

# Appendix A

## Spectra

**Figure A.1** (Following pages.) Continuum fits on the spectrum of the Cloudy Night QSO. Each Figure panel (A.1 (a)–(f)) shows two orders of the Cloudy Night QSO spectrum. In each panel, the unnormalised spectrum is shown. Superposed on the spectrum are my continuum fit (solid line) and the true continuum level (dashed line). Note that in every order except order 56, the fitted continuum level is always lower than the true continuum. A full description of this figure is given in Section 2.2.

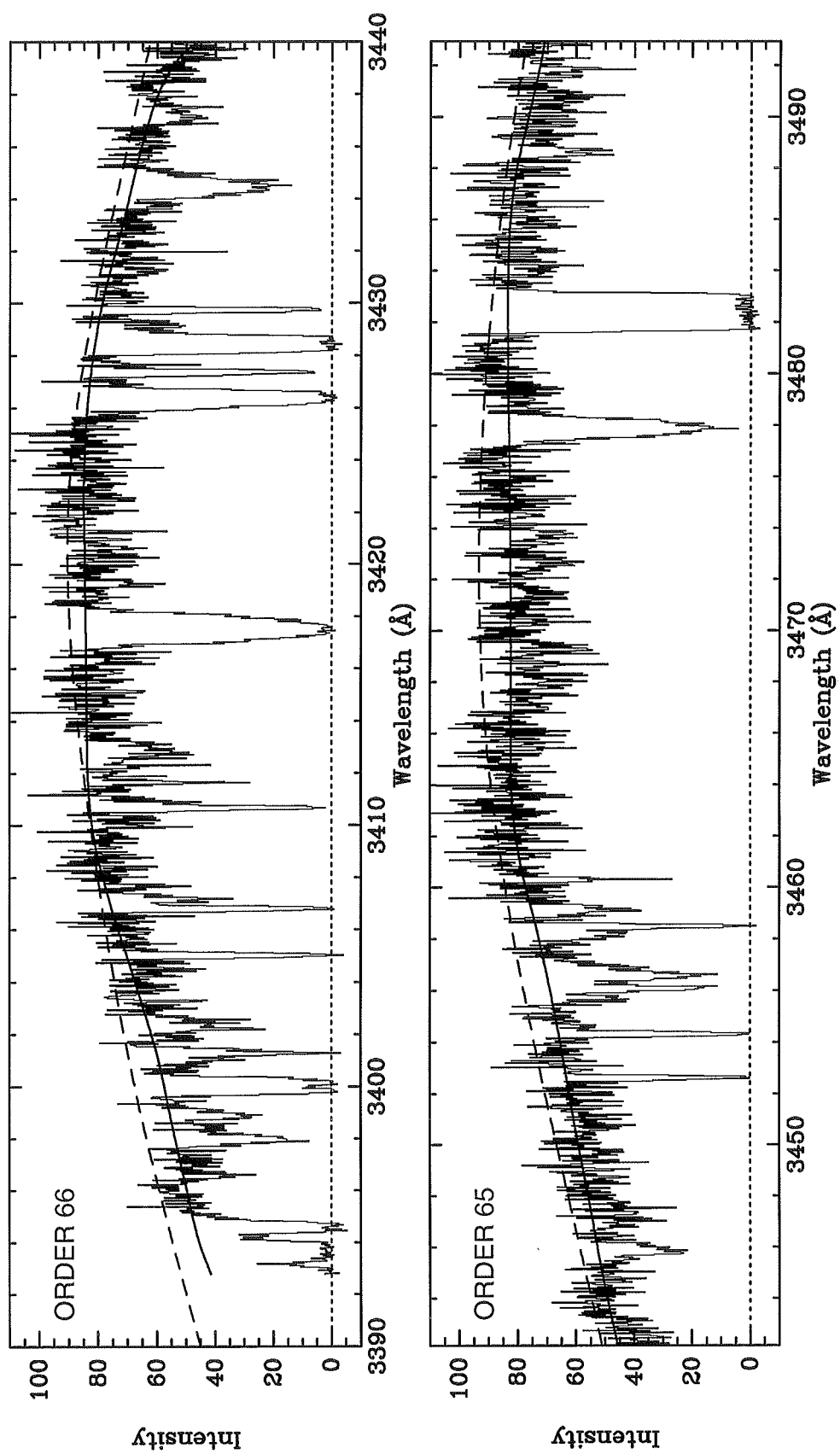


Figure A.1 (a) *CNQ* spectrum with continuum fits: Orders 66 and 65.

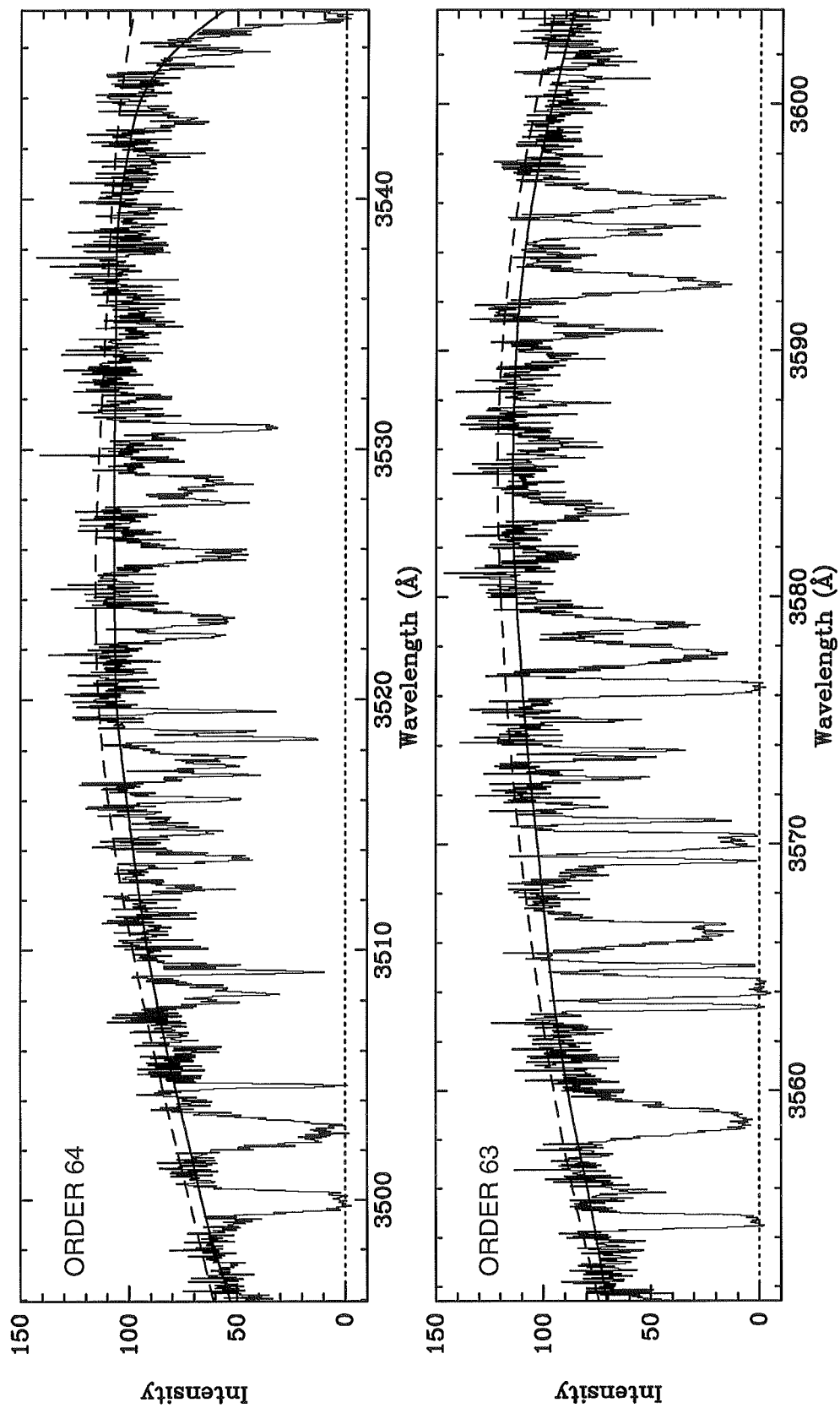
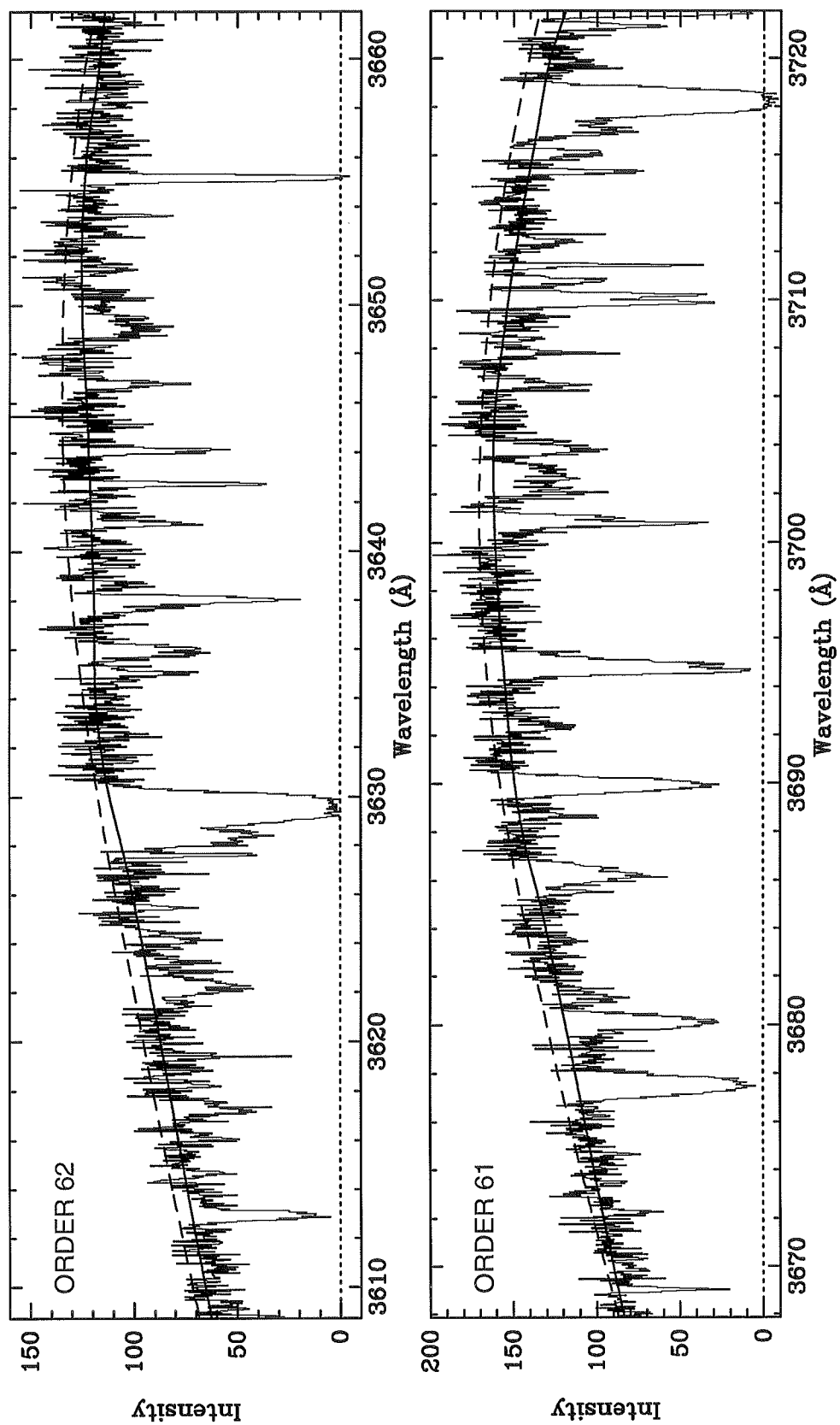


Figure A.1 (b) *CNQ* spectrum with continuum fits: Orders 64 and 63.

Figure A.1 (c) *CNQ* spectrum with continuum fits: Orders 62 and 61.

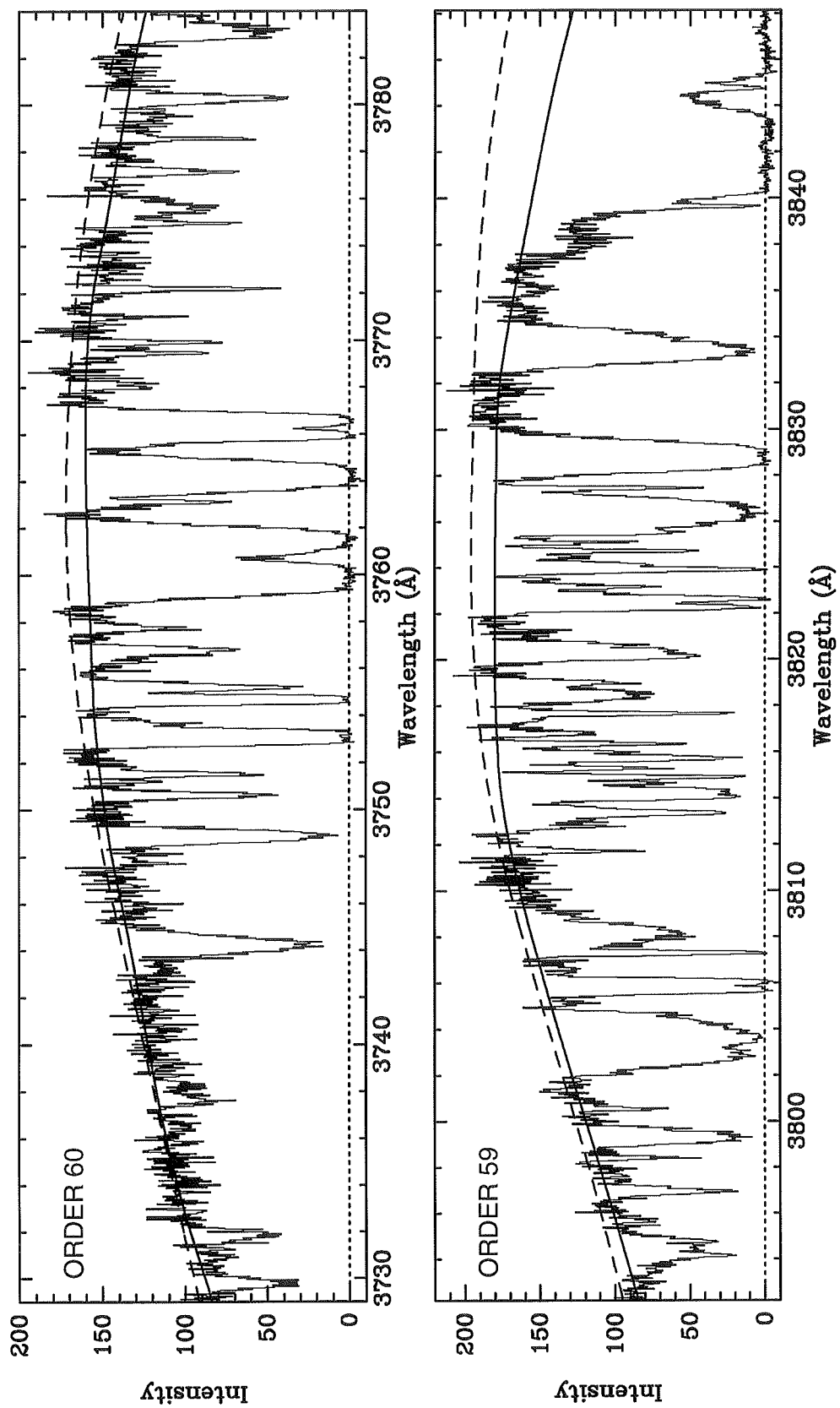


Figure A.1 (d) *CNQ* spectrum with continuum fits: Orders 60 and 59.

