | 8.60 | 2 40 | 1,6 |
| 68 | — | 20.93 | 2.40 | 2,3 |
| 69 | — | 17.38 | 2.40 | 2,3,4 |
| 70 | — | 11.45 | 2.37 | 1,5,6 |
| 71 | 129 | 11.89 | 2.36 | 1,5 |
| 72 | 172 | 9.13 | 2.31 | 1,5,6 |
| 73 | 61 | 18.98 | 2 20 | 2,3 |
| 74 | 107 | 14 02 | 2.13 | 1,4,5 |
| 75 | — | 9.14 | 2.11 | 1,5,6 |
| 76 | — | 9.69 | 2 02 | 1,5,6 |
| 77 | 167 | 9.37 | 1.95 | 1,5,6 |
| 78 | 2 | 24.12 | 1.88 | 2 |
| 79 | — | 9.42 | 1.80 | 1,5,6 |
| 80 | — | 14.93 | 1.58 | 1,3,4,5 |
| 81 | — | 18.40 | 1.53 | 2,3 |
| 82 | 56 | 19.18 | 1.51 | 2,3 |
| 83 | — | 15.58 | 1.50 | 1,3,4,5 |
| 84 | — | 24.90 | 1.43 | 2 |
| 85 | — | 26.72 | 1.43 | 2 |
| 86 | 113 | 13.22 | 1 40 | 1,4,5 |
| 87 | — | 11 87 | 1.39 | 1,5,6 |
| 88 | 50 | 19.59 | 1,38 | 2,3 |
| 89 | — | 13.00 | 1.18 | 1,4,5 |
| 90 | — | 10.78 | 1 18 | 1,4,5,6 |
| 91 | — | 12.50 | 1.10 | 1,4,5,6 |
| 92 | 191 | 8 41 | 0.96 | 1,5,6 |
| 93 | 126 | 11 99 | 0.92 | 1,5,6 |
| 94 | — | 19.90 | 0.92 | 2,3 |
| 95 | — | 12 53 | 0.81 | 1,4,5,6 |
| 96 | 11 | 22.91 | 0.60 | 2,3 |
| 97 | — | 12.49 | 0.60 | 1,4,5,6 |
| 98 | — | 9.22 | 0.59 | 1,5,6 |
| 99 | — | 19.22 | 0.57 | 2,3,4 |
| 100 | — | 8.51 | 0.41 | 1,5,6 |
| 101 | 13 | 22 73 | 0.31 | 2,3 |
| 102 | — | 11.39 | 0.17 | 1,5,6 |
| 103 | 197 | 6.89 | 25.98 | 1,5,6 |
| 104 | — | 23.23 | 26.08 | 2 |
| 105 | — | 18.35 | 26.00 | 2,3,4 |
| 106 | — | 25 50 | 25.69 | 2 |
| 107 | — | 18.10 | 25.46 | 2,3,4,5 |

| Kavalur No. | Mendoza Gomez No. | X cms | Y cms | Identification on figure |
|---|---|---|---|---|
| 108 | — | 12.80 | 25.38 | 2,3 |
| 109 | — | 11.65 | 25.38 | 1,5,6 |
| 110 | — | 21.70 | 25.31 | 2,3 |
| 111 | 34 | 19.80 | 25 31 | 2,3 |
| 112 | 76 | 16.03 | 25.30 | 3,4,5 |
| 113 | — | 7.62 | 25.25 | 1,5,6 |
| 114 | 12 | 21 80 | 25 20 | 2,3 |
| 115 | 181 | 7.93 | 25.18 | 1,5,6 |
| 116 | — | 4.70 | 25 01 | 6 |
| 117 | 202 | 6.10 | 24.98 | 1,5,6 |
| 118 | 90 | 15.00 | 24.93 | 3,4,5 |
| 119 | — | 9.51 | 24.87 | 4,5,6 |
| 120 | 93 | 14.70 | 24.86 | 3,4,5 |
| 121 | 54 | 18.21 | 24.80 | 2,3 |
| 122 | — | 17.84 | 24.80 | 2,3,4 |
| 123 | — | 3.50 | 24 80 | 6 |
| 124 | 36 | 19.73 | 24.78 | 2,3 |
| 125 | 22 | 20.80 | 24.73 | 2,3 |
| 126 | — | 9.43 | 24.70 | 1,4,5,6 |
| 127 | 38 | 19.51 | 24.70 | 2,3 |
| 128 | — | 9.20 | 24.65 | 1,4,5,6 |
| 129 | 147 | 9.78 | 24.68 | 1,4,5,6 |
| 130 | — | 19.10 | 24.58 | 2,3,4 |
| 131 | — | 9.00 | 24.56 | 1,4,5,6 |
| 132 | 58 | 17.86 | 24.52 | 2,3,4 |
| 133 | 43 | 19.00 | 24 50 | 2,3,4 |
| 134 | 42 | 19.10 | 24.48 | 2,3,4 |
| 135 | — | 2 65 | 24.45 | 6 |
| 136 | — | 9.20 | 24.39 | 1,4,5,6 |
| 137 | — | 12.60 | 24.20 | 3,4,5,6 |
| 138 | 191 | 6.32 | 24.18 | 1,5,6 |
| 139 | — | 11 73 | 23.94 | 4,5,6 |
| 140 | — | 8 89 | 23 88 | 1,5,6 |
| 141 | — | 2.79 | 23 88 | 6 |
| 142 | — | 23 36 | 23.78 | 1,2,3 |
| 143 | — | 7.88 | 23.76 | 5,6 |
| 144 | — | 7.89 | 23.59 | 1,5,6 |
| 145 | 16 | 21 32 | 23.48 | 2,3 |
| 146 | 27 | 20.60 | 23.43 | 2,3 |
| 147 | — | 9.59 | 23.42 | 4,6 |
| 148 | 71 | 16.53 | 23.28 | 3,4,5 |
| 149 | 195 | 7.12 | 23.21 | 5,6 |
| 150 | 84 | 15.32 | 23.12 | 3,4,5 |
| 151 | — | 15.51 | 23.09 | 3,4,5 |
| 152 | 86 | 15.15 | 22.96 | 3,4,5 |
| 153 | — | 11.90 | 22.94 | 4,5,6 |
| 154 | — | 16.21 | 22.87 | 3,4,5 |
| 155 | — | 4.70 | 22.87 | 6 |
| 156 | 196 | 7.04 | 22.85 | 5,6 |
| 157 | 92 | 14.70 | 22.78 | 3,4,5 |
| 158 | — | 10.36 | 22.77 | 4,5,6 |
| 159 | 66 | 17.29 | 22.77 | 3,4 |
| 160 | 7 | 22.20 | 22.75 | 3 |
| 161 | — | 5.26 | 22 71 | 6 |
| 162 | 132 | 10.55 | 22.70 | 5,6 |
| 163 | — | 5.05 | 22.68 | 6 |

