the quail (*Coturnix novae zealandiae*), and it is reasonable to suppose that it may still be represented on some flats that settlement has not reached. My inquiries extended only to the mainland; I did not deal with the islands included in the colony's boundaries.

JAS. DRUMMOND.

Christchurch, New Zealand, September 8.

Showers from near β and γ Piscium.

ON October 12, at 9h. 50m., I saw a second-magnitude meteor at $346°+3°$, and it appeared to be nearly stationary at that point, but I recorded the object imperfectly, as I was looking toward the western sky at the time.

On October 2, 1902, I noticed a small meteor almost stationary at $345°+3°$, and several others directed from the same point. This shower in Pisces is rather a prominent one in the months of August and September, and it has frequently been observed. The following are some of the determinations of the radiant:—

July 25 to Aug. 12, 1879	... $343°+3°$	Weiss	6 meteors
Aug. 10, 1897	... $345+3$	Libert	6 ,,
Aug. 13–16, 1893	... $347+0$	W.F.D.	6 ,,
Aug., 1893	... $347+0$	Corder	6 ,,
Aug. 16–20, 1885	... $345+0$	W.F.D.	7 ,,
Aug. 15–21, 1901	... $345+0$	W.F.D.	7 ,,
Aug. 19, 1900	... $346+1$	W.F.D.	fireball radiant
Aug. 21, 1901	... $341+5$	W.F.D.	meteor radiant
Aug. 21–23, 1879	... $350+0$	W.F.D.	10 meteors
Aug. 24–Sept. 7, 1886	... $346+1$	W.F.D.	5 ,,
Sept. 1–4, 1885	... $346+0$	W.F.D.	9 ,,
Sept. 3–14	... $346+3$	Schmidt	
Sept. 8, 1899	... $347+3$	W.F.D.	fireball radiant
Sept. 14, 1901	... $345+1$	W.F.D.	,, ,,
Sept. 14, 1875	... $348+0$	Tupman	,, ,,
Sept. 15–20, 1876–1879	... $346+0$	W.F.D.	10 meteors
Sept.	... $344-3$	Schmidt	
Sept. 1858–63	... $346-3$	Heis-Neumayer	
Sept. 17, 1885	... $345+0$	W.F.D.	4 meteors
Sept. 17, 1898	... $343+0$	W.F.D.	meteor radiant
Sept. 20–Oct. 4, 1886	... $347+0$	W.F.D.	5 meteors
Sept.–Oct. 1, 1891	... $345+0$	Milligan	
Sept. 27, 1906	... $347+2$	W.F.D.	fireball radiant
Sept. 29–Oct. 2, 1877–1902	... $347+3$	W.F.D.	13 meteors

Possibly several showers may be involved in producing these radiants. As they nearly agree with the radiant point computed for Daniel's comet on September 12, they possess an interest of rather special character, and it is to be hoped that observations will be augmented, particularly at the middle of September.

Bristol, October 14. W. F. DENNING.

The "Quaternary" Period.

IN Dr. Wright's interesting review of "Les Grottes de Grimaldi," by M. L. de Villeneuve (NATURE, October 10, p. 590), I find the following:—"M. Rivière attributed them [the deposits] to the Quaternary period, M. Mortillet, on the other hand, regarded them as Neolithic." Now it is impossible to conceive any defensible use of the word "Quaternary" that does not include the Neolithic. Many authors have condemned the expression on the ground that the Pleistocene and Recent are nothing more than the latest and very subordinate portions of the Tertiary period. For my own part I believe that the great influence which man has already exerted on the character and distribution of the forms of life upon the earth, as well as on the purely physical conditions of its surface and the still greater changes that his activity must occasion even in the near future, are ample justification for marking his effective appearance on the scene by the commencement of a new period in the earth's history, a period the threshold of which we have scarcely passed. If, however, the Quaternary "period" is to be considered to close at the end of the Pleistocene, it becomes so insignificant in comparison with the long ages of its predecessors that it would be better to dispense with it altogether. JOHN W. EVANS.

Imperial Institute, London, October 11.

THE separation of the Quaternary period from the Recent period, which begins with the Neolithic, is attributable to the fact that an interruption was supposed to have occurred in Man's occupation of Europe. According to this view, the Recent period begins with his reappearance. Of late years it has been shown that such a view is untenable, and that no such interruption occurred. There is therefore much reason in Dr. Evans's contention that the Quaternary period should be extended to include the Recent period. The term "Quaternary" has, however, a recognised meaning which could not be changed without entering into a discussion of the reasons for the step—a discussion which would be quite outside the province of the writer of a short review.

WILLIAM WRIGHT.

To Deduce the Polar from the Intrinsic Equation.

I SHALL be grateful if one of your mathematical readers can give me the polar equation of the spiral which satisfies the condition $\rho s=c$, *i.e.* the spiral the curvature of which is a linear function of the arc. A. B. PORTER.

324 Dearborn Street, Chicago, September 19.

THE curve in which the *radius* of curvature is proportional to the arc is easily seen to be an equiangular spiral. If, as your correspondent assumes, the radius of curvature is *inversely* proportional to the arc, the problem is more complicated, and it is best in the first instance to express the Cartesian coordinates in terms of a third variable before attempting to form the polar equation. If instead of $\rho s=c$ we write $\rho s=\frac{1}{2}k^2$, we get with the usual notation

$$\tfrac{1}{2}k^2\frac{d\phi}{ds}=s,\ \text{whence}\ \phi=\frac{s^2}{k^2}$$

(choosing axis so that $s=0$ when $\phi=0$).

Put

$$u=\sqrt{\phi}=\frac{s}{k}$$

and we have

$$x=\int ds\cos\phi=k\int\cos u^2du=\frac{k}{2}\int\frac{\cos\phi\, d\phi}{\sqrt{\phi}}$$

$$y=\int ds\sin\phi=k\int\sin u^2du=\frac{k}{2}\int\frac{\sin\phi\, d\phi}{\sqrt{\phi}}.$$

By a suitable choice of origin, the lower limit of integration can be made to be zero in each case.

The integrals are known functions closely allied to the well-known error function. In fact, we have

$$x+iy=k\int_0^u e^{iu^2}du=\frac{k}{\sqrt{i}}\,erf\,u\sqrt{i}$$

To find the polar equation, we first transform the coordinates to new axes of X and Y, making an angle α with the old axes. Thus

$$X=x\cos\alpha+y\sin\alpha=k\int_0^u\cos(u^2-\alpha)\,du$$

$$Y=y\cos\alpha-x\sin\alpha=k\int_0^u\sin(u^2-\alpha)\,du$$

If now r, θ are the polar coordinates, we may adapt the last results to polar coordinates by taking $X=r$, $Y=0$, $\alpha=\theta$. The polar equation is thus the eliminant of the two simultaneous equations

$$r=k\int_0^u\cos(u^2-\theta)du$$

$$0=k\int_0^u\sin(u^2-\theta)au.$$

In terms of ϕ we have

$$r=\frac{k}{2}\int_0^\phi\frac{\cos(\phi-\theta)}{\sqrt{\phi}}d\phi,\quad 0=\int_0^\phi\frac{\sin(\phi-\theta)}{\sqrt{\phi}}d\phi$$

while the inclination ψ of the tangent to the radius vector is given by $\psi=\phi-\theta$.

This method can be applied to find the polar equation of a curve the radius of curvature of which is any function of the arc, but, as in the present example, the integrations cannot always be evaluated in terms of the functions discussed in elementary text-books. G. H. B.