tion and discussion. Part of the problem is that the shorter the event the smaller is the chance of detecting it, especially in continental igneous rocks whose sequences are not continuous in time; and even if an event is found to be recorded in more than one lava flow the relevant outcrops are likely to be stratigraphically unrelated. When to these difficulties is added the fact that the errors on potassium-argon ages are usually comparable to the duration of the events being measured, it is easy to see that events will be difficult to resolve. Nor are deep sea sediments likely to provide the final solution, because, as Watkins (*Bull. Geol. Soc. Am.*, **83**, 551; 1972) has pointed out, although sediments frequently form continuous time sequences, the magnetic data from them are not always too consistent and accurate dating methods are even less applicable than to igneous rocks.

The confusion likely to result is well illustrated by the polarity events within the Matuyama reversed epoch from 2.41 to 0.69 million years ago. One of the major normal events is undoubtedly the Olduvai event which was discovered in rocks from the Olduvai Gorge, Tanzania, and later also recognised in lavas from Alaska and the Cocos Islands as well as in deep sea sedimentary cores. The age assigned to the Olduvai normal basalts by Grommé and Hay (*Nature*, **200**, 560; 1963) was 1.92 m.y., and so when Chamalaun and McDougall (*Nature*, **210**, 1212; 1966) found normal polarity lavas of ages 2.03 ± 0.05 m.y. (at the normal to reversed boundary) on Réunion island they tentatively correlated them with the Olduvai event while recognising that there was a significant age difference. Later, however, McDougall and Wensink (*Earth planet. Sci. Lett.*, **1**, 232; 1966) discovered another major normal polarity event (the so-called Gilsa event) at 1.6 m.y. in Icelandic lavas; and this was subsequently also recognised in Tenerife, Alaska and Madeira. Moreover, even more recently, Grommé and Hay (*Earth planet. Sci. Lett.*, **10**, 179; 1971) have revised the age of the Olduvai event to 1.72 m.y.

It now seems probable that the Olduvai and Gilsa events are identical, although the identity cannot yet be considered proved. But what is more certain is that the now-named Réunion event first recognised by Chamalaun and McDougall is quite distinct from both the Olduvai and Gilsa events. At the same time, however, the limits of the Réunion event have never been precisely defined; and so to remedy this deficiency, McDougall and Watkins (*Earth planet. Sci. Lett.*, **19**, 443; 1973) have returned to Réunion to study two sequences of olivine basalt lava flows which between them cover the full reversed-normal-reversed polarity sequence defining the event.

The stratigraphically higher of the two lava sequences was sampled by the two lava sequences was sampled by four reversed flows overlying two normal flows and separated by a flow whose four specimens gave scattered directions of magnetisation. Since this stratigraphically intermediate flow produced fresh specimens petrographically similar to those from the flows immediately above and below, it seems likely that it was extruded during the normal to reverse polarity transition. The stratigraphically lower of the two lava sequences comprised sixteen reversed flows overlain by eleven normal flows, the whole being overlain by a flow of transitional polarity. The two lava sequences may thus even overlap slightly; but, be that as it may, they certainly record the full Réunion event.

From three potassium-argon dated flows in the upper sequence, McDougall and Watkins conclude that the normal to reverse transition defining the end of the Réunion event took less than 30,000 yr and that the absolute age of the transition is 2.02 ± 0.2 m.y. Similarly, from eight dated flows in the lower lava sequence, they estimate the reverse to normal polarity change at the start of the event to have occurred 2.01 ± 0.01 m.y. ago. Clearly, the lack of a significant age difference between the two transitions means that the Réunion event was very short, probably between 10,000 and 50,000 yr long. This shortness probably explains why the event has been recorded so rarely in deep sea cores, and in this, as well as in absolute age, it contrasts strongly with the much longer Olduvai event.

Finally, there has been some suggestion in the past that there may, in fact, be two distinct normal events around 2.0 m.y. ago. Normal polarity lavas in Alaska, for example, have been dated at 1.95 ± 0.10 and 1.96 ± 0.04 m.y., in Argentina at 2.05 ± 0.02 and 2.06 ± 0.03, and on Cocos Island at 2.09 ± 0.04. Insofar as all the errors involved here give ranges overlapping, or almost overlapping, the age range of the Réunion event, the corresponding rocks could represent the same event. Similarly the age of the Réunion event as determined by McDougall and Watkins corresponds closely to the age of 1.99 ± 0.06 or 1.97 m.y. for the W anomaly recognised in oceanic ridge magnetic profiles by Emilia and Heinrichs (*Mar. geophys. Res.*, **1**, 436; 1972). On the other hand, anomaly X, identified by Heirtzler *et al.* (*J. geophys. Res.*, **72**, 2603; 1957), has been dated at 2.3 ± 0.1 m.y. As McDougall and Watkins note, their results neither confirm nor refute the idea of a normal event pair; but data already in existence suggest that the polarity-time scale story is still far from complete.

CHEMISTRY

Dimeric Oxygen

from our Chemical Physics Correspondent

SINCE the ground state of an oxygen molecule contains two unpaired electrons, there has for many years been speculation as to whether the dimer, $(O_2)_2$, could form. In 1924 G. N. Lewis suggested, on the basis of measurements on the magnetic susceptibility of the liquid, that some dimerisation does occur, but most of the recent evidence does not support the presence of abnormal forces between two oxygen molecules. Now, from their spectroscopic studies on the cold gas, Long and Ewing (*J. chem. Phys.*, **58**, 4824; 1973) find clear evidence of dimer formation. Nevertheless they note that such dimerisation is of the type to be expected from a typical van der Waals attraction and does not seem to have any exceptional features associated with the unpaired electrons.

Because of its symmetry an isolated oxygen molecule shows no infrared absorption, although at high pressures some very broad features are observed and interpreted in terms of a loss of symmetry during a collision. The collisions are of short duration, so that the uncertainty principle predicts the observed broadness. The new observation of weak, but much narrower, features on top of the band must indicate a longer lived complex. The most prominent features are at 1,553.3 and 1,557.9 cm^{-1} which is the correct position for the excitation of an O–O stretching vibration. The intensity is proportional to the square of the pressure, which indicates a dimer, and although the features are plain at 87 K they disappear above 100 K. Accurate temperature and intensity measurements indicate a molar energy of formation of -2.3 kJ mol^{-1}. The fine structure of eight lines in all has been qualitatively assigned to changes in the relative rotational motions of the molecules with a low hindering potential.

The electronic absorption centred at 17,282 cm^{-1} also has sharp features superimposed on its collision-induced broad line. These confirm the general picture and a fine structure analysis suggests a vibrational interval of 24 cm^{-1} in the ground state for the mode associated with the intermolecular distance coordinate. The value falls to 18 cm^{-1} in the electronically excited level and both are appropriate values for the weak minimum associated with ordinary van der Waals type intermolecular potentials.