| Kavalur No. | Mendoza Gomez No. | X cms | Y cms | Identification on figure |
|---|---|---|---|---|
| 164 | 4 | 22.80 | 22.63 | 3 |
| 165 | 51 | 18.39 | 22.60 | 3,4 |
| 166 | — | 9 63 | 22.57 | 4,5,6 |
| 167 | — | 4.78 | 22.48 | 6 |
| 168 | 180 | 8.03 | 22.47 | 5,6 |
| 169 | 127 | 10.90 | 22 40 | 5,6 |
| 170 | — | 15.58 | 22.40 | 3 4,5 |
| 171 | 5 | 22.79 | 22.40 | 3 |
| 172 | 30 | 22.60 | 22 40 | 3 |
| 173 | — | 5.45 | 22.40 | 6 |
| 174 | 198 | 6 87 | 22.40 | 5,6 |
| 175 | 168 | 8.62 | 22.38 | 5,6 |
| 176 | 6 | 22.40 | 22.34 | 3 |
| 177 | — | 8.72 | 22.32 | 5,6 |
| 178 | — | 18.66 | 22.32 | 3,4 |
| 179 | 114 | 12.21 | 22.30 | 4,5,6 |
| 180 | — | 18.24 | 22.29 | 3,4 |
| 181 | 193 | 7.42 | 22.28 | 5,6 |
| 182 | 70 | 16.60 | 22.27 | 3,4,5 |
| 183 | 137 | 10.28 | 22.27 | 4,5,6 |
| 184 | 124 | 11 48 | 22.25 | 5,6 |
| 185 | 177 | 8.14 | 22 23 | 5,6 |
| 186 | — | 12.30 | 22.22 | 4,5,6 |
| 187 | 183 | 7.95 | 22.21 | 5,6 |
| 188 | — | 13.00 | 22.20 | 3,4,5,6 |
| 189 | — | 15.38 | 22.20 | 3,4,5 |
| 190 | 165 | 8.71 | 22.18 | 5,6 |
| 191 | 112 | 12.27 | 22.12 | 4,5,6 |
| 192 | 41 | 19.19 | 22.12 | 3,4 |
| 193 | 166 | 8.63 | 22.10 | 5,6 |
| 194 | 170 | 8.53 | 22.10 | 5,6 |
| 195 | — | 18.93 | 22.10 | 3,4 |
| 196 | 3 | 22.81 | 22.10 | 3 |
| 197 | 52 | 18.30 | 22.02 | 3,4 |
| 198 | 175 | 8.24 | 22.01 | 5,6 |
| 199 | — | 10.32 | 21.98 | 4,5,6 |
| 200 | 77 | 15 85 | 21.98 | 3,4,5 |
| 201 | — | 18.42 | 21.95 | 3,4 |
| 202 | 174 | 8.40 | 21.95 | 5,6 |
| 203 | 23 | 20.90 | 21.94 | 3 |
| 204 | — | 19.18 | 21.92 | 3,4 |
| 205 | 31 | 20.41 | 21.90 | 3 |
| 206 | — | 15.43 | 21.88 | 3,4,5 |
| 207 | — | 17.37 | 21.78 | 3,4 |
| 208 | — | 19.10 | 21.76 | 3,4 |
| 209 | 135 | 10.41 | 21.73 | 4,5,6 |
| 210 | 179 | 8.05 | 21.72 | 5,6 |
| 211 | 164 | 9.31 | 21.66 | 5,6 |
| 212 | 153 | 9.32 | 21.63 | 5,6 |
| 213 | 186 | 7.90 | 21.61 | 5,6 |
| 214 | 190 | 7.74 | 21.58 | 5,6 |
| 215 | 35 | 19.78 | 21.55 | 3 |
| 216 | — | 4.33 | 21,50 | 6 |
| 217 | — | 9.82 | 21.48 | 5,6 |
| 218 | — | 11.53 | 21.47 | 4,5,6 |
| 219 | — | 22.31 | 21.40 | 3 |

