materials a lanthanum compound in stoichiometric mixture with the transition metal.

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Russell *et al.*⁵, of 1,600 m.y. for the conformable leads, and "less than 1,000 m.y." for the event causing the formation of the transgressive Thackaringa-type deposits. Further measurements are in progress, and more complete details of these experiments are to be published elsewhere.

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GEOLOGY

Potassium-Argon Ages at Broken Hill, Australia

WE have obtained three results which contribute something to an understanding of the more recent events in the Broken Hill district of New South Wales. Field evidence^{1,2} indicates that the main lead lodes lie conformably with gneisses of the Willyama Series, thought to have been formed from sediments of older Precambrian age. These have been strongly folded, the metamorphism and folding having taken place before deposition of the younger Torrowangee Series, which is regarded³ as equivalent to the Adelaide System of Upper Precambrian age. At some subsequent time, possibly in the early Palaeozoic, green-schist facies assemblages were developed (White, A. J. R., personal communication) in the Torrowangee Series, suggesting that temperatures were reached adequate for the loss of a considerable proportion of any argon (if not all) accumulated up to that time⁴. Although there is comparatively little evidence for this heating (Carruthers, D. S., personal communication) in the earlier Willyama rocks, it is inconceivable that they can have been completely unaffected. This inference is supported by our results.

The Broken Hill samples analysed were:

GA 113	Upper granitic gneiss (Formation No. 13), New Broken Hill Consolidated, Ltd.	Age 504 m.y.
GA 114	Sillimanite biotite garnet gneiss (Formation No. 4), No. 21 level, Zinc Corporation, Ltd.	Age 526 m.y.

These results are to be compared with the age determined on a transgressive-type granite (GA 212) from Encounter Bay, in the southern part of the Adelaide Geosyncline. The date obtained here, 457 m.y., can be regarded as being related to the more recent events in the Adelaide Geosyncline, thus constituting a possible upper limit to the time of any movement of the Torrowangee at Broken Hill. Thus the Cambrian ages obtained for the undoubtedly older gneisses suggest that the event affecting the Torrowangee happened between 500 and, say, 460 m.y. ago, with the implication that the effect on the older Willyama rocks may not have been sufficiently intense to cause total loss of argon. There is inadequate evidence to relate these results with the two 'model ages' derived from lead isotope measurements by

METALLURGY

Difference between High- and Low-Stress Fatigue

RECENT papers by Porter and Levy¹ and Benham and Ford² have suggested that the conventional S/N curve is composed of two separate curves, a discontinuity occurring at some particular stress-level. The former authors concluded from a large number of rotating bending tests on copper that the discontinuity occurred at about $\pm 21,500$ lb./sq. in.; for lower stresses fatigue cracks originating in slip bands; for higher stresses cracks developing from L-shaped nuclei. Kemsley³ also found that with copper specimens tested at $\pm 15,000$ lb./sq. in. (giving fracture after long endurance) cracks formed in slip bands and were transcrystalline, while at $\pm 25,000$ lb./sq. in. (giving fracture with low endurance) slip bands were virtually absent from the specimen and cracks appeared to be intercrystalline. Benham and Ford², who tested mild steel in direct stress, found for large stress amplitudes that the specimen gauge-length extended permanently each cycle and a 'necked-out' fracture resulted. They termed this phenomenon 'cyclic creep' and such failures occurred while the stresses corresponded to the upper portion of the composite S/N diagram. For stresses in the lower portion of the S/N diagram typical fatigue fractures occurred and they suggested that, if the fatigue mechanism could be suppressed as the cyclic stress decreased, the upper curve might flatten out to a 'cyclic creep limit'.

Low-endurance fatigue tests have been carried out by many workers, the usual procedure being to apply strain cycles rather than stress cycles of constant amplitude; the work of Coffin⁴ is typical. Coffin suggested the results of such tests could be represented by the equation:

$$N^{\frac{1}{2}} \epsilon_p = C$$

(where N = number of cycles to failure, ϵ_p = cyclic-plastic strain amplitude and C = material constant). The endurance over which this relationship applies vary with material. Coffin found for copper it was about 10^2 cycles, for aluminium about 10^5 cycles.