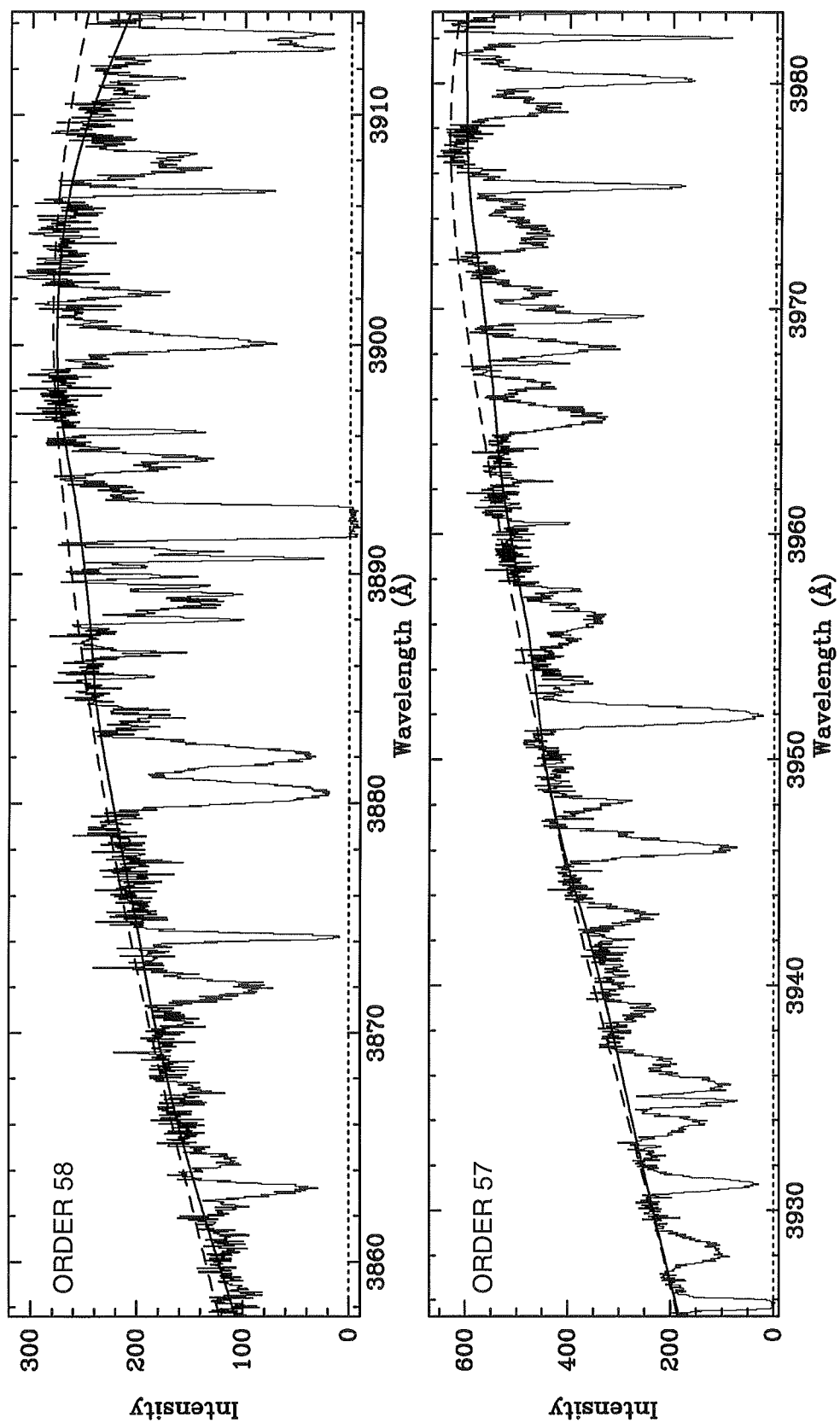


Figure A.1 (e) *CNQ* spectrum with continuum fits: Orders 58 and 57.

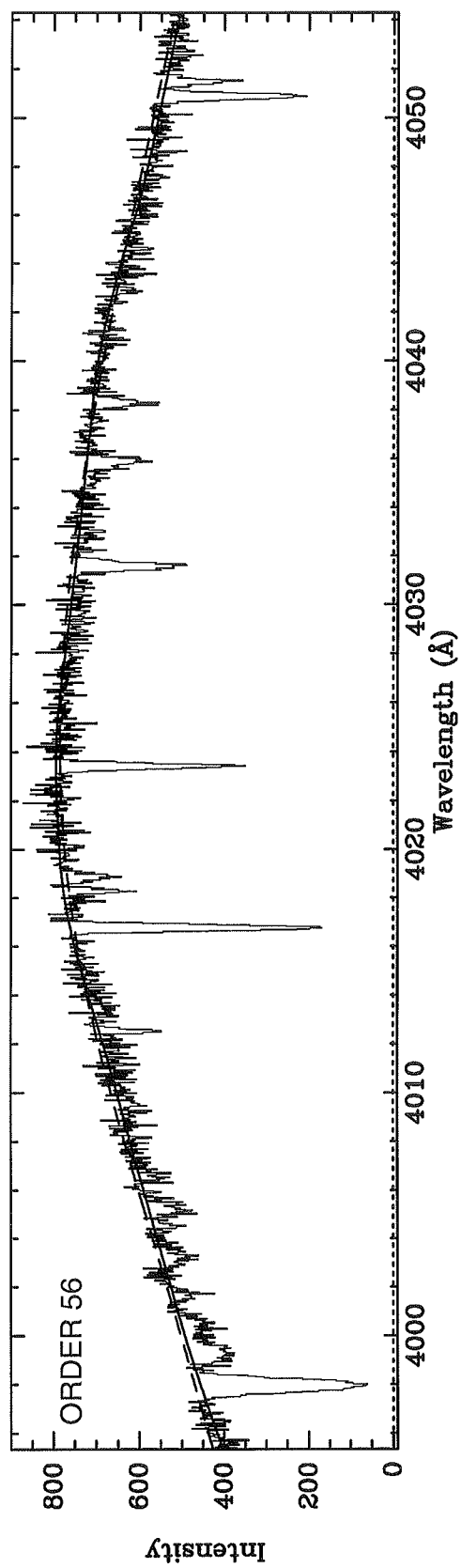


Figure A.1 (f) CNQ spectrum with continuum fits: Order 56.

**Figure A.2** (Following pages.) Continuum fits on a box-filter smoothed spectrum of the Cloudy Night QSO. Each Figure panel (A.2 (a)–(c)) shows four orders of the Cloudy Night QSO spectrum. Each order was generated from the corresponding order shown in Figure A.1 with an eleven-point mean box-filter. Superposed on the spectrum are my continuum fit (solid line) and the true continuum level (dashed line). A full description of this figure is given in Section 2.2.



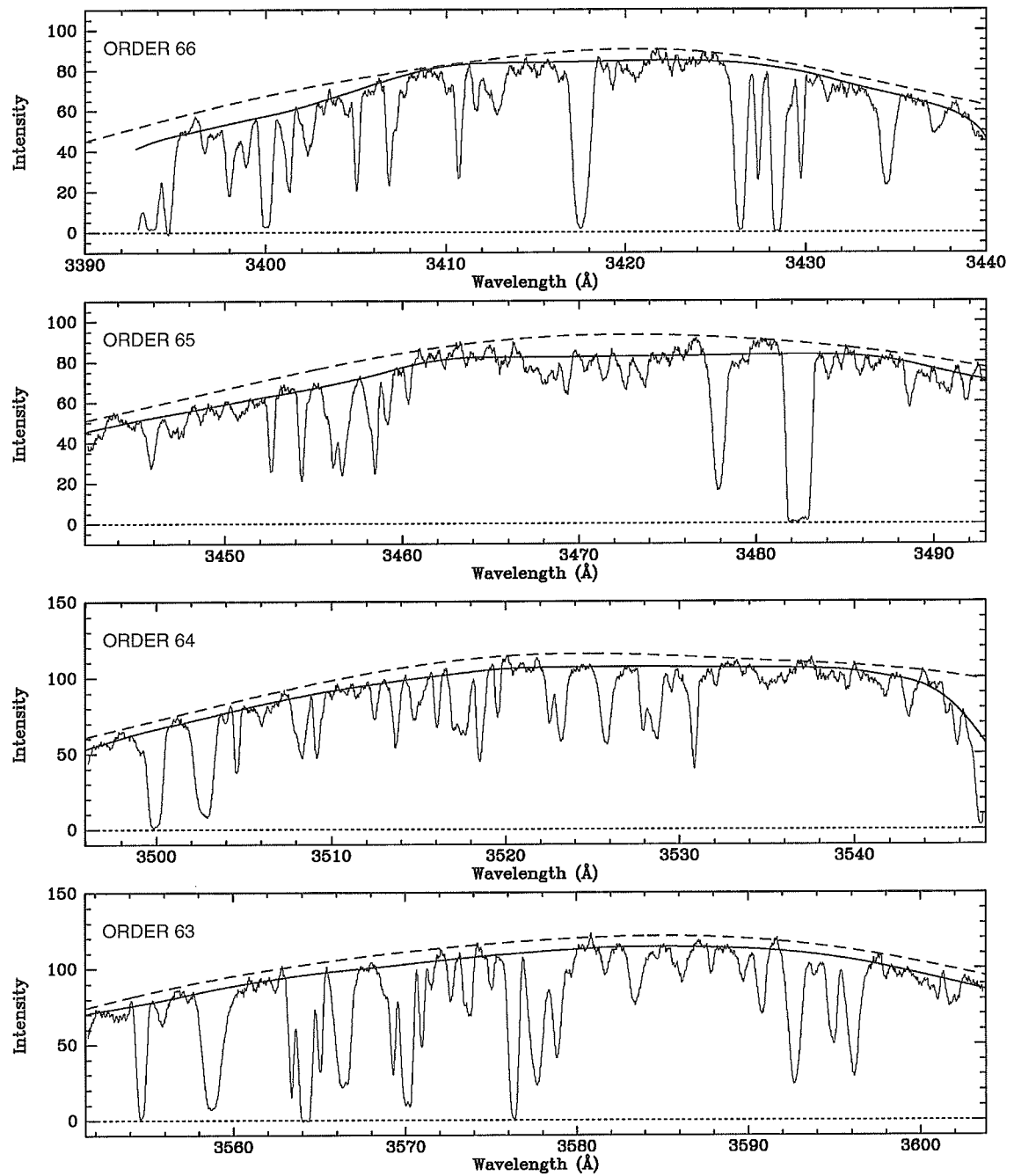


Figure A.2 (a) Smoothed CNQ spectrum with continuum fits: Orders 66, 65, 64 and 63.

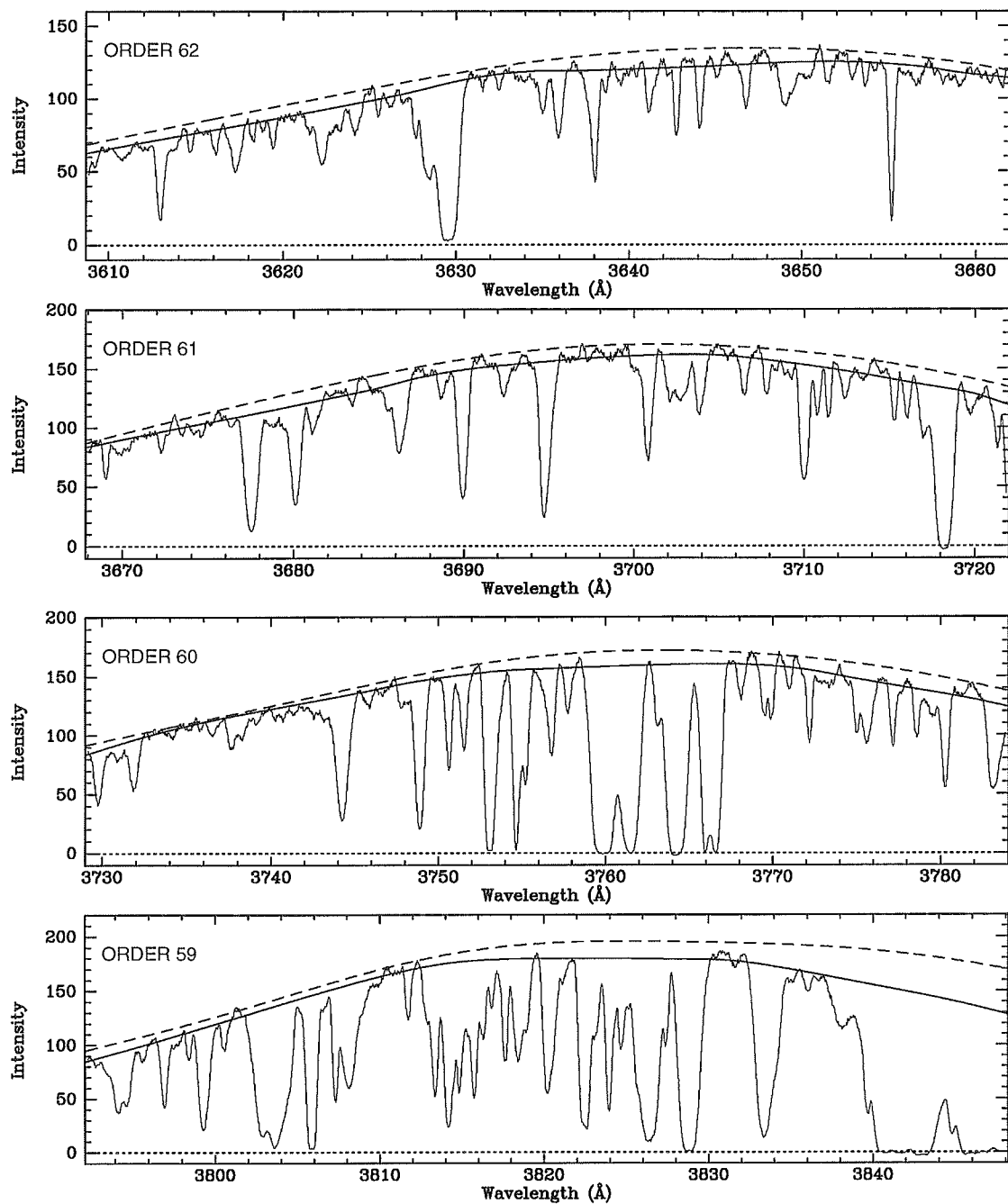


Figure A.2 (b) Smoothed CNQ spectrum with continuum fits: Orders 62, 61, 60 and 59.

