females, 22 were pregnant (Table 1). This coincided with the sprouting of salt grass rhizomes in the habitat. Thus, the control population initiated reproductive activity approximately 6 weeks later than the treated island population.

We replicated the regime in the winter of 1975–1976 but began the experiment earlier in the winter, on 24 December. The basis for this procedure was our hypothesis that males in the previous experiment had responded in both areas to increasing photoperiod. We hypothesized that beginning the experimental regime closer to the winter solstice might more clearly demonstrate male responses to the wheatgrass supplement. In addition, we used two experimental areas, the island and another area on the mainland several hundred yards away. Two mainland control areas were also used. One of the control areas was located directly adjacent to the mainland experimental area but was separated from it by a channel of water and ice approximately 10 m wide. The treatment with sprouted wheat began on 27 December 1975 and ended on 10 January 1976.

The results (Table 2) were similar to those of the earlier experiment, although the incidence of pregnancies was lower. This was not unexpected, as the animals would not as yet have experienced the stimulating influence of increasing photoperiod. Hence, a somewhat greater time lag could be expected in response to the wheatgrass stimulus. Further, heavy snowfall during the feeding period resulted in about 50 percent less consumption of wheatgrass than in the previous experiment. Nonetheless, all but one of the females from the experimental areas (Table 2) were either pregnant or cycling with large developing follicles in the ovaries. Again, none of the females from the control areas were pregnant, and the ovaries from these animals lacked developing follicles. Similarly, male gonadal development was significantly affected in those populations receiving the grass supplements. Males from the experimental areas had a mean paired testicular weight of 89.9 ± 38.0 mg ($N = 10$) as compared to a mean testicular weight of 28.3 ± 11.2 mg ($N = 9$) in the control areas ($P < .01$, t-test). Histological examination of the testes demonstrated that 70 percent of the treated animals had begun active spermatogenesis as compared to no spermatogenesis in animals from the control areas. Continued sampling from the control areas demonstrated that the normal onset of breeding in the untreated populations did not occur until April 1976.

These results are unequivocal experimental evidence that wild populations of *M. montanus* cue their reproductive effort from compounds present in actively growing plant tissue. The results are noteworthy in view of the fact that the low temperature regimes of midwinter and the suboptimal food resources are unfavorable for reproduction and survival of young.

Few investigators have attempted to experimentally manipulate food resources in natural populations of microtine rodents. Krebs and DeLong (*6*) supplemented crimped oats or corn and chick starter mash in areas populated by *Microtus californicus* but observed no increases in reproductive activity, perhaps because of the absence of stimulating compounds present in growing plant tissues. However, there is abundant observational evidence that various species of mammals cue their reproductive efforts on the basis of chemical signals present in the plant food resources (*7*). Experimental manipulations of the sort described here should be undertaken with other species of herbivores to test the generality of this cueing mechanism.

We are currently working on the chemical isolation and identification of the plant compounds that stimulate reproductive activity in *M. montanus*. In the course of these studies we have identified a group of phenolic compounds that inhibit reproduction in both male and female *M. montanus* (*8*). These compounds are reported to increase in concentration in grasses as they approach flowering and fruiting (*9*). Simultaneously the stimulator compounds disappear in the matured plants. It thus seems probable that both initiation and termination of reproductive activity in *M. montanus* may be cued by chemical signals in the plant food resources, the inhibitors being effective only when the stimulators are absent. Further investigation of such plant-herbivore interactions may elucidate the problems of microtine population dynamics.

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References and Notes

1. For example, W. J. Hamilton, Jr., *J. Agric. Res.* **54**, 779 (1937); C. Elton, *Voles, Mice and Lemmings: Problems in Population Dynamics* (Oxford, London, 1942); F. A. Pitelka, *Cold Spring Harbor Symp. Quant. Biol.* **22**, 237 (1958); D. Chitty, *Can. J. Zool.* **38**, 99 (1960); G. O. Batzli and F. A. Pitelka, *J. Mammal.* **52**, 141 (1971); C. J. Krebs, M. S. Gaines, B. L. Keller, J. H. Myers, R. H. Tamarin, *Science* **179**, 35 (1973).
2. A. J. Pinter and N. C. Negus, *Am. J. Physiol.* **208**, 633 (1965); N. C. Negus and A. J. Pinter, *J. Mammal.* **47**, 596 (1966); R. Hinkley, Jr., *ibid.*, p. 396; P. J. Berger and N. C. Negus, *ibid.* **55**, 747 (1974); N. C. Negus and P. J. Berger, *Experientia* **27**, 215 (1971).
3. N. C. Negus *et al.*, *J. Mammal.*, in press.
4. Timpie Springs, Utah, is located 80 km west of Salt Lake City on Interstate 80.
5. Winter wheat was sprouted from seed in the greenhouse at the University of Utah. The wheat was sprouted in a vermiculite substrate to a height of 7 cm.
6. C. J. Krebs and K. T. DeLong, *J. Mammal.* **46**, 566 (1965).
7. W. E. Poole, *CSIRO Wildl. Res.* **5**, 21 (1960); A. E. Newsome, *ibid.* **11**, 187 (1966); J. C. Beatley, *Ecology* **50**, 721 (1969); N. C. Negus and P. J. Berger, in *Biology of Reproduction*, J. T. Velardo and B. A. Kasprow, Eds. (Third Pan American Congress of Anatomy, New Orleans, 1972), p. 89; H. G. Reynolds and F. Turkowski, *J. Mammal.* **53**, 893 (1972); K. M. Van de Graaf and R. P. Balda, *ibid.* **54**, 509 (1973).
8. P. J. Berger, E. H. Sanders, P. D. Gardner, N. C. Negus, *Science* **195**, 575 (1977).
9. S. Z. El-Basouni and G. H. N. Towers, *Can. J. Biochem.* **42**, 203 (1964); S. Kuwatsuka and H. Shindo, *Soil Sci. Plant Nutr. (Tokyo)* **19**, 219 (1973).
10. We thank E. F. Gordon for technical assistance. Supported by NSF grant GB-41725, NIH grant HD-07243, and PHS grant FR-07092.