| Kavalur No. | Mendoza Gomez No. | X cms | Y cms | Identification on figure |
|---|---|---|---|---|
| 220 | 163 | 8.80 | 21.40 | 5,6 |
| 221 | 85 | 15.20 | 21.35 | 3,4,5 |
| 222 | — | 6.99 | 21.20 | 5,6 |
| 223 | 19 | 21.15 | 21.07 | 3 |
| 224 | — | 20.09 | 21 00 | 3 |
| 225 | 128 | 10.93 | 20.97 | 4,5,6 |
| 226 | 149 | 9.63 | 20.92 | 5,6 |
| 227 | 117 | 11.80 | 20.85 | 4,5,6 |
| 228 | 109 | 12.52 | 20.70 | 3,4,5,6 |
| 229 | 91 | 14.81 | 20.70 | 3,4,5 |
| 230 | — | 13.43 | 20.70 | 3,4,5,6 |
| 231 | 119 | 11.48 | 20.66 | 5,6 |
| 232 | 192 | 7.62 | 20 65 | 5,6 |
| 233 | 88 | 14 83 | 20.64 | 3,4,5 |
| 234 | 33 | 19 83 | 20.59 | 3 |
| 235 | — | 7.62 | 20 58 | 5,6 |
| 236 | — | 14.90 | 20.57 | 3,4,5 |
| 237 | 67 | 17.22 | 20.55 | 3,4 |
| 238 | 10 | 21.82 | 20 51 | 3 |
| 239 | — | 7.97 | 20.48 | 5,6 |
| 240 | — | 19.97 | 20.39 | 3 |
| 241 | 148 | 9.72 | 20.36 | 5,6 |
| 242 | 87 | 14.97 | 20.29 | 3,4,5 |
| 243 | — | 19.52 | 20.29 | 3 |
| 244 | — | 14.62 | 20.22 | 3,4,5 |
| 245 | 116 | 11 9 | 20.13 | 5,6 |
| 246 | — | 19.35 | 20.12 | 3 |
| 247 | — | 13.50 | 20.10 | 3,4,5 |
| 248 | 159 | 9.22 | 20.02 | 5,6 |
| 249 | — | 15.58 | 19.91 | 3,4,5 |
| 250 | 144 | 9.96 | 19.90 | 5,6 |
| 251 | — | 10.83 | 19.89 | 5,6 |
| 252 | — | 11.78 | 19 87 | 5,6 |
| 253 | 82 | 15.47 | 19.73 | 3,4,5 |
| 254 | 123 | 11,22 | 19.70 | 5,6 |
| 255 | 73 | 18.22 | 19.62 | 3,4,5 |
| 256 | 115 | 12.68 | 19.62 | 5,6 |
| 257 | 67 | 17.87 | 19.60 | 3,4 |
| 258 | 72 | 18.28 | 19.57 | 3,4,5 |
| 259 | — | 9 78 | 19 50 | 5,6 |
| 260 | 25 | 20.63 | 19.43 | 3 |
| 261 | — | 11.46 | 19 42 | 5,6 |
| 262 | — | 7.78 | 19.32 | 5,6 |
| 263 | 101 | 14.17 | 19.27 | 3,4,5 |
| 264 | — | 14.62 | 19.24 | 3,4,5 |
| 265 | 161 | 8.80 | 19.22 | 5,6 |
| 266 | 81 | 15.58 | 19.18 | 3,4,5 |
| 267 | 29 | 20.43 | 19.16 | 3 |
| 268 | 56 | 18 00 | 19.11 | 3,4 |
| 269 | — | 10.78 | 19.10 | 6 |
| 270 | 130 | 10.97 | 19.08 | 6 |
| 271 | 171 | 8.49 | 19.00 | 5,6 |
| 272 | 141 | 10.03 | 18.90 | 5,6 |
| 273 | 136 | 10.40 | 18.79 | 5,6 |
| 274 | 138 | 10.29 | 18.65 | 5,6 |
| 275 | — | 8.31 | 18.62 | 5,6 |
| 276 | 140 | 10.12 | 18.60 | 5,6 |

| Kavalur No. | Mendoza Gomez No. | X cms | Y cms | Identification on figure |
|---|---|---|---|---|
| 277 | 45 | 18.83 | 18.59 | 3 |
| 278 | 122 | 11.37 | 18.55 | 5,6 |
| 279 | 100 | 14.39 | 18.53 | 3,4,5 |
| 280 | — | 17.08 | 18.52 | 3,4 |
| 281 | — | 10.23 | 18.52 | 5,6 |
| 282 | 118 | 11.59 | 18.51 | 5,6 |
| 283 | 176 | 8.21 | 18.48 | 5,6 |
| 284 | 62 | 17.43 | 18.33 | 3,4 |
| 285 | 143 | 10.09 | 18.30 | 5,6 |
| 286 | 97 | 14.69 | 18.23 | 3,4,5 |
| 287 | — | 11.34 | 18.10 | 5,6 |
| 288 | 32 | 20.23 | 18.02 | 3 |
| 289 | 194 | 7.30 | 17.94 | 6 |
| 290 | 79 | 15.62 | 17 78 | 3,4 |
| 291 | — | 5.79 | 17.70 | 6 |
| 292 | 80 | 15.50 | 17.69 | 3,4 |
| 293 | 199 | 6.83 | 17.68 | 6 |
| 294 | — | 13.89 | 17.68 | 5 |
| 295 | 178 | 8.20 | 17.38 | 6 |
| 296 | 134 | 10.61 | 17.31 | 5 |
| 297 | 156 | 9.33 | 17 27 | 5,6 |
| 298 | 160 | 9.10 | 17.00 | 6 |

and the reliability of an estimate of the I magnitude. Stars listed by Mendoza and Gomez as of magnitude 13.2 are atleast three quarters of a magnitude brighter than the limit detectable on the exposure. This argument would, however, be of interest only when a discussion of survey completeness and effects of selection are made prior to studies of true distribution.

Table 1 contains a listing of the red objects detected. The first column gives the Kavalur number of the star, followed by the number in the Mendoza-Gomez catalogue. The third and fourth columns refer to the distance of the object on the Hodge-Wright Atlas with the bottom-left corner as origin. Stars with numbers 1 to 102 have X, Y measures on Hodge-Wright chart number 53V, while numbers 103 to 298 are to be located on Hodge-Wright chart 54V. Figures 1 to 6 are enlargements of the micorspectra fields used in the study, with the red objects marked on them to enable identification. Figure 7 depicts the coordinates of the fields observed.