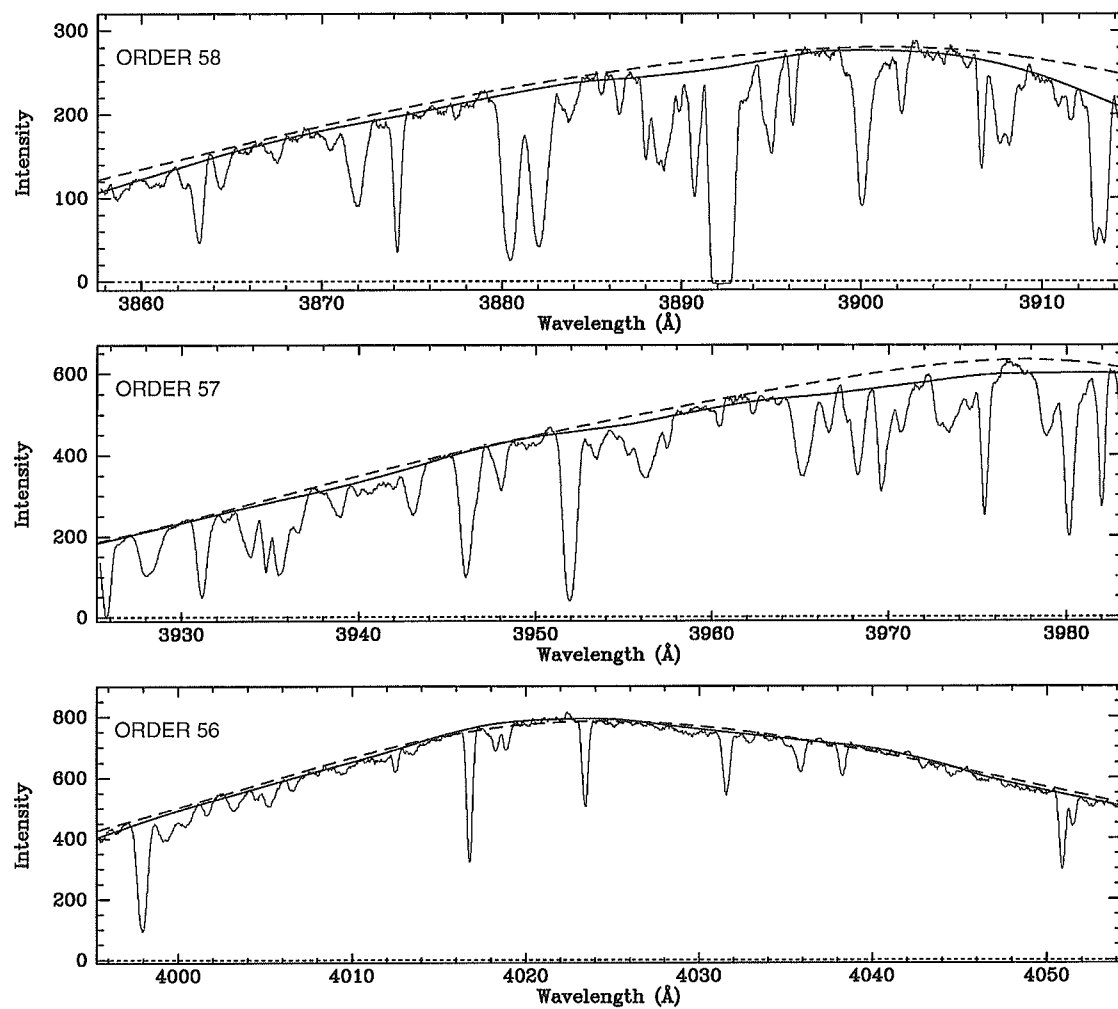
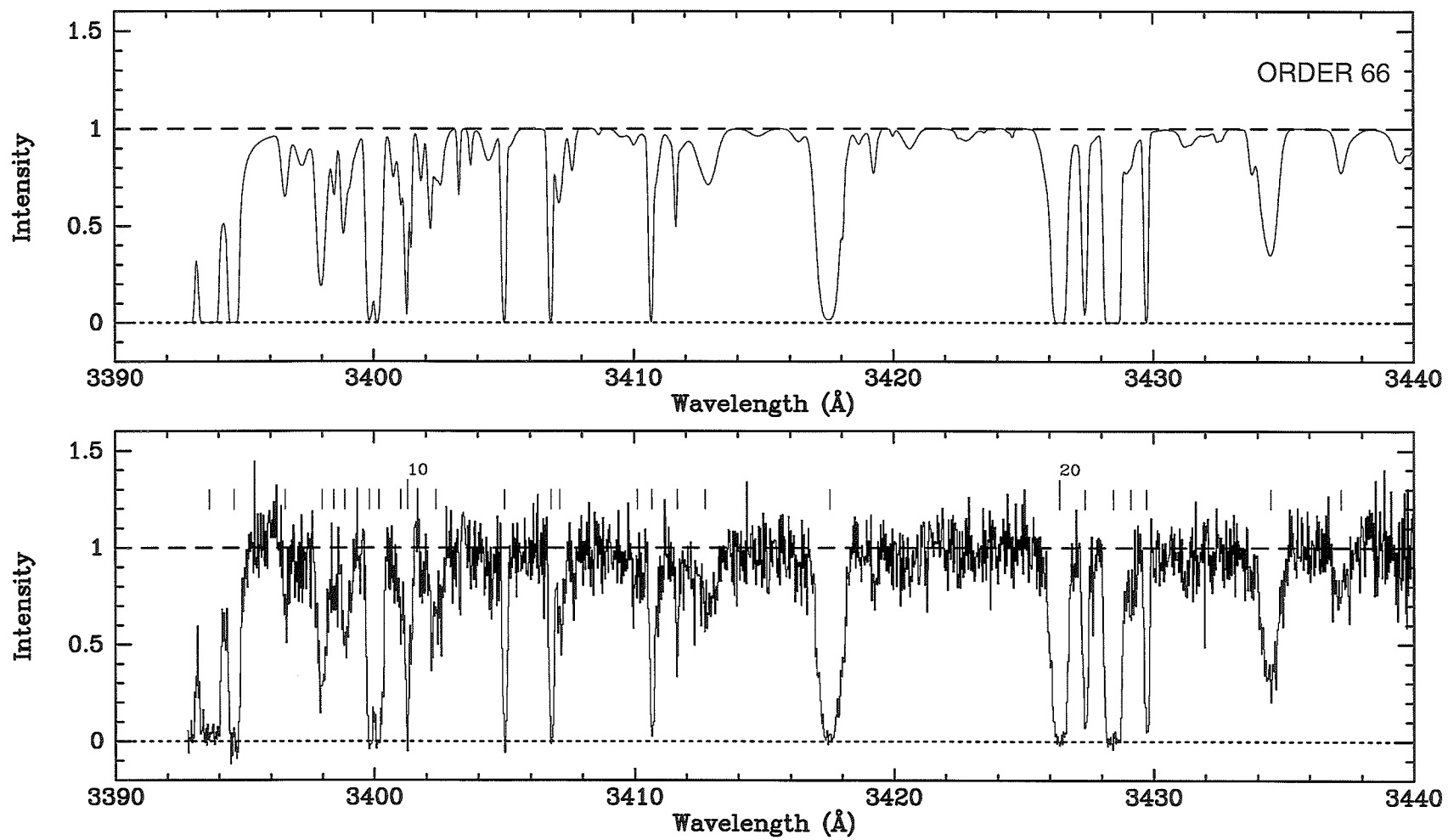


Figure A.2 (c) *Smoothed CNQ spectrum with continuum fits: Orders 58, 57 and 56.*

**Figure A.3** (Following pages.) The spectrum of the Cloudy Night QSO. Each Figure panel (A.3 (a)–(k)) shows one order of the Cloudy Night QSO spectrum. The upper panels are the noise-free spectrum produced by Ed Jenkins. The lower panels are the noisy spectrum which was analysed, after normalisation by the continuum fits. In some places, the error in the continuum fits is made obvious by comparison with the noise-free orders. Each measured absorption line is indicated by a vertical bar at the appropriate wavelength. Each tenth bar is longer and is numbered. The numbers correspond to the line numbers given in Table B.3.

Figure A.3 (a) *CNQ* spectrum normalised: Order 66.

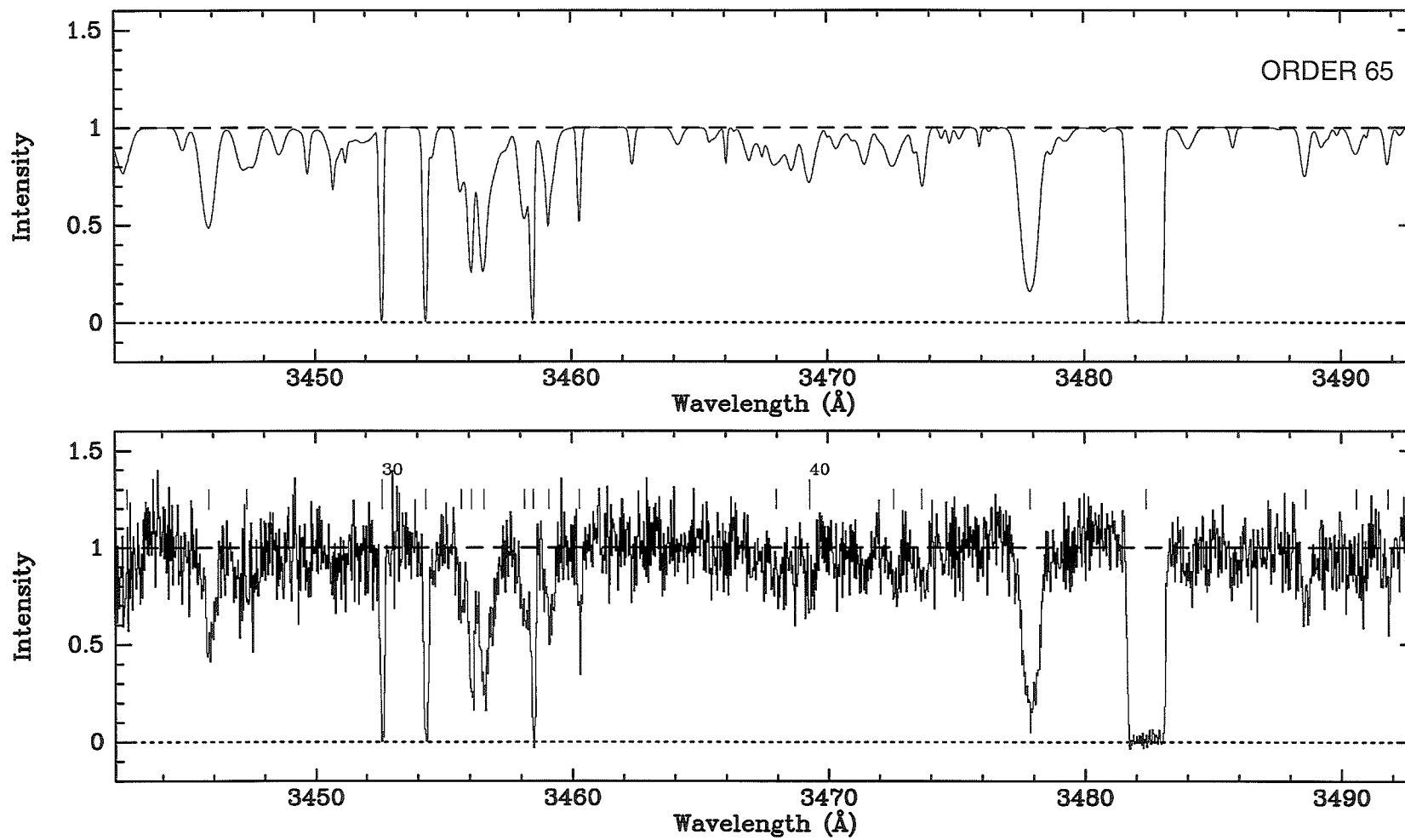


Figure A.3 (b) *CNQ* spectrum normalised: Order 65.

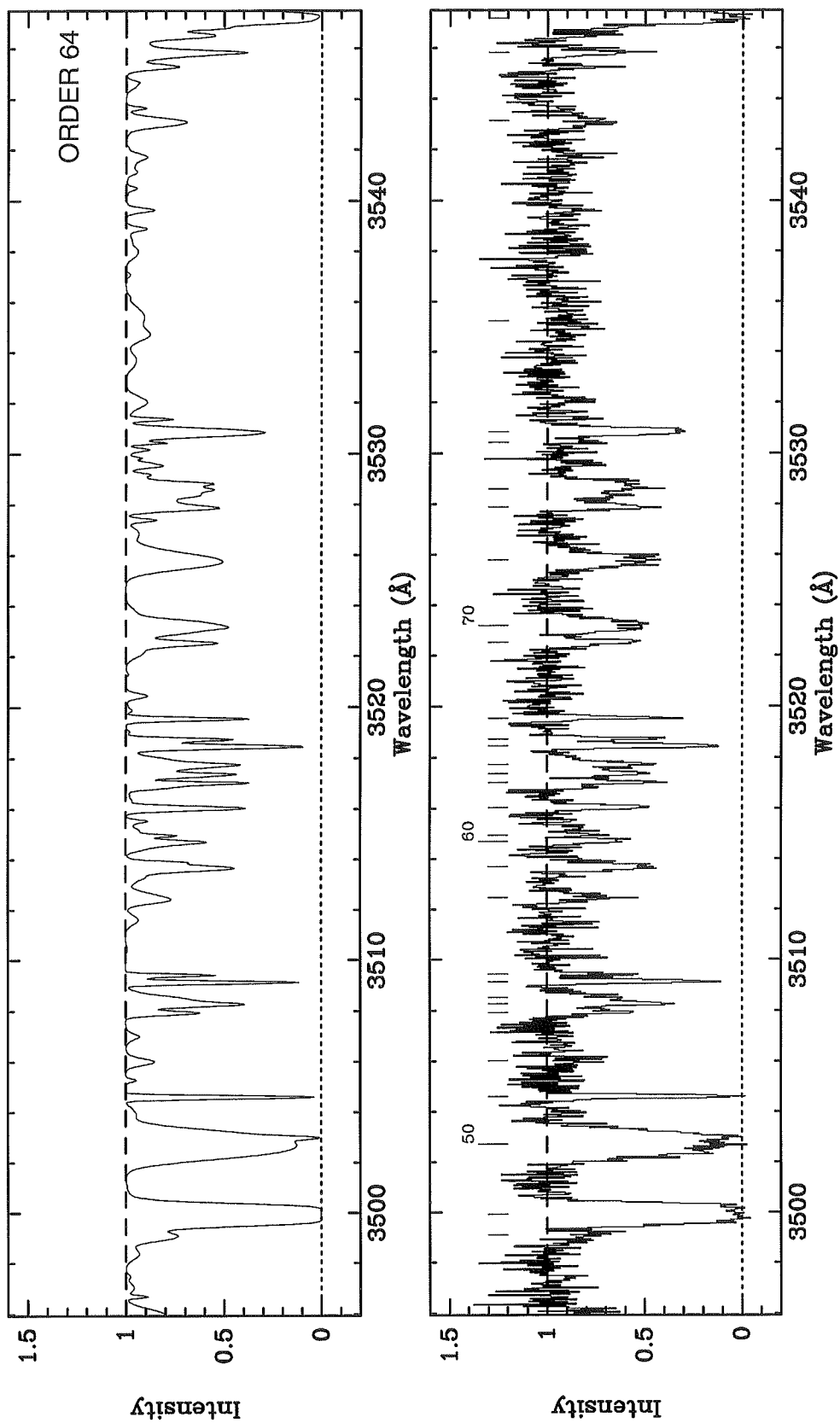


Figure A.3 (c) *CNQ* spectrum normalised: Order 64.

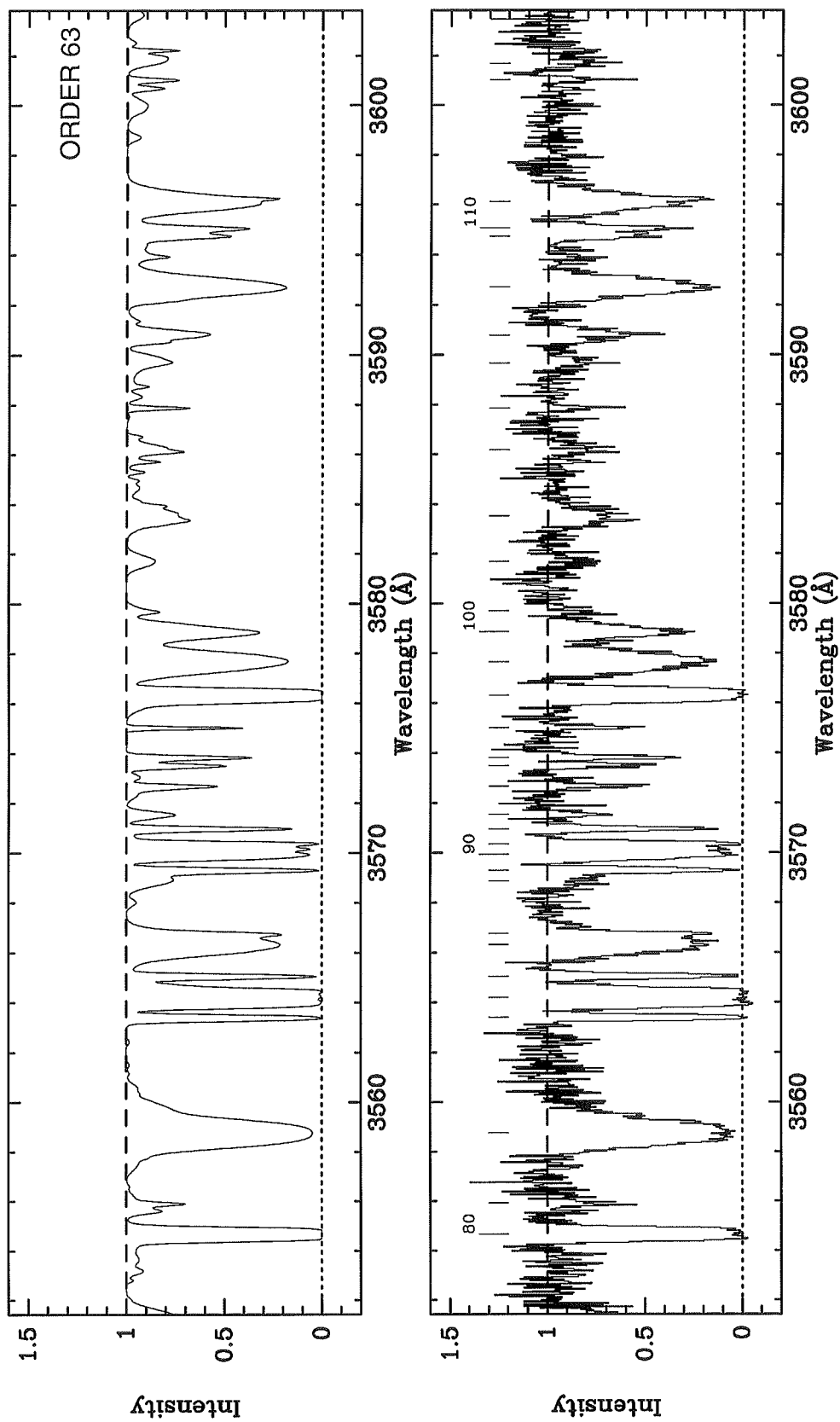


Figure A.3 (d) *CNQ* spectrum normalised: Order 63.