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On Explosive Cenozoic Volcanism and Climatic Implications

We disagree with several of the major conclusions proposed by Ninkovich and Donn (*1*) concerning the Cenozoic history of explosive volcanism as determined from the analysis of volcanic ash in Deep Sea Drilling Project (DSDP) sites. In our previous discussion on the history of Neogene explosive volcanicity, we concluded that the distribution of volcanic ash reported in DSDP sites throughout the oceans is consistent with a much higher rate of explosive volcanism during the last 2 million years (*2*). Volcanism on a global basis and in various regions has *not* been uniform throughout the Neogene, but rather shows maxima in activity occurring during the Quaternary, at various times during the Pliocene, and during the Middle Miocene. These episodes are separated by intervals of much lower inferred intensity, although there is variability from region to region. The distribution of volcanic ash in deep-sea sequences is clearly the result of a number of factors other than the volcanism itself. These include the effects of plate motion, wind direction, wind speed, and diagenetic alteration of the ash, but these are unlikely to be the primary controls of the globally compiled Neogene record. Increased explosive volcanism during the last 2 million years coincides approximately with that episode of the Cenozoic marked by major and rapidly fluctuating climate.

Ninkovich and Donn's conclusions based on volcanic ash in western Pacific and Indonesian region DSDP sites of Neogene age and Quaternary piston cores are clearly in conflict, because they believe that the upward increase of volcanic ash in Neogene deep-sea drill cores that we reported is solely a reflection of sea-floor plate motion toward volcanic sources; they consider that the recovered marine record is insufficiently continuous to allow determinations of differences in rates of explosive volcanism through time. Ninkovich and Donn believe that the sites which have been essentially motionless relative to potential volcanic sources during the Neogene record uniformity of explosive volcanism. They ignore data from the terrestrial record over wide areas which clearly show that volcanism has not been uniform in intensity through the Neogene. Furthermore, they question the validity of our observed increase in Quaternary explosive volcanism and our belief of its potential paleoclimatic significance, although the potential importance of explosive volcanism as a possible modulating climatic factor is recognized.

These rather fundamental differences in our respective understanding of the history of Cenozoic explosive volcanism require us to amply comment on the previous arguments, to clarify misconceptions of our article by Ninkovich and Donn, and to point out important data not included by Ninkovich and Donn in their compilations.

The idea that plate motion has had an effect on the distribution of volcanic detritus in Neogene sequences was clearly demonstrated by Heezen *et al.* (3) and recognized by us (2) and by Stewart (4). The amount of influence that such plate motion has had on a conspicuous increase in Quaternary volcanic ash in deep-sea sites is, however, minimal, as we now demonstrate. The paleopositions of all ash-bearing DSDP sites have been determined for 5, 10, and 15 million years ago, using the ages of marine magnetic anomalies compiled by Pitman *et al.* (5) and the clockwise rotation of Pacific sites around a pole at 67°N, 59°W at a rate of 0.83° per million years (6). The DSDP sites as a whole are distributed over a wide range of tectonic regimes, with many located landward of island arc areas, within marginal basin complexes (such as the southwestern and western Pacific, the Panama Basin, and the Caribbean), or in enclosed seas (such as the Mediterranean and the Gulf of Mexico). A number of sites are on oceanic crust moving toward or away from potential source regions of volcanic ash. We have constructed a series of histograms in which the number of ash layers at these DSDP sites is plotted within the framework of the Neogene planktonic foraminiferal zones (Fig. 1). The data from those sites that are moving toward or away from volcanic sources have been eliminated from the compilation, so that the resulting pattern can be compared with the initial histogram containing all data. This shows that the amplitudes of certain peaks in Fig. 1 are changed slightly; however, the conspicuous Quaternary peak is still dominant. Thus we conclude that plate motions are clearly not the primary cause of the observed ash distributions in DSDP sequences.

