that so little attention was paid to the possible effects of non-linearities which could arise from the complicated convective and radiative mechanisms by which heat is transferred to the furnace stock. Although unsteady state heat transfer plays an important part in the production of metals, the emphasis placed on heat transfer processes by the conference reflects simplicity as much as importance. A paper on the blast furnace showed how much work must be done before that process is thoroughly understood, and it is no doubt significant that there was no formal paper on the more complicated liquid metal refining processes such as steel-making.

NUCLEAR EXPLOSIONS

Detecting Nuclear Explosions

from our Geomagnetism Correspondent

IT is not only of scientific interest but also of considerable political importance that seismic events be distinguished from underground nuclear explosions. Unfortunately, as pointed out two weeks ago (*Nature*, **221**, 511; 1969), the precise situation is uncertain because in the United States a classified seismological network operates in parallel with basic seismological research and unclassified projects for monitoring explosions. All the outsider can do is to scrutinize the published literature and make an intelligent guess on what is, or is not, possible.

An ingenious method for differentiating between earthquakes and explosions is made possible by the differing relative magnitudes of surface and body waves produced by each type of event. As far as one can tell from unclassified literature, Press *et al.* (*J. Geophys. Res.*, **68**, 2909; 1963) and Brune *et al.* (*J. Geophys. Res.*, **68**, 3501; 1963) were the first to show that underground nuclear explosions generate smaller surface waves than earthquakes of comparable Richter magnitude, although, curiously, this phenomenon had been predicted on theoretical grounds by the Russian Keylis-Borok (*Tr. Inst. Fiz. Zemli*, No. 15 (182), 71; 1961) some years before. Continuing work along these lines, Basham (*Geophys. J.*, **17**, 1; 1969) has analysed the vertical component P and Rayleigh waves from twenty-eight United States and Mexico earthquakes and twenty-eight United States nuclear explosions, each of which was recorded by nineteen stations within the Canadian seismographic network. Unfortunately for the present network, the minimum detection level for explosion Rayleigh waves corresponds to magnitude 3·5, and the lower limit of detection for earthquake P waves is magnitude 4·0. But within these limitations it is possible to discriminate between explosions and seismic events with a remarkable degree of accuracy.

Thus graphical comparisons of the magnitudes of the surface waves and the body waves produce distinct groupings for explosions and earthquakes. The regression curve for each group is linear and parallel to the other, the two lines having a surface wave magnitude separation of 1·1 and a body wave magnitude separation of 0·8. For each type of event, the individual points are scattered almost normally about their respective curves with only slight overlap in the distributions. In practical terms, this means that as long as observations are made on the same continent, underground nuclear explosions may be distinguished from seismic events in North America in 98 per cent of cases.

Analysis of previously published data also shows that discrimination between explosions and earthquakes is better for events observed on the same continent. In intercontinental systems, the situation is less satisfactory because continental margins produce surface wave attenuation to an unknown and variable degree. One effect of this is to increase the threshold level of wave observation by one degree of magnitude. But even on the intracontinental scale, the minimum detection level for each type of wave is influenced by the microseismic background. The threshold level may be higher during a period of strong microseism than during a quiet period by a degree of magnitude. Reduction of the threshold is almost entirely a technical problem; and with more sophisticated equipment it should be possible to achieve high degrees of explosion–earthquake discrimination down to lower magnitudes in intracontinental regions. The important point is that the principle behind the method has been adequately demonstrated.

CONSERVATION

Homes for Animals

LAST year the Board of Trade issued 626,850 licences for the importation of rare animals into Britain. Eighty-six were species for which licences are granted only after individual consideration by the advisory Committee on the Animals (Restriction of Importation) Act, 1964, which has just produced its third summary of statistics (HMSO, 4*s*). Nine apes were refused licences, but contraventions of the act—designed to protect rare wild animals by rigidly controlling importation—were rare and no animals were confiscated.

Family	Exhibition*	Scientific research†	Pets	Resale‡	Total
Marsupials					
Macropodidae (kangaroos and wallabies)	6	6	0	0	12
Phalangeridae (koalas, possums)	8	0	0	0	8
Primates					
Tardiidae (tarsiers)	4	0	0	0	4
Lemuridae (lemurs)	1	0	0	0	1
Cebidae (new world monkeys)	55	510	7	3,125	3,697
Callithricidae (marmosets, tamarins)	12	284	10	972	1,278
Cercopithecidae (old world monkeys)	137	18,510	49	2,502	21,198
Pongidae (anthropoid apes)	51	1	5	0	57
Ungulates					
Rhinocerotidae (rhinoceros)	3	0	0	0	3
Reptiles					
Testudinidae (tortoises)	129	3	87	599,605	599,824
Igunidae (iguana)	18	0	2	747	767
Sphenodontidae (tautara)	1	0	0	0	1
Total	425	19,314	160	606,951	626,850

* Includes zoos and breeding.
† Includes the production and testing of vaccines.
‡ Includes resale and exhibition, resale and re-export, resale and research.