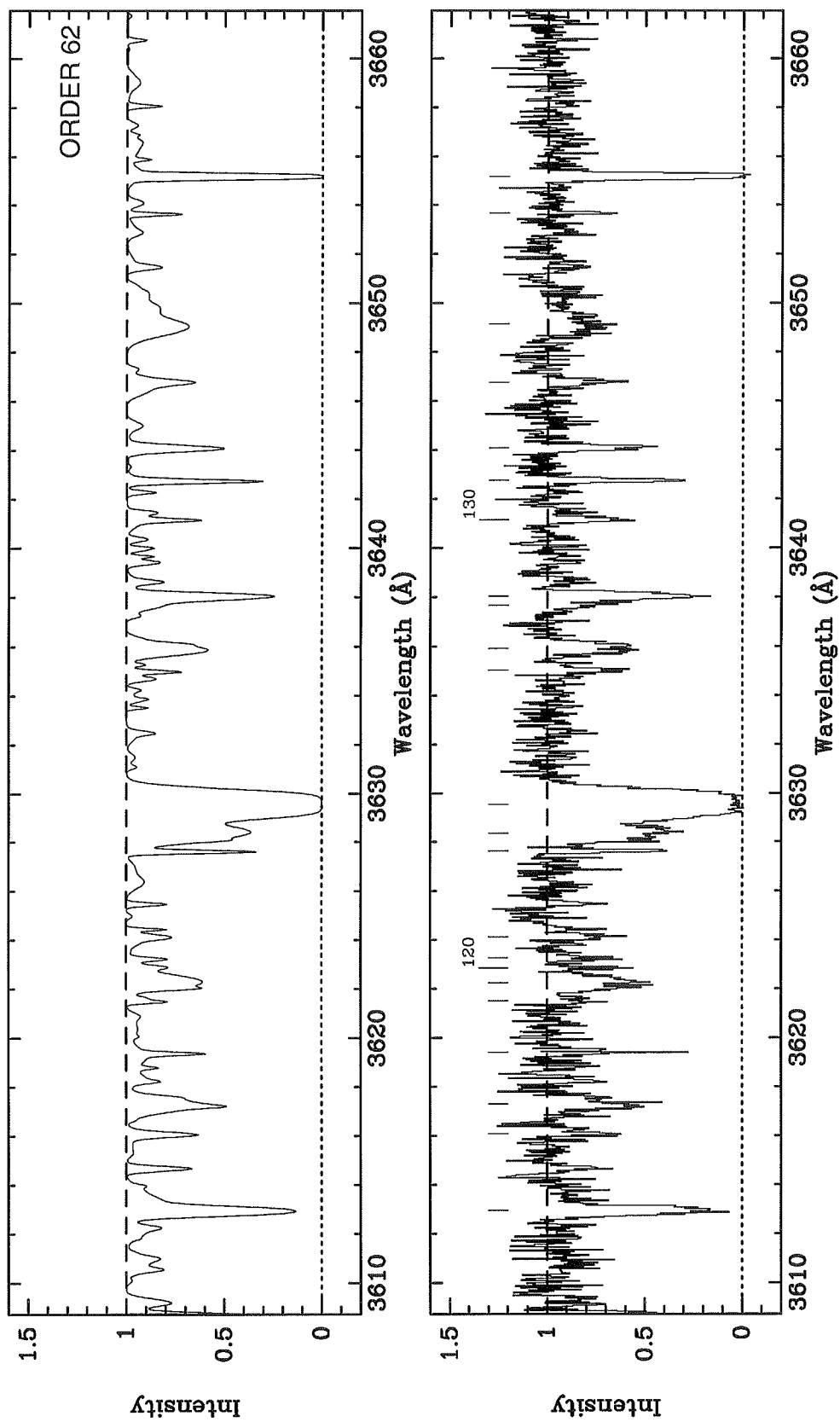


Figure A.3 (e) *CNQ* spectrum normalised: Order 62.

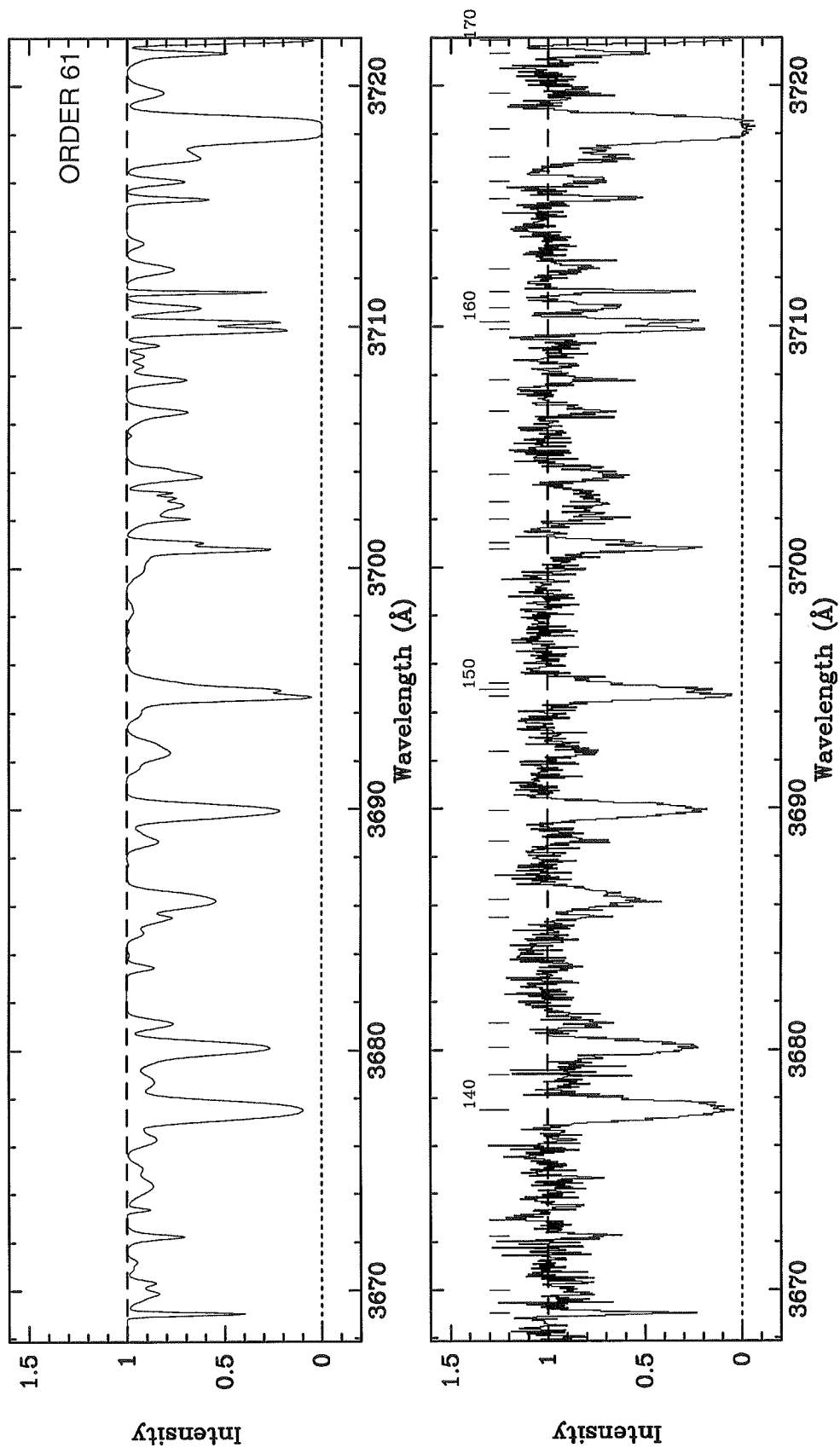
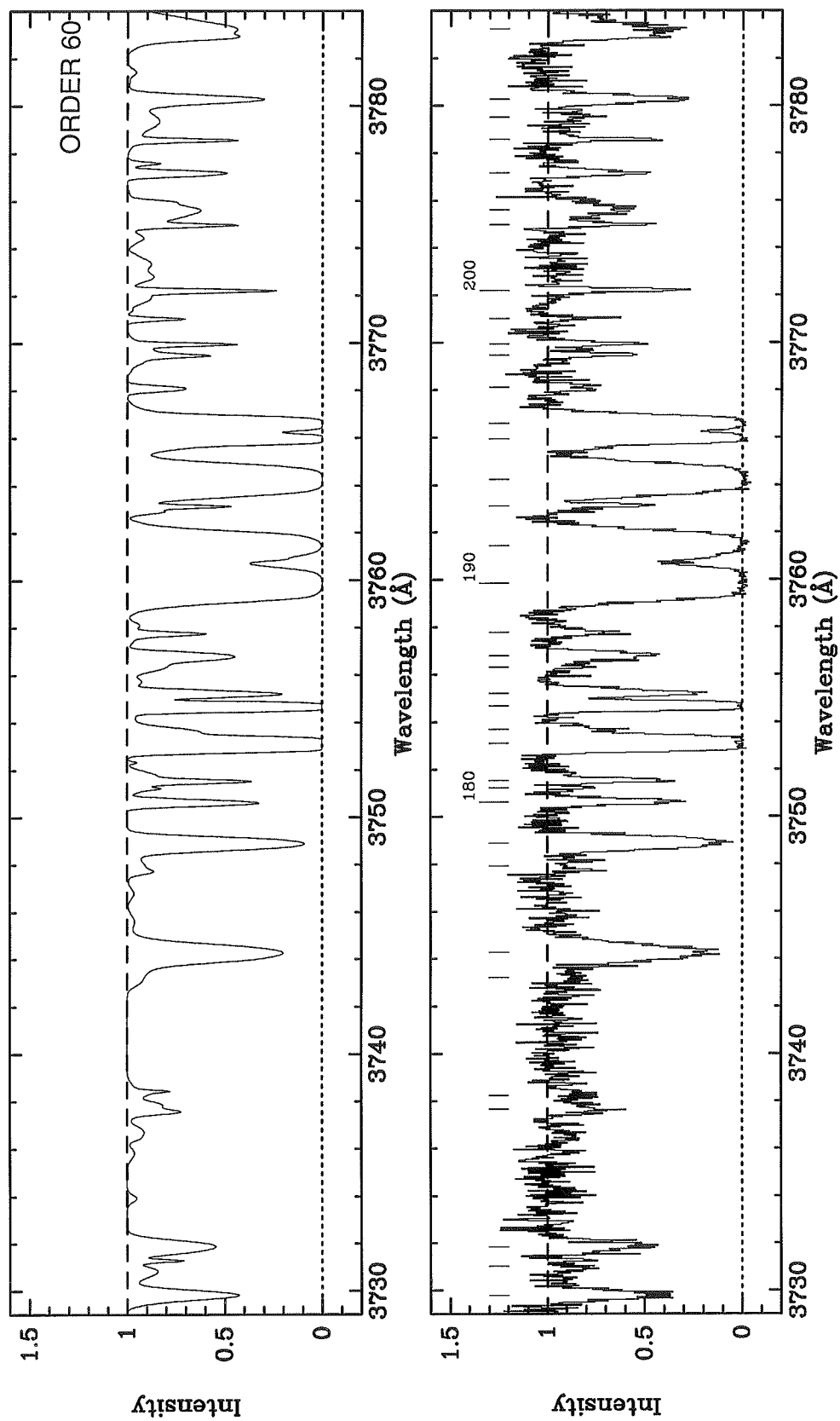
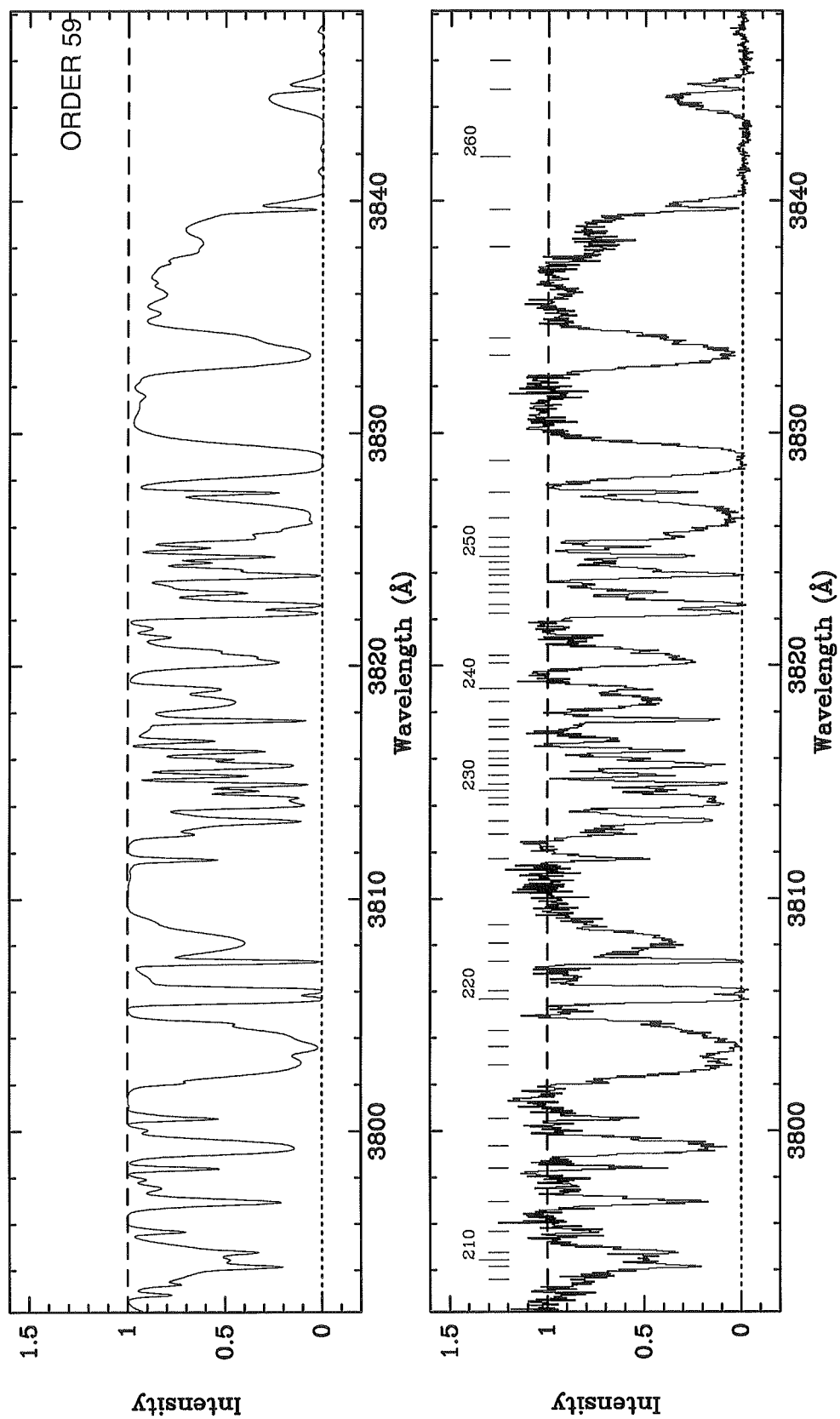


Figure A.3 (f) *CNQ* spectrum normalised: Order 61.