**References**

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Westerlund, B E., 1964, IAU/URSI Symp. 20, p239, eds. F.J. Kerr A.W. Rodgers, Australian Acad. Sci., Canberra, Australia.

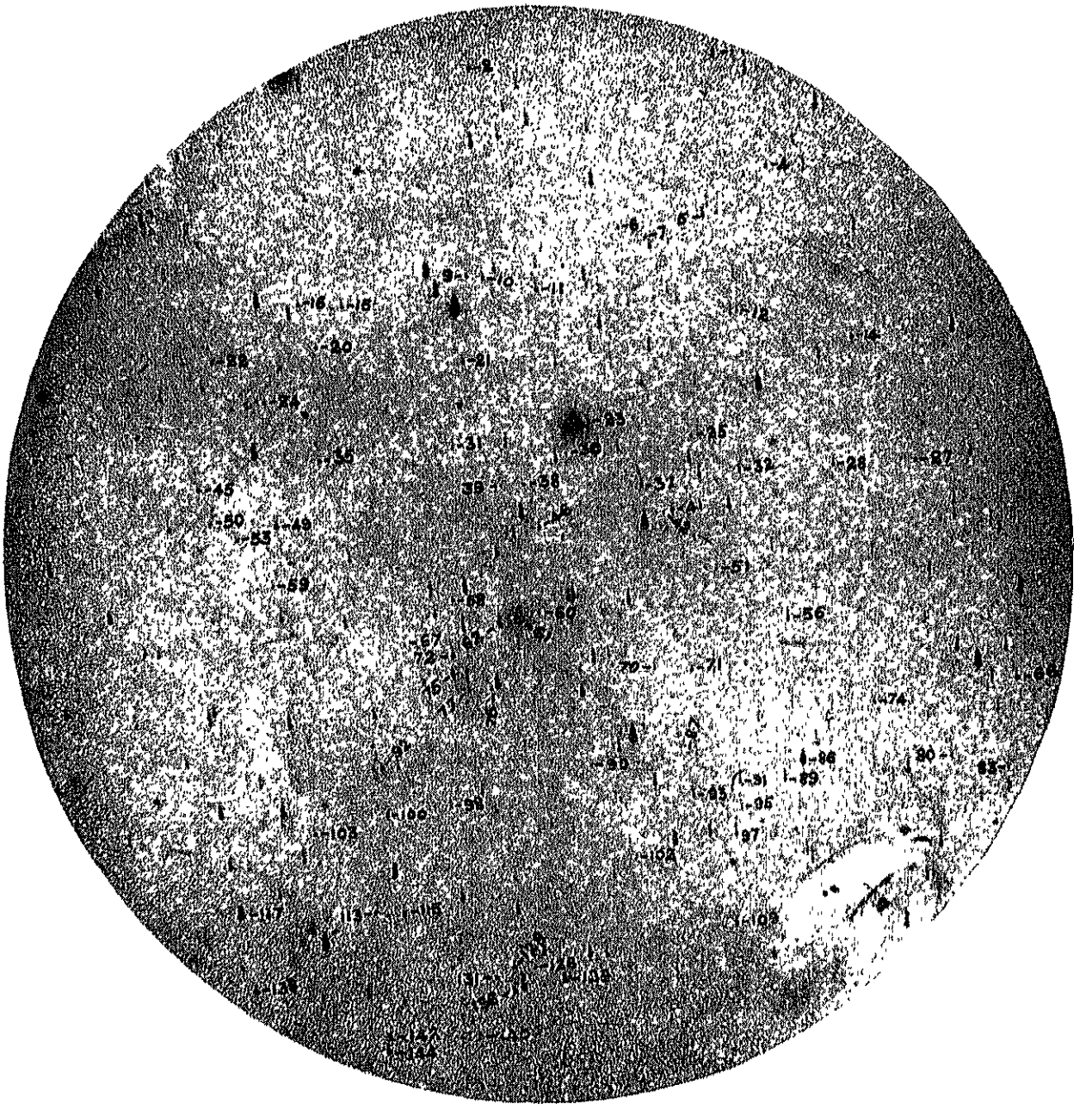

Fig. 1. Red stars in the direction of LMC. Chart centre has 1950 coordinates; R. A. $5^h\,41.4^m$ Dec. $-68°\ 52'$. North is at the top and east towards the left.

