also in order of abundance, are silicon, sodium, magnesium, aluminum, carbon, calcium, iron, zinc, titanium, manganese, chromium, potassium, vanadium, strontium, barium, (hydrogen, and helium). All the atoms for which quantitative estimates have been made are included in this list. Although hydrogen and helium are manifestly very abundant in stellar atmospheres, the actual values derived from the estimates of marginal appearance are regarded as spurious.

The absence from the stellar list of eight terrestrially abundant elements can be fully accounted for. The substances in question are oxygen, chlorine, phosphorus, sulphur, nitrogen, fluorine, zirconium, and nickel, and none of these elements gives lines of known series relations in the region ordinarily photographed.

The $1^5S - m^5P$ " triplets " of neutral oxygen, in the red, should prove accessible in the near future; the point of disappearance of these lines would not be difficult to estimate, and they would furnish a value for the stellar abundance of oxygen. The lines of ionized oxygen, which have not yet been analyzed into series, are conspicuous in the B stars,[14] and the element is probably present in large quantities.

Sulphur and nitrogen both lack suitable lines in the region usually studied; the analyzed spectrum of neutral sulphur is in the green and red,[15] or in the far ultra-violet,[16] and the neutral nitrogen spectrum has not as yet been arranged in series. Both sulphur and nitrogen appear, in hotter stars, in the once and twice ionized conditions,[17] and are probably abundant elements in stellar atmospheres.

For the remaining elements, phosphorus, chlorine, fluorine, zirconium and nickel, series relations are not, as yet, available. No lines of phosphorus or the halogens have been detected in stellar spectra, but these elements have not been satisfactorily analyzed spectroscopically, and their apparent absence from the stars is probably a result of a deficiency in suitable lines. Nickel

[14] H. C. 256, 1924.
[15] Fowler, Report on Series in Line Spectra, 170, 1922.
[16] Hopfield, Nature, 112, 437, 1923. [17] H. C. 256, 1924.

and zirconium will probably be analyzed in the near future; they are both well represented in stellar spectra, and nickel especially is probably abundant.

The relative abundances, in the stellar atmosphere and the earth, of the elements that are known to occur in both, display a striking numerical parallelism. Table XXIX gives the data for the sixteen elements most abundant in the stellar atmosphere. Successive columns give the atomic number, the atom,

TABLE XXIX

Atomic Number	Atom	Stellar Abundance	Terrestrial Abundance		Abundance Stony Meteorites
			Crust	Whole Earth	
14	Si	5.7	16.2	9.58	11.2
11	Na	5.7	2.02	0.97	0.6
12	Mg	4.2	0.42	3.38	2.8
13	Al	3.6	4.95	2.66	1.1
6	C	3.6	0.21	....	....
20	Ca	2.9	1.50	1.08	0.56
26	Fe	2.5	1.48	46.37	5.92
30	Zn	0.57	0.0011	....	....
22	Ti	0.43	0.241	0.12	....
25	Mn	0.36	0.035	0.06	....
24	Cr	0.29	0.021	0.05	0.29
19	K	0.11	1.088	0.38	0.10
23	V	0.05	0.0133	....	....
38	Sr	0.002	0.0065	....	....
54	Ba	0.005	0.0098	....	....
3	Li	0.0000	0.0829	....	....

the relative stellar abundance, the relative terrestrial abundance (both for the lithosphere, hydrosphere, and atmosphere, and for the whole earth),[18] and the relative abundance in stony meteorites.[19] The figures in the fifth column are derived from Clarke's estimates of the percentage composition of the earth. The composition of the earth has been variously estimated by different

[18] Clarke, U. S. Geol. Surv. Prof. Pap. 132, 1924.
[19] G. P. Merrill, quoted by Clarke, U. S. Geol. Surv. Bul. 491.