Figure A.3 (g) *CNQ* spectrum normalised: Order 60.

Figure A.3 (h) *CNQ* spectrum normalised: Order 59.

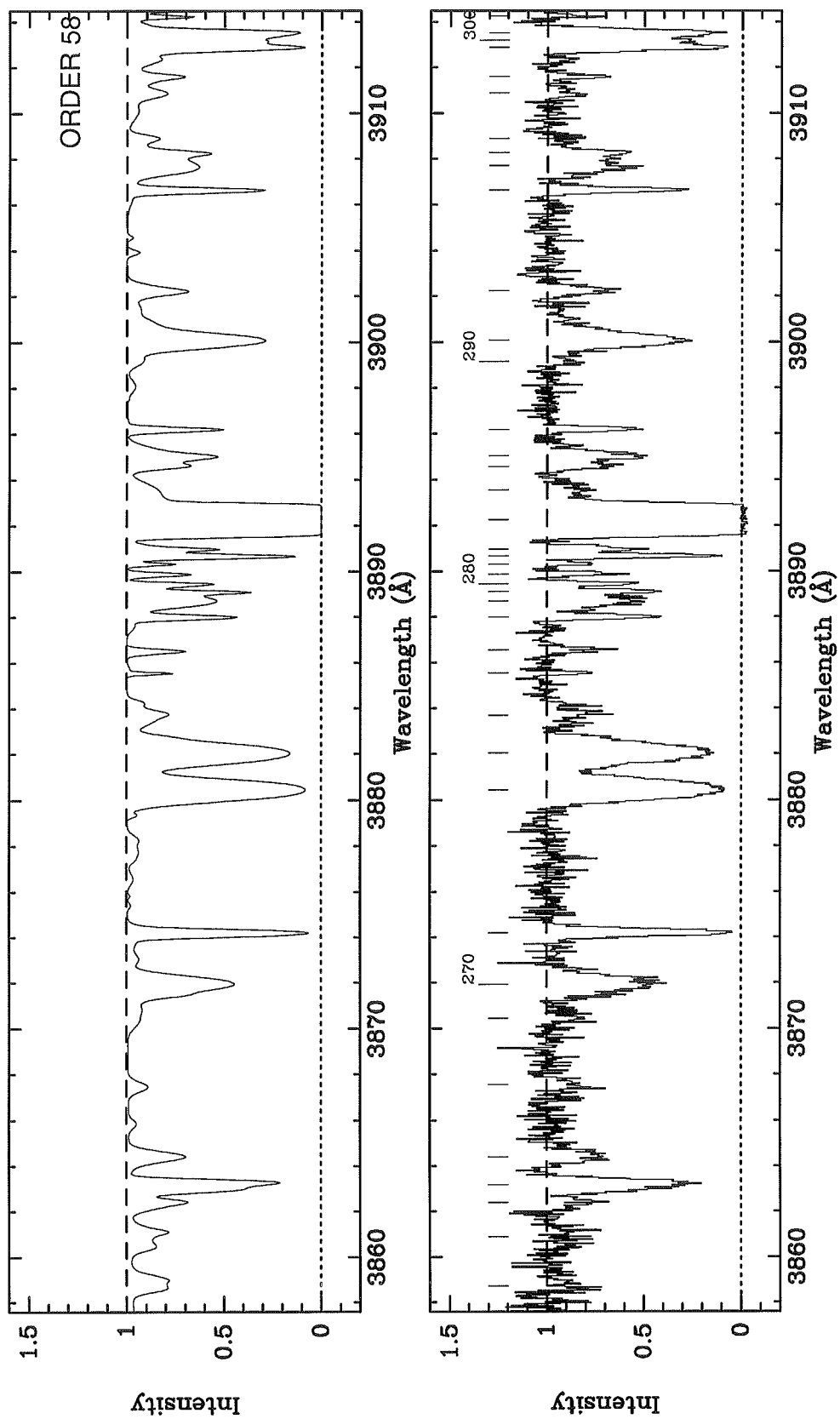


Figure A.3 (i) *CNQ* spectrum normalised: Order 58.

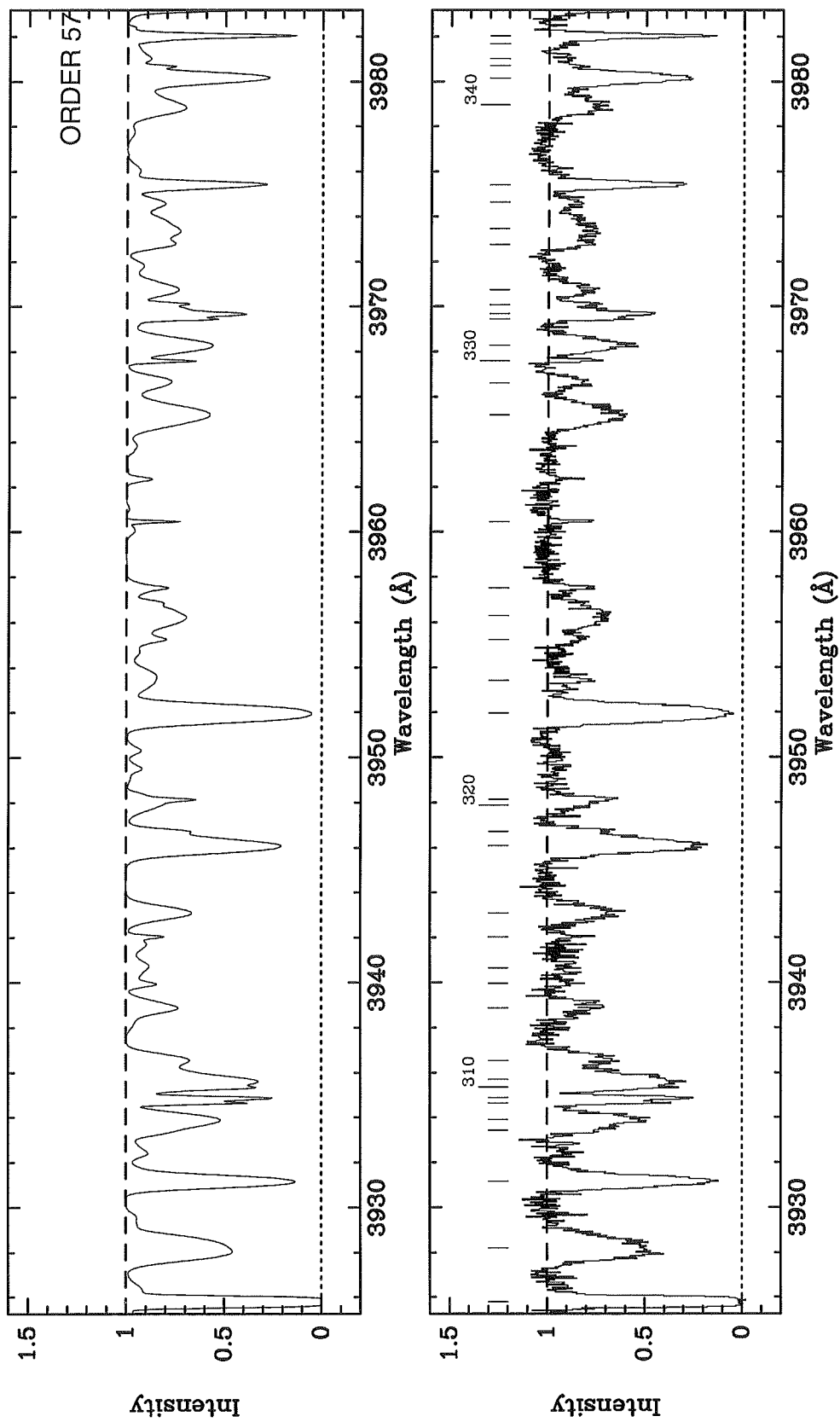


Figure A.3 (j) *CNQ* spectrum normalised: Order 57.

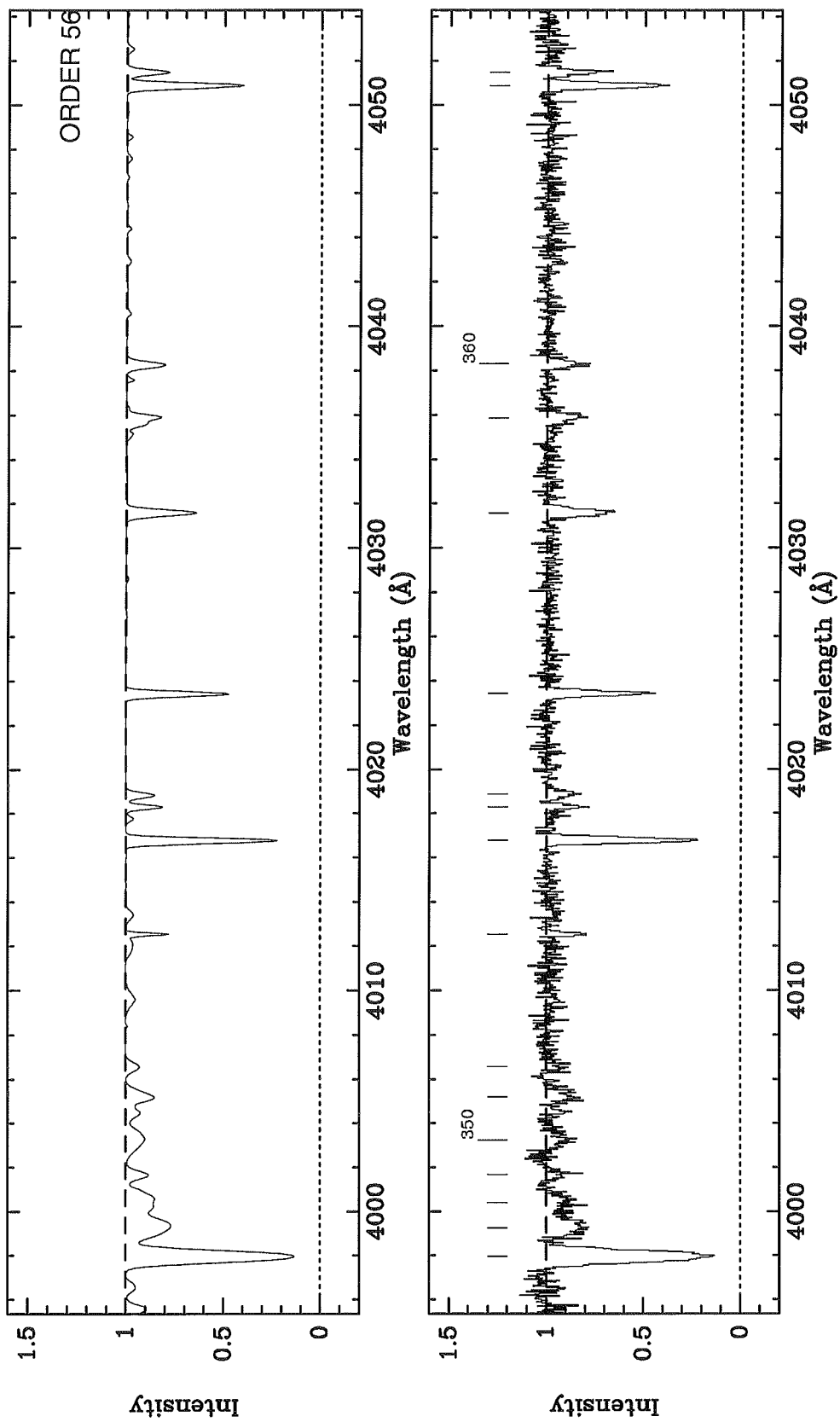
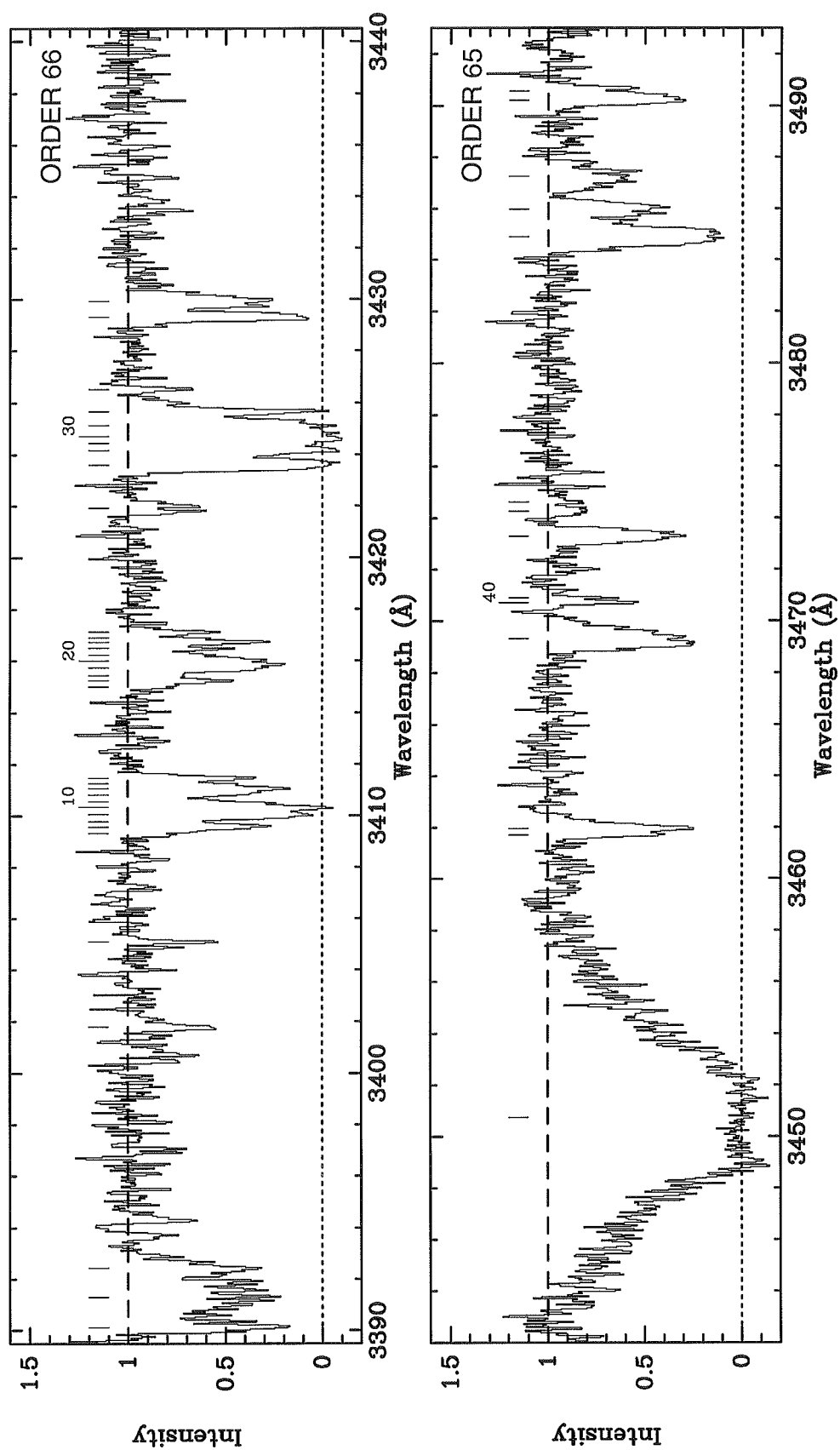
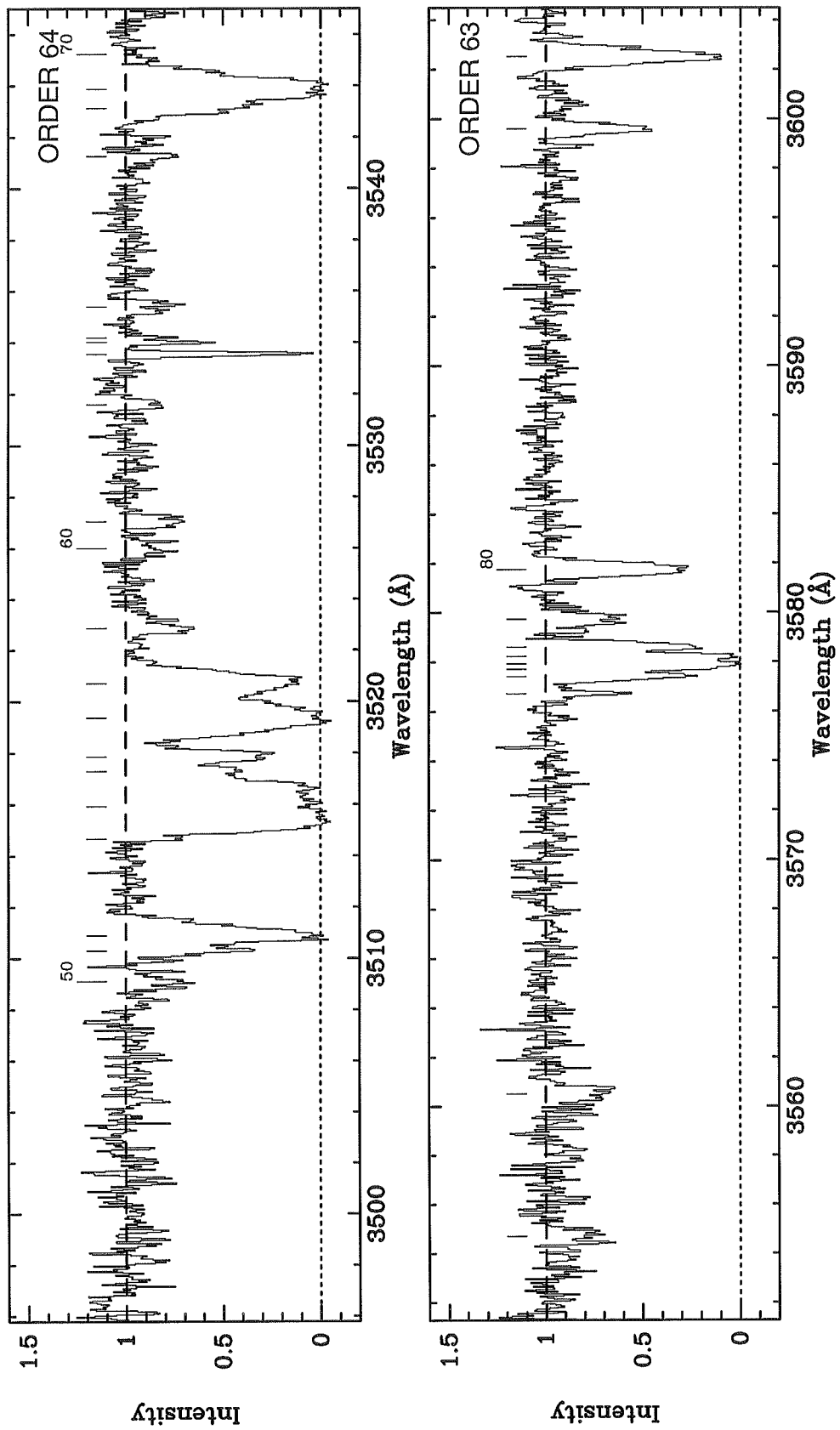