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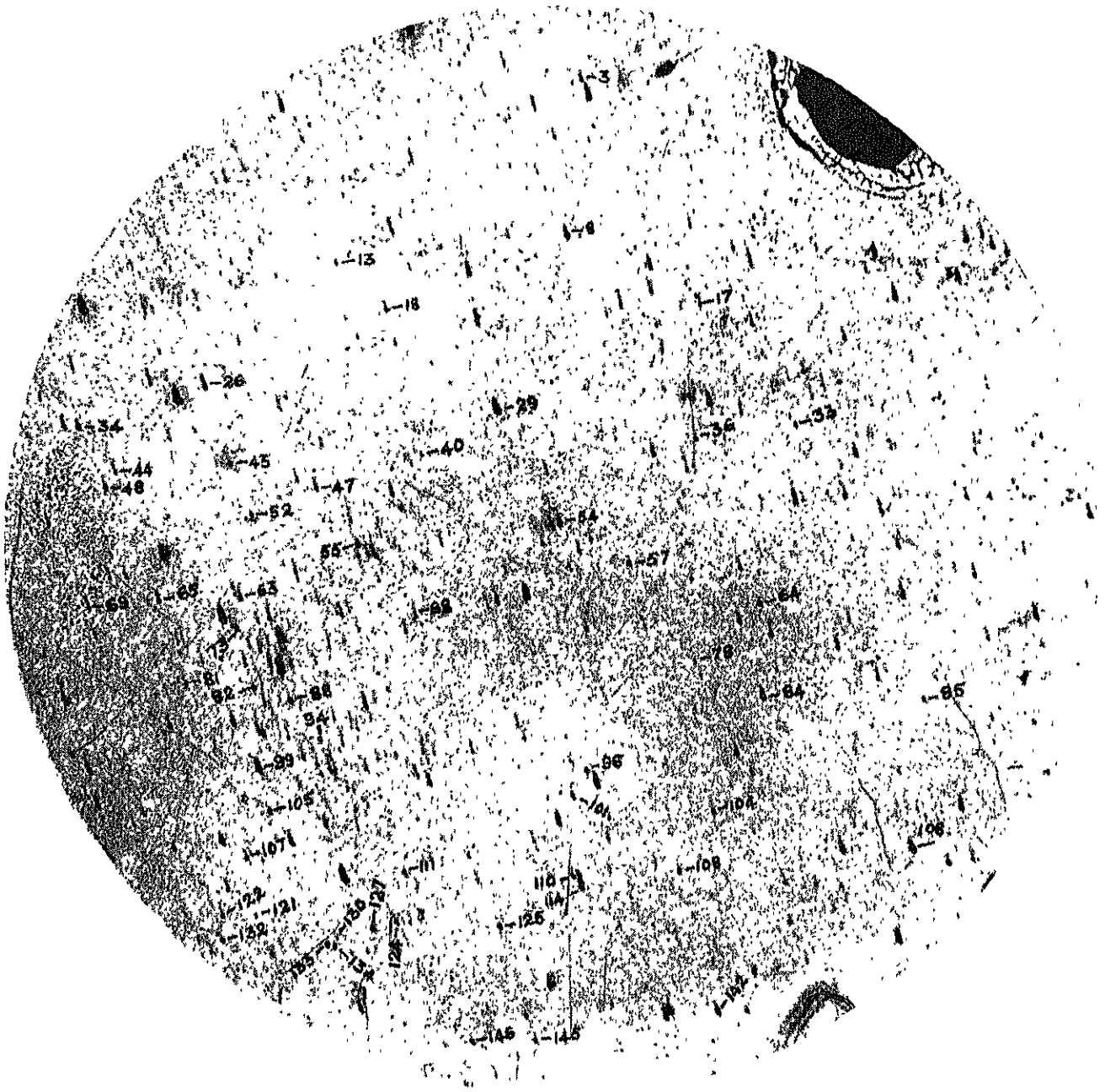

Fig. 2. Red stars in the direction of LMC. Chart centre has 1950 coordinates: R. A. 5h 34.7 Dec. − 68° 52′. North is at the top and east towards the left.