Figure A.3 (k) *CNQ* spectrum normalised: Order 56.

**Figure A.4** (Following pages.) The spectrum of Q1101–264. Each Figure panel (A.4 (a)–(d)) shows two orders of the normalised echelle spectrum. Each measured absorption line is indicated by a vertical bar at the appropriate wavelength. Each tenth bar is longer and is numbered. The numbers correspond to the line numbers given in Table B.6.



Figure A.4 (a) *Q1101-264* spectrum: Orders 66 and 65.

Figure A.4 (b) *Q1101-264* spectrum: Orders 64 and 63.

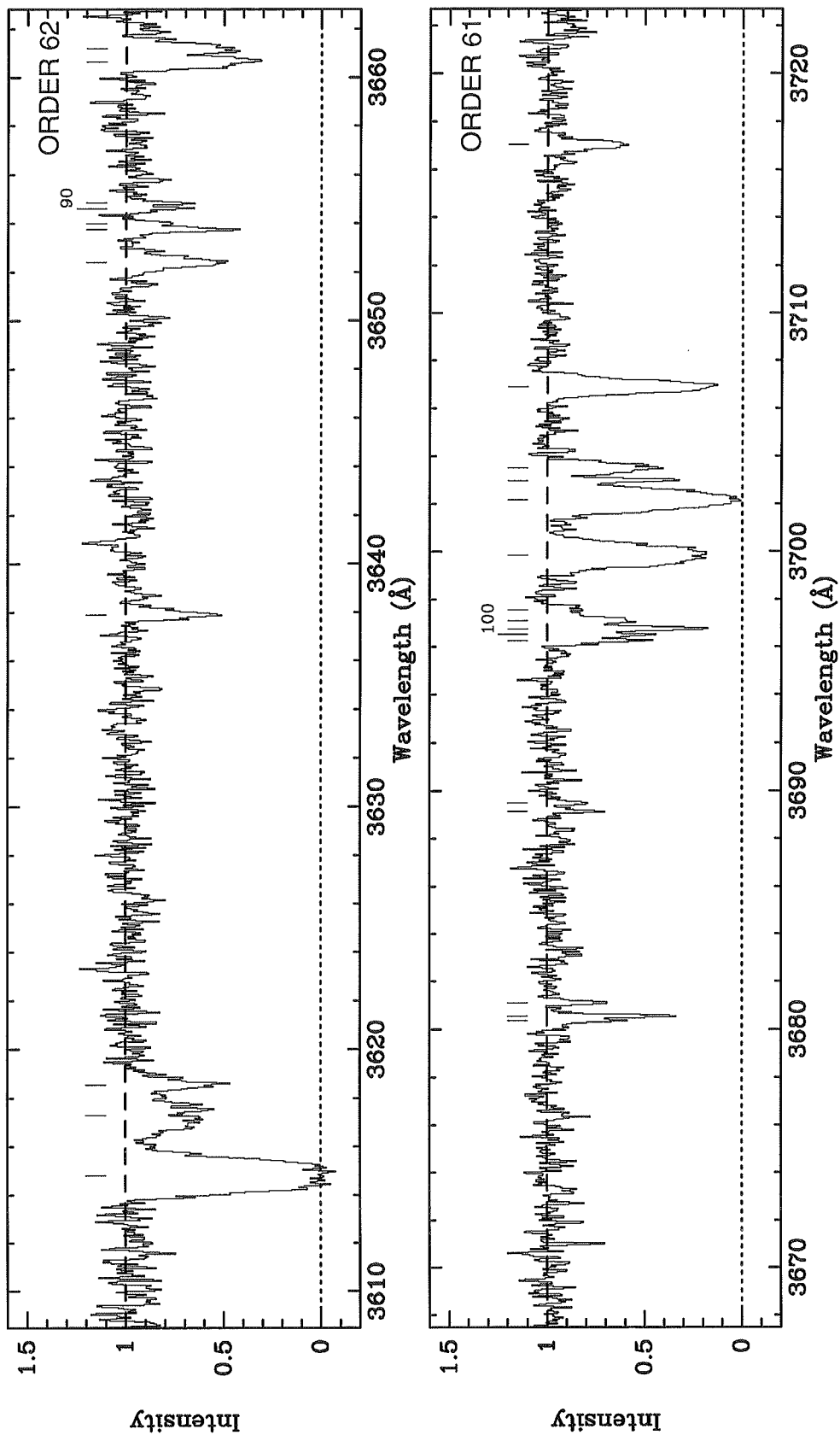


Figure A.4 (c) *Q1101-264* spectrum: Orders 62 and 61.

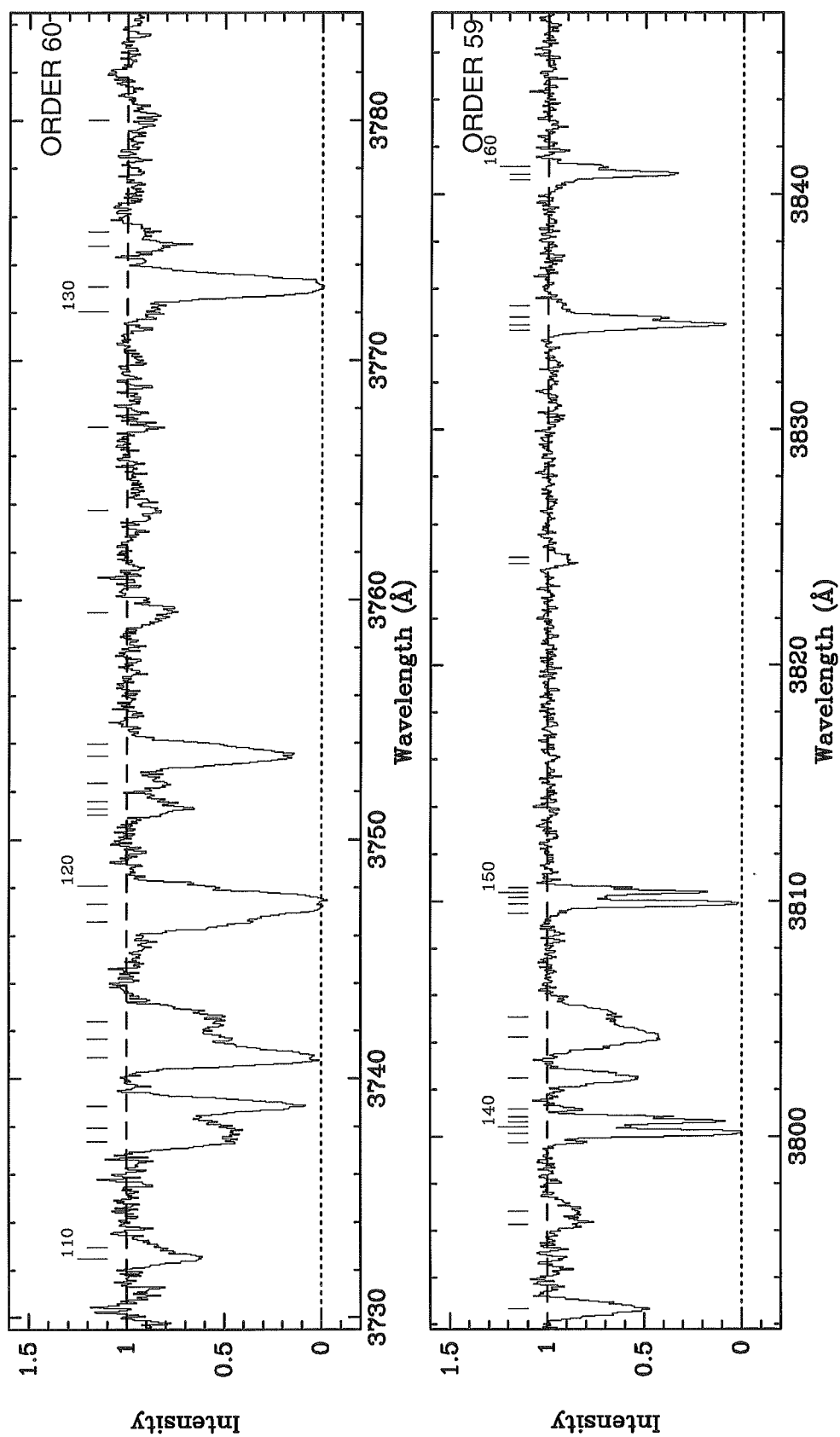


Figure A.4 (d) *Q1101-264* spectrum: Orders 60 and 59.

**Figure A.5** (Following pages.) The spectrum of Q2348–147. Each Figure panel (A.5 (a)–(g)) shows two orders of the normalised echelle spectrum. The final panel (A.5 (h)) shows the portions of spectrum observed between the limits of the echelle orders. See Section 4.2 for a full explanation. Each measured absorption line is indicated by a vertical bar at the appropriate wavelength. Each tenth bar is longer and is numbered. The numbers correspond to the line numbers given in Table B.8.

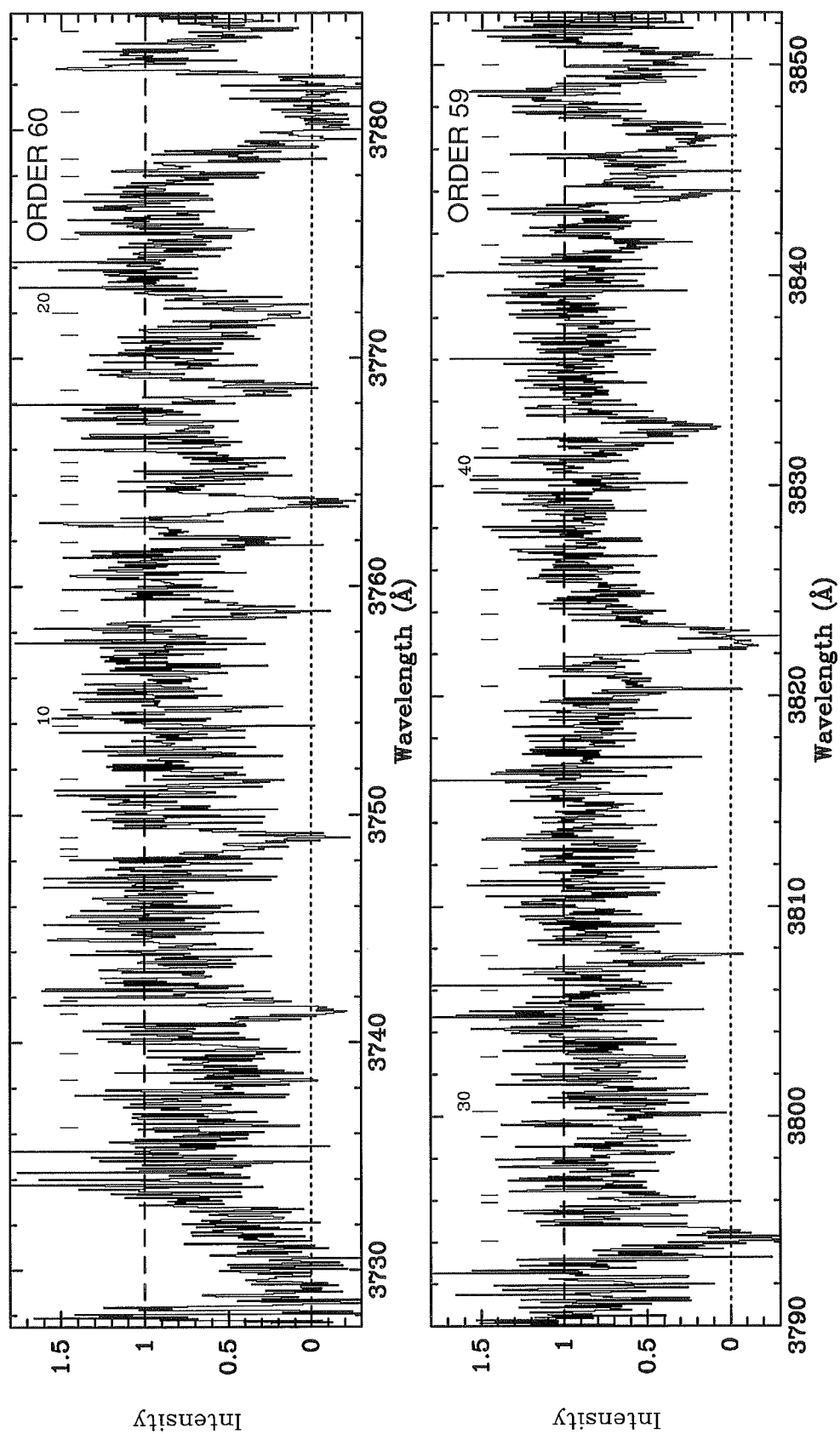
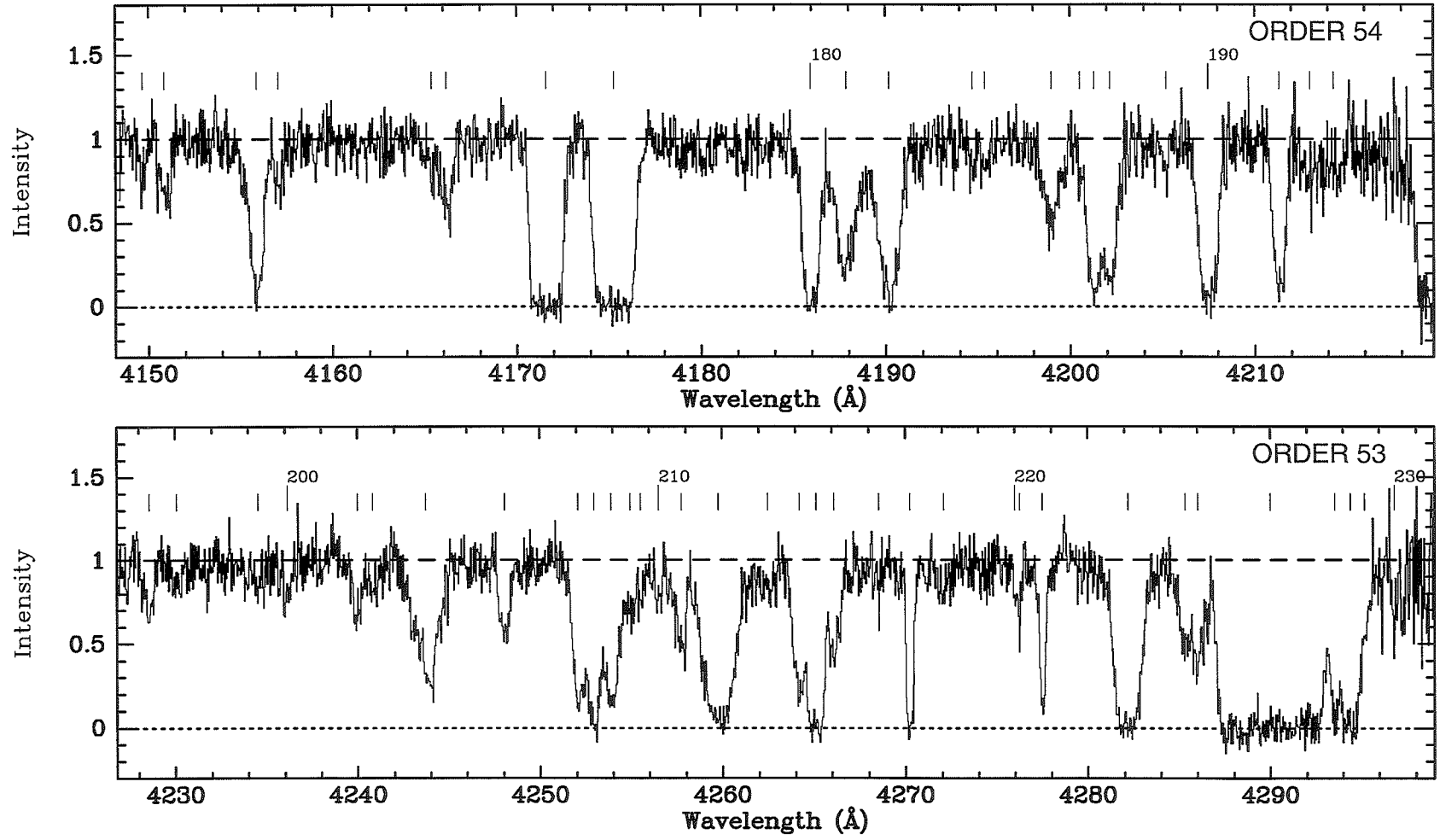


Figure A.5 (a) *Q2348-147* spectrum: Orders 60 and 59.

Figure A.5 (b) *Q2348-147* spectrum: Orders 58 and 57.



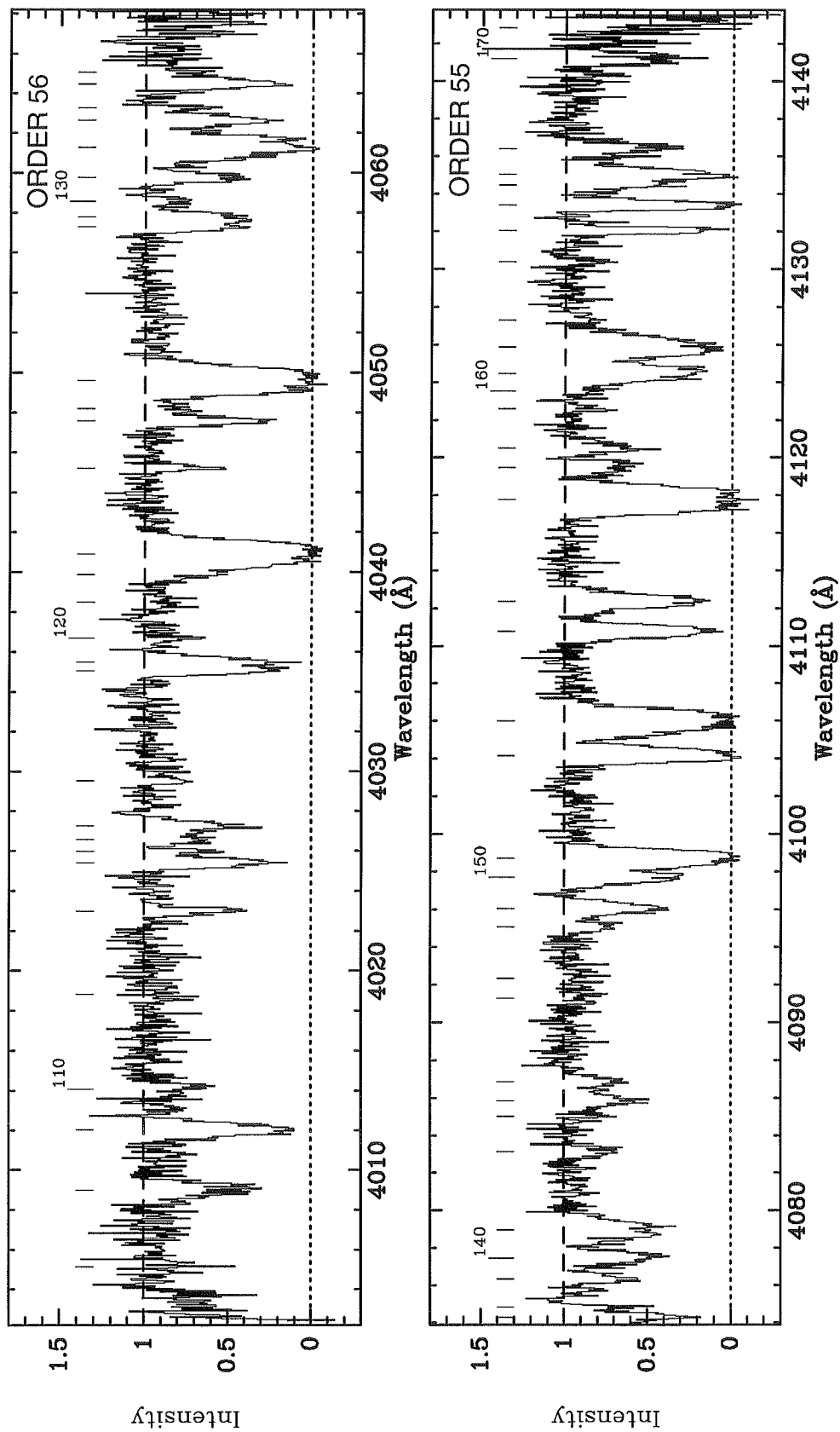
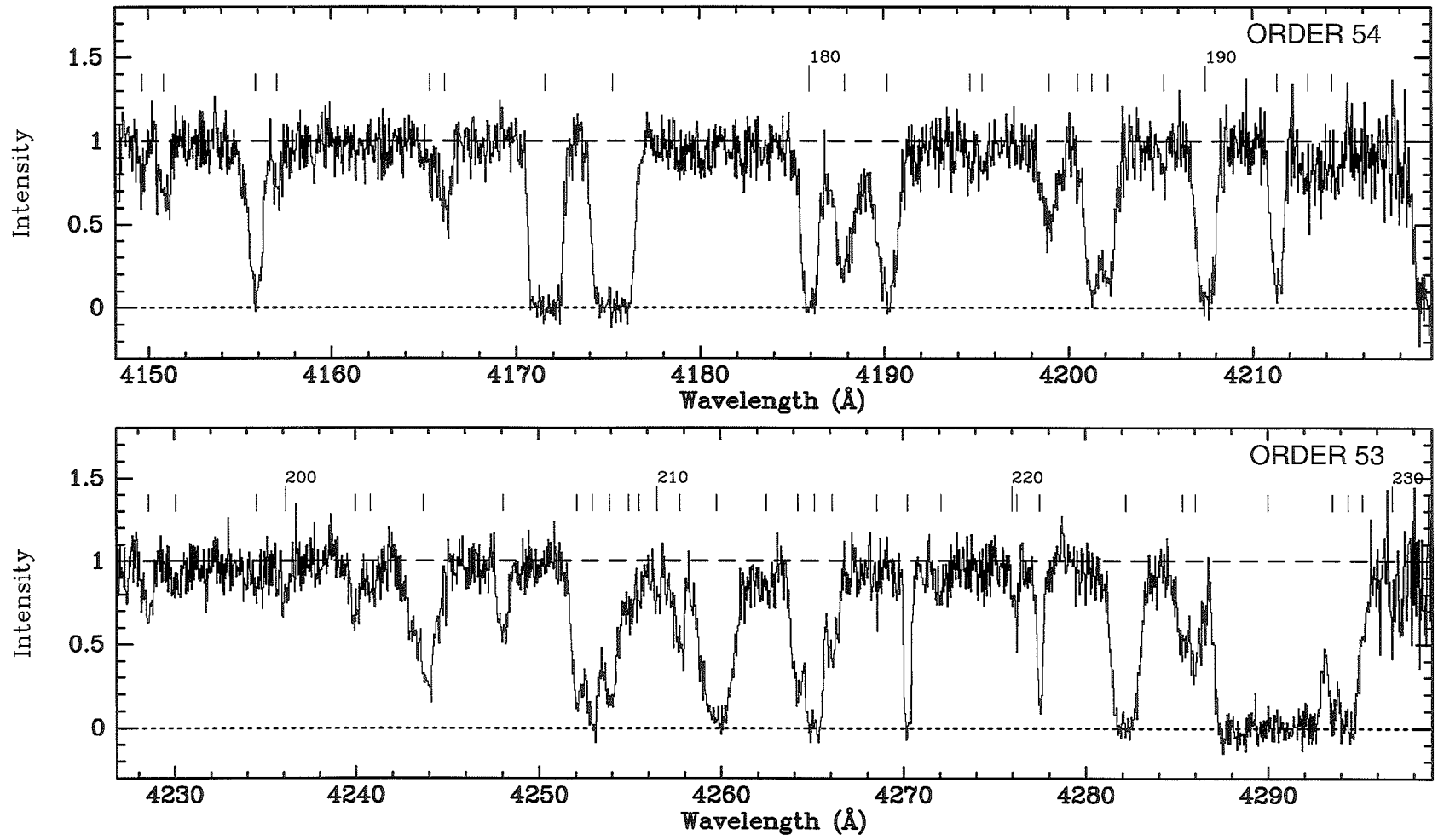


Figure A.5 (c) *Q2348-147* spectrum: Orders 56 and 55.



Figure A.5 (d) *Q2348-147* spectrum: Orders 54 and 53.