Bappu *et al. (see page 88)*

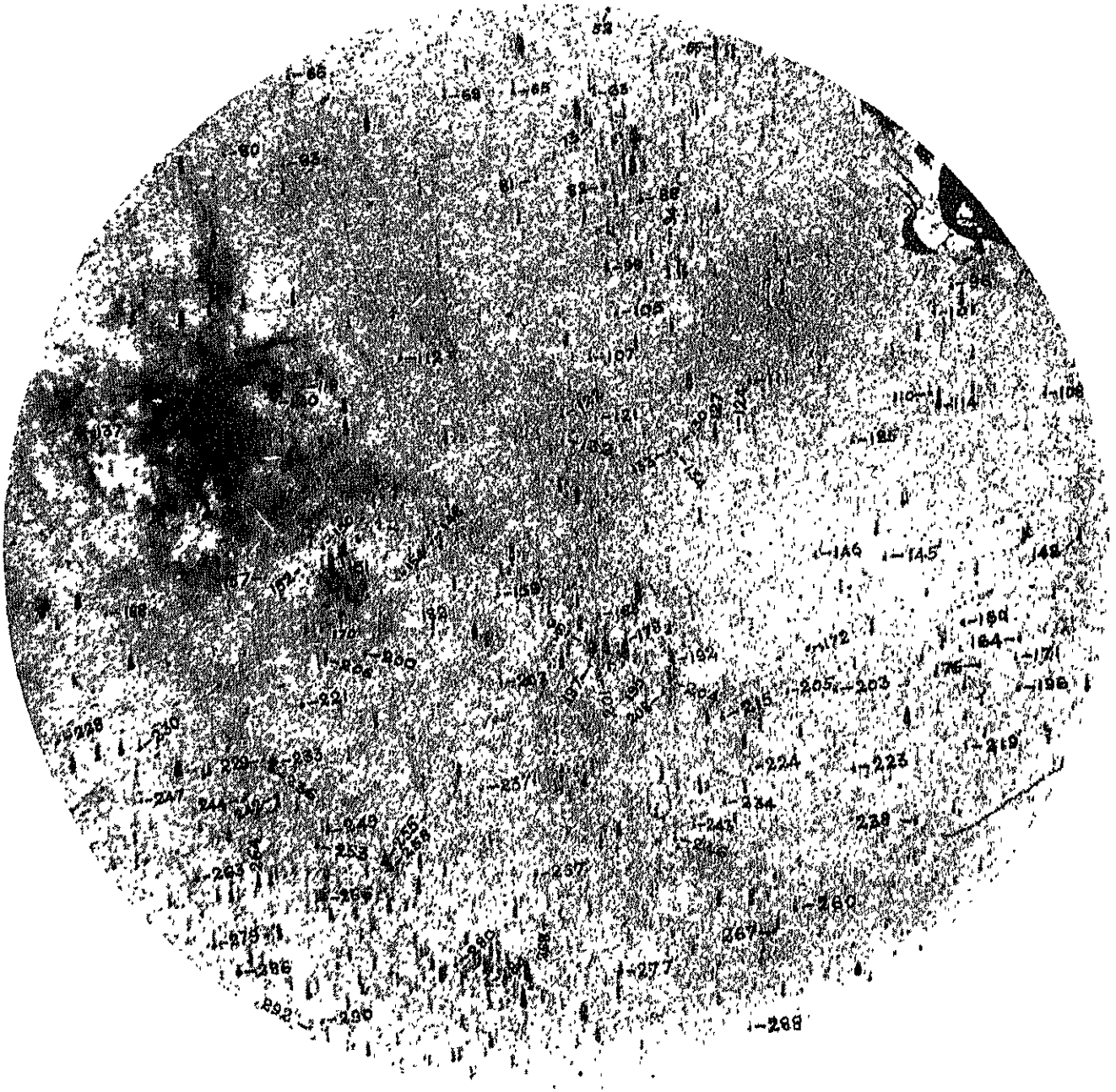

Fig. 3. Red stars in the direction of LMC. Chart centre has 1950 Coordinates; R. A. 6h 36.5m Dec. – 69° 10'. North is at the top and east towards the left.

Bappu *et al. (see page 88)*

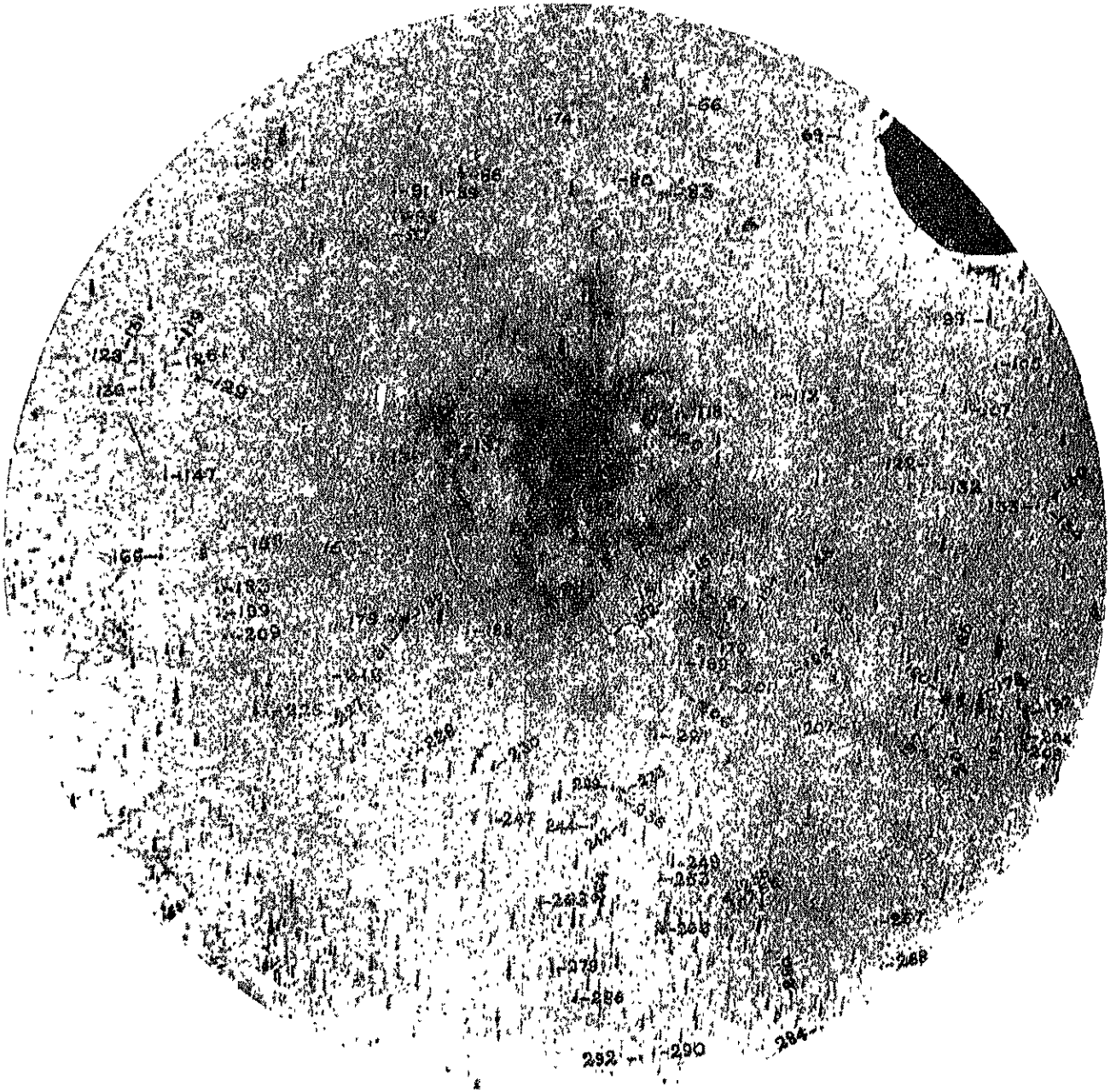

Fig. 4. Red stars in the direction of LMC. Chart centre has 1950 coordinates; R A. 5h 38.7m Dec. – 69° 10'. North is at the top and east towards the left