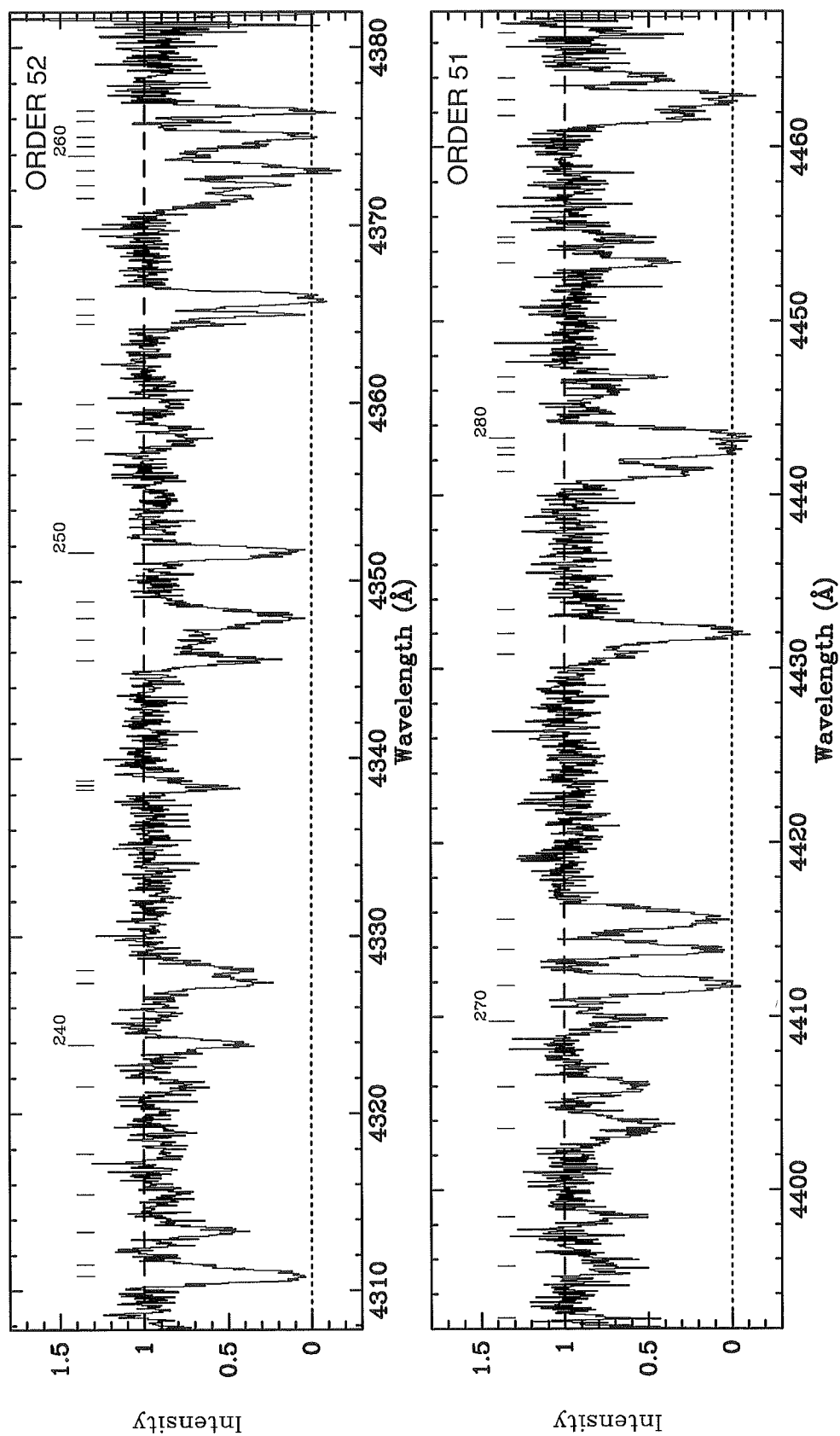
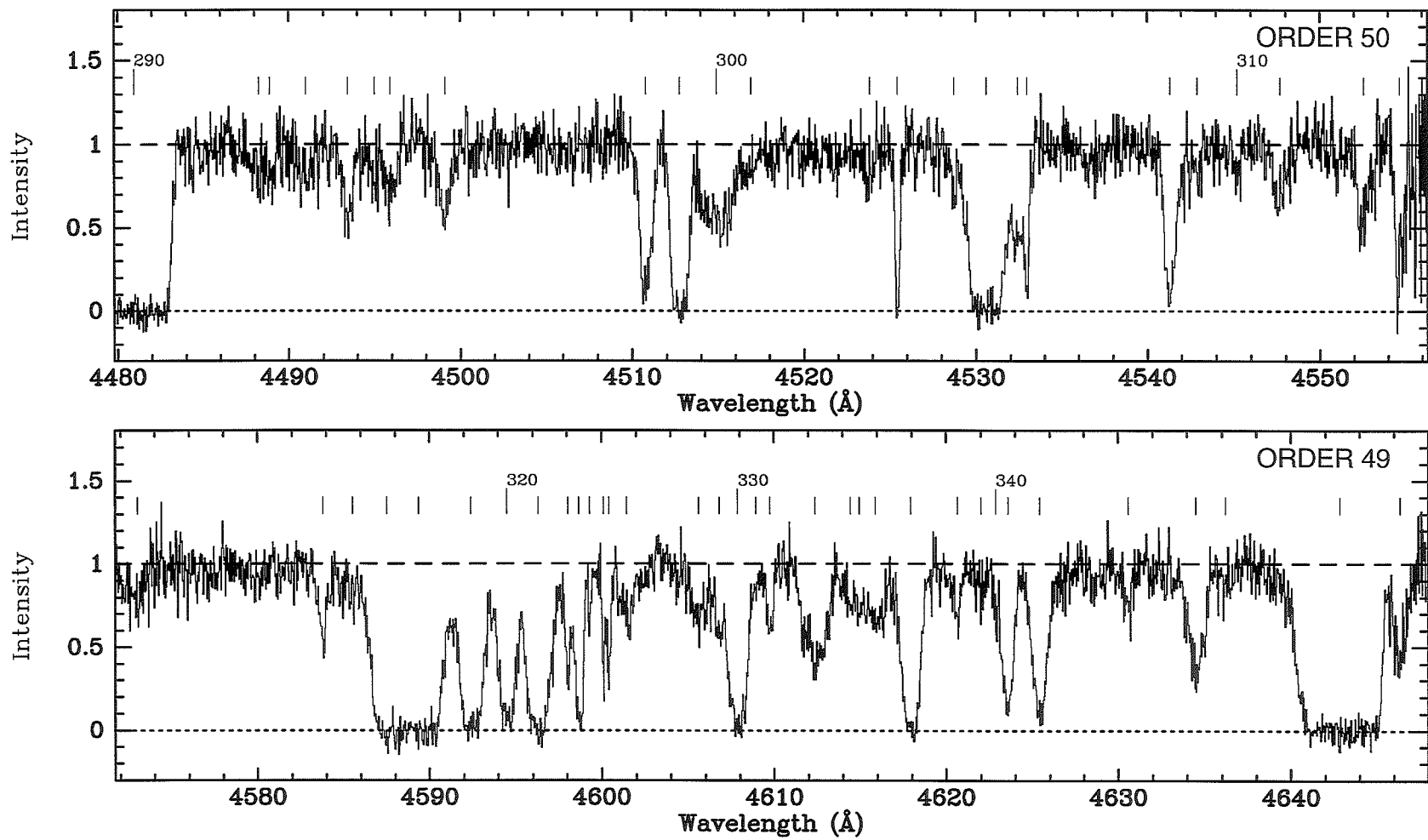
Figure A.5 (e) *Q2348-147* spectrum: Orders 52 and 51.

Figure A.5 (f)  $Q2348-147$  spectrum: Orders 50 and 49.



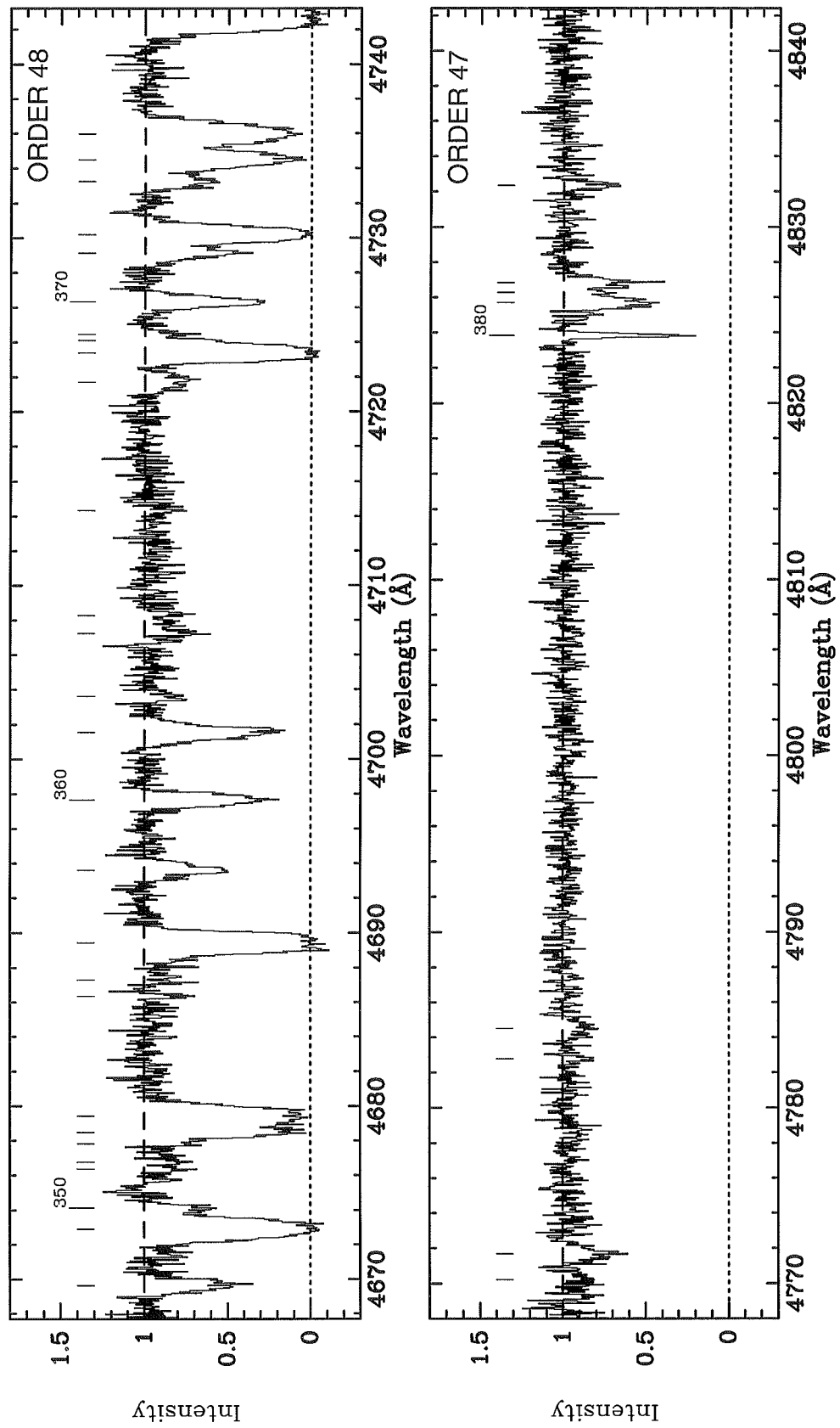
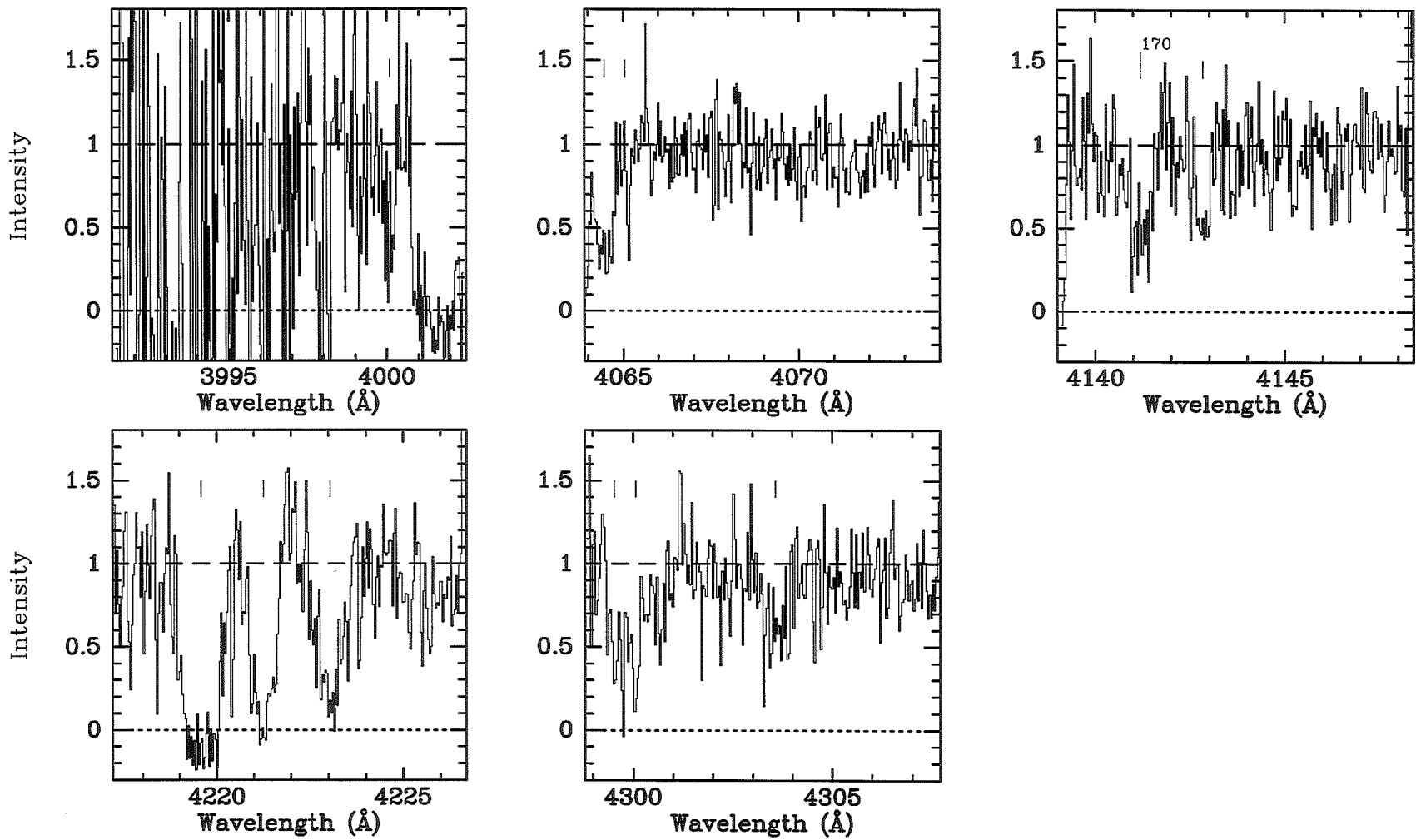


Figure A.5 (g) *Q2348-147* spectrum: Orders 48 and 47.

Figure A.5 (h) *Q2348-147* spectrum: Spectral regions between main echelle orders.



**Figure A.6** (Following page.) The spectrum of Q2348–147 redward of the Lyman  $\alpha$  emission peak. The following page shows the two low resolution CCD spectra described in Section 4.3. Each identified absorption line is indicated by a vertical bar at the appropriate wavelength. The lines and their identifications are listed in Table B.10. Apparent lines which could not be identified are not marked. The prominent spike at 5577 Å is caused by imperfect subtraction of an atmospheric emission line. The spike at 5820 Å is an artefact of a cosmic ray strike.

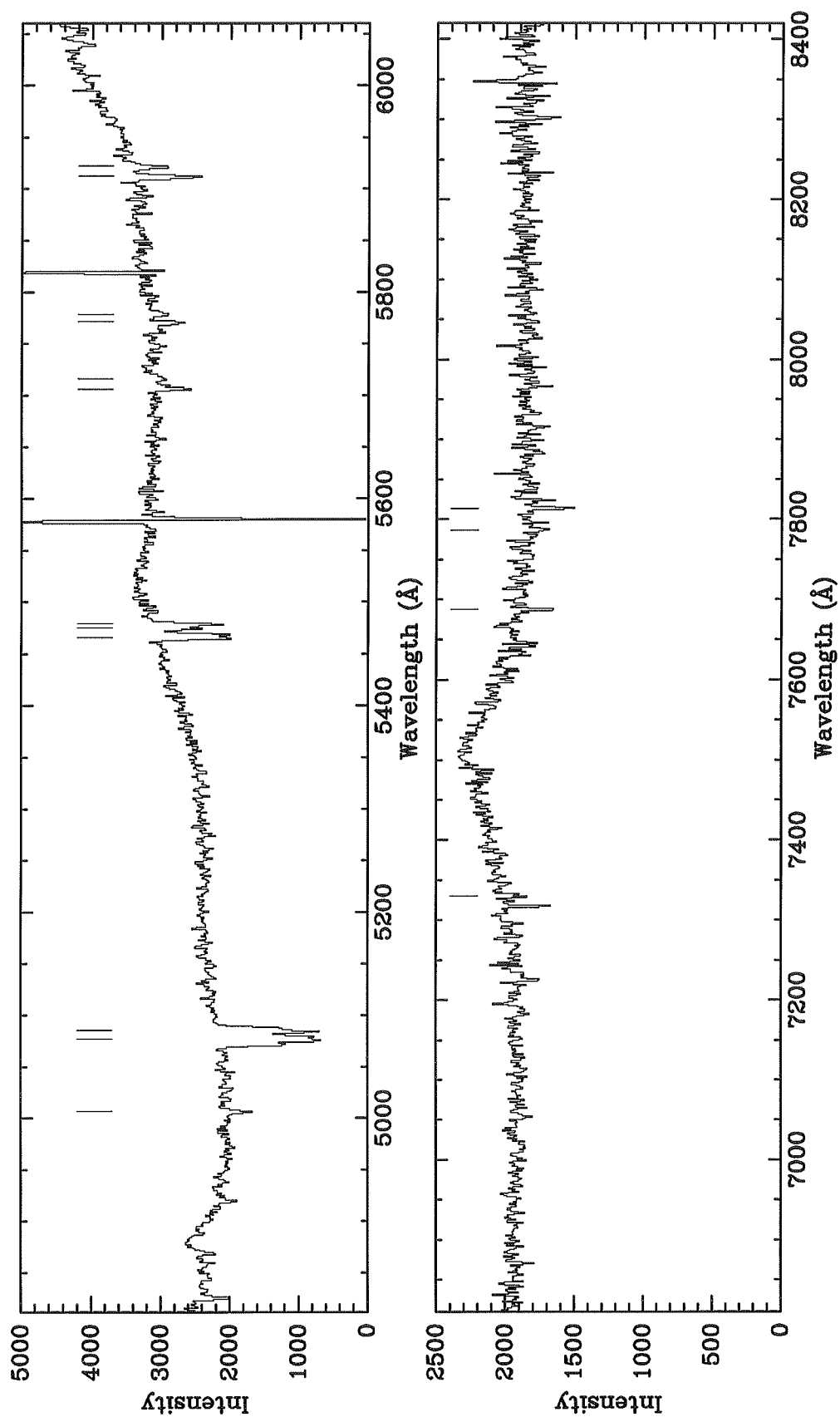


Figure A.6 CCD spectra of Q2348-147.