Bappu *et al. (see page 88)*

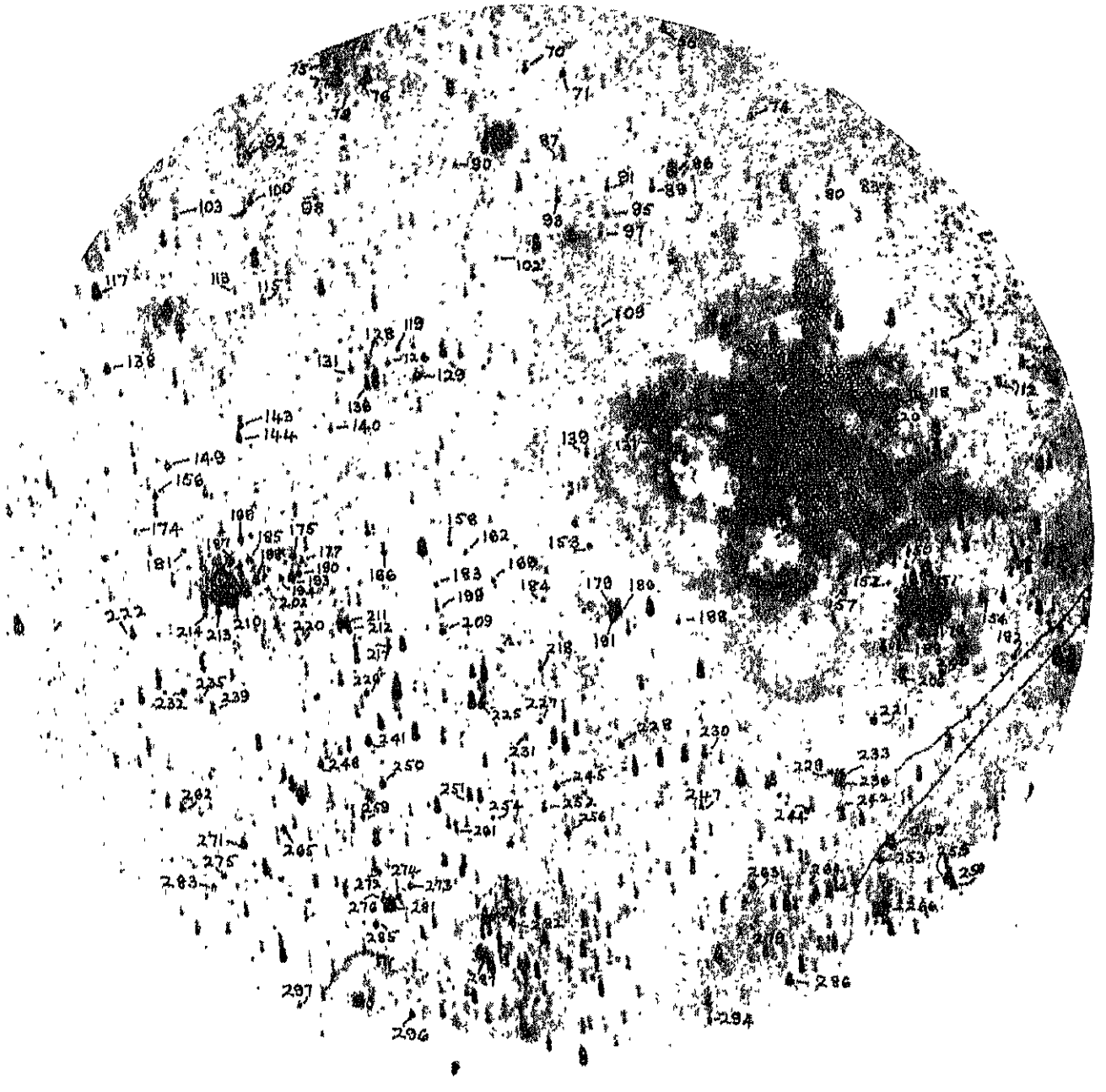

Fig. 5. Red stars in the direction of LMC. Chart centre has 1950 coordinates; R. A. $5^h\,40^m$ Dec $-69°\,10'$. North is at the top and east towards the left.

Bappu *et al. (see page 88)*

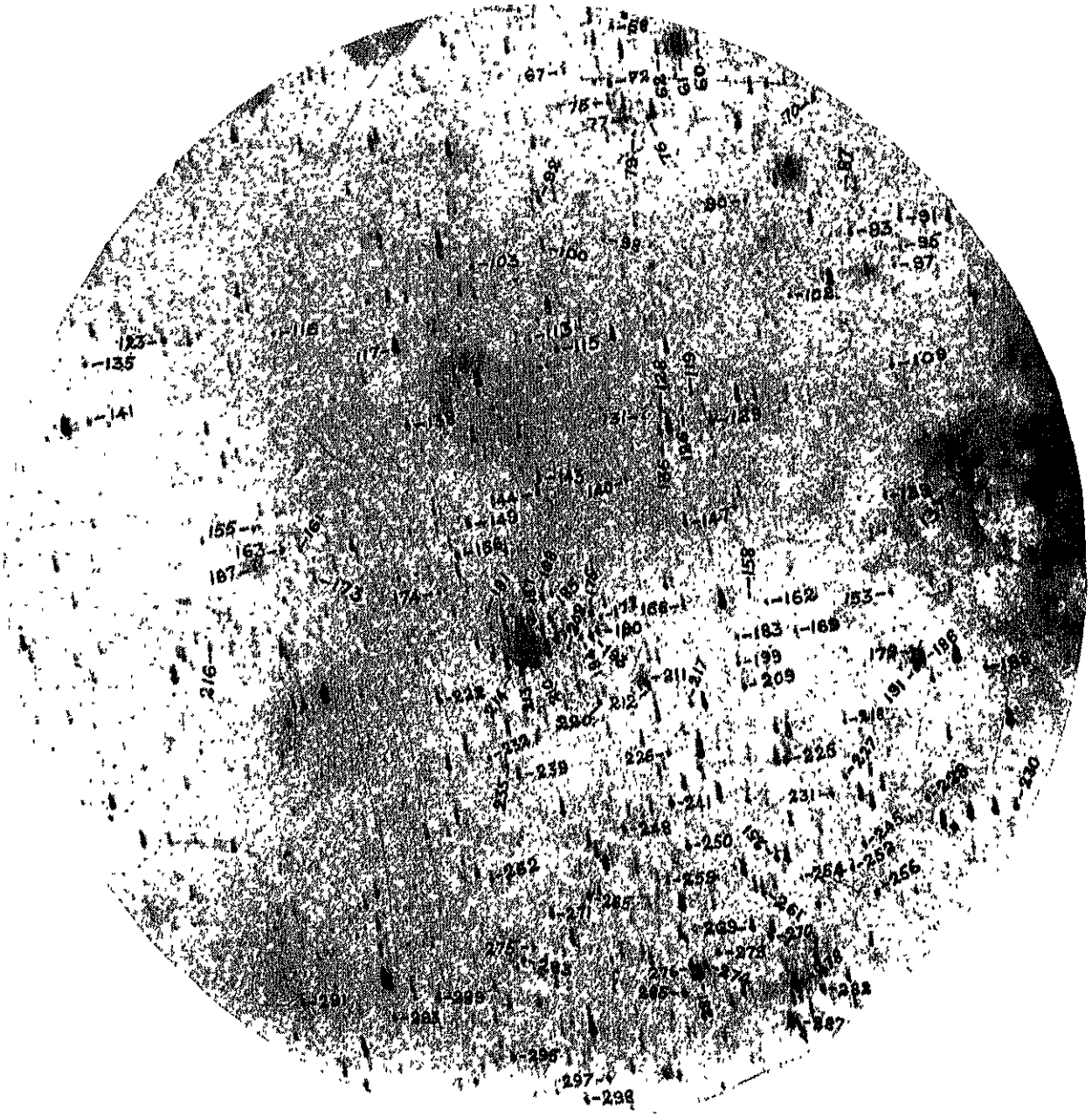

Fig. 6. Red stars in the direction of LMC Chart centre has 1950 coordinates, R. A. 5h 42.3m Dec. — 69° 10'. North is at the top and east towards the left.

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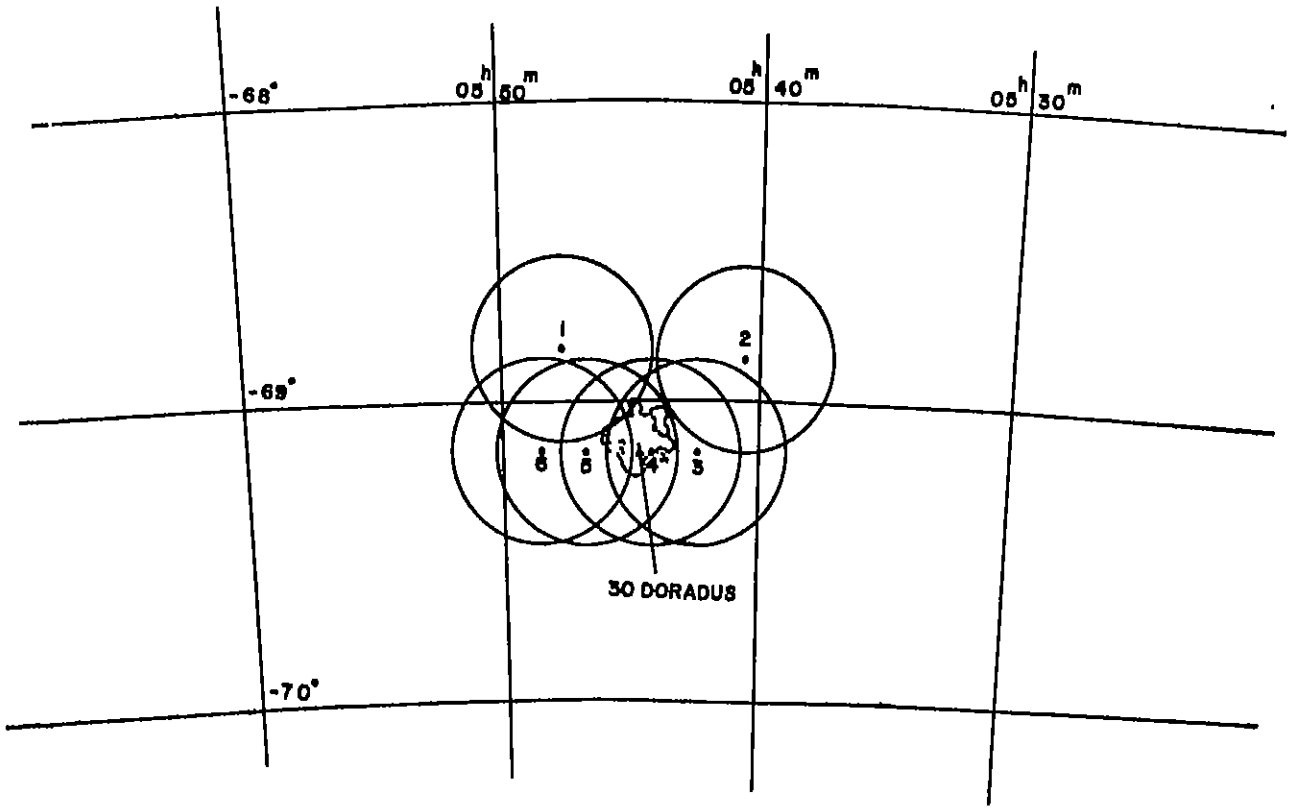


Fig. 7. LMC fields 1 to 6 and their 1975 equatorial coordinates.

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