For the sites south of Indonesia which are under the influence of northward plate motion toward the volcanic sources, the sequence we described for the last 10 million years (7) is similar to that of Ninkovich and Donn. They prefer, however, to interpret the curve entirely as a result of sea-floor motion moving the sites within a zone of ash distribution, the limits of which are defined by piston core observations, but they have not included some relevant data (8). For example, site 212 has two important levels of ash described by smear slide analysis in the initial report (9) as being 75 percent ash. The levels are dated as Early Pliocene, and therefore deposition would have occurred when the paleoposition of this site was well removed from the Quaternary ash-layer zone. These horizons of abundant ash clearly represent major volcanic episodes that created distribution patterns which cannot simply be related to plate motion history (1). A single Quaternary layer in site 218 is interpreted as the result of movement of this site into the inferred edge of the Quaternary ash zone arbitrarily drawn from sparse piston core data [see figure 1 in (1)]. The edge of this ash zone can be equally well drawn to show that site 218 was potentially completely within or out of range of volcanism throughout the last 10 million years. Thus, from the data presented, the Quaternary volcanic ash in this sequence can just as readily be explained as reflecting wider dispersal of ash, perhaps resulting from greater volcanic explosivity.

In the extreme northwest Pacific re-

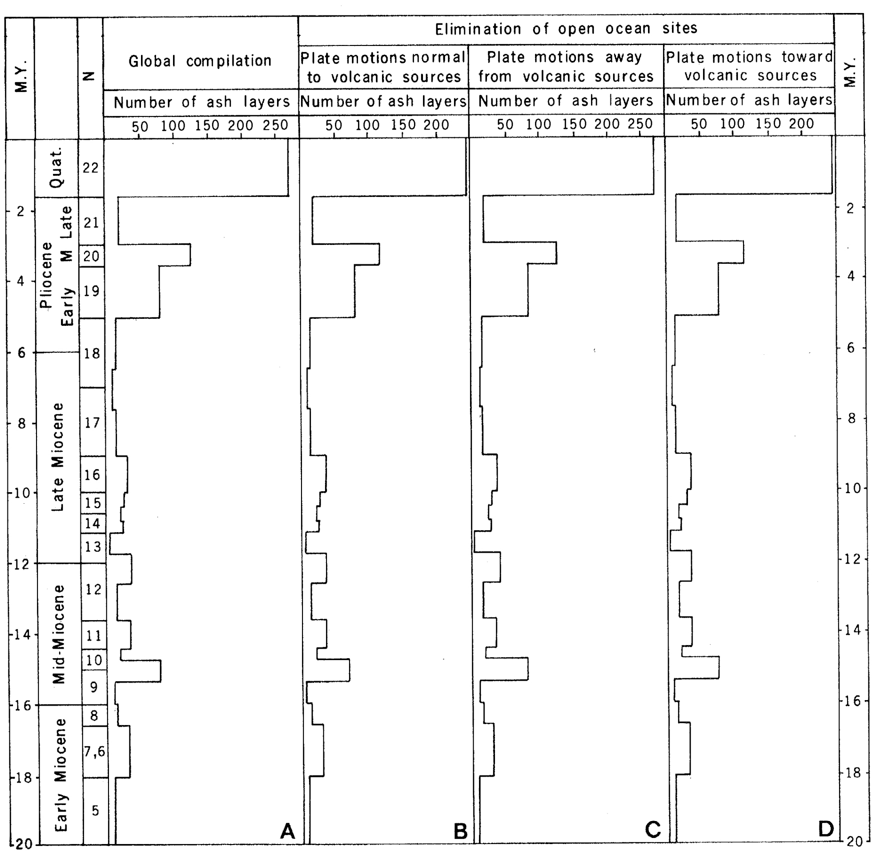

Fig. 1. Comparison of histograms representing the number of ash horizons in various deep-sea sedimentary sections (DSDP legs 1 to 31) demonstrating the effect of plate motions on the stratigraphy of volcanic ash in the Neogene. (A) Global compilation of all such recorded ash horizons plotted within the chronological framework of the *N* foraminiferal zonations. (B) All sites are eliminated that clearly show plate motion normal to (moving toward or away from) potential volcanic ash sources, as in certain areas of subduction. These sites include 47, 49, 50, 51, 52, 60, 79, 80, 81, 194, 195, 199, 211, 212, 213, and 216. (C and D) Compilations excluding sites that have undergone motion (C) away from and (D) toward potential volcanic sources. See (15) for more detailed discussions.

gion adjacent to Kamchatka and the Aleutian Islands, Ninkovich and Donn consider that a marked increase in the number of ash layers within the Quaternary of site 192 reflects the movement of this site toward Kamchatka. Although its relative motion is not well known (*10*), the site was also within range of volcanic debris from the Aleutians throughout the Late Cenozoic. Thus a dual volcanic source is probable, and the stratigraphic record of ash also partly reflects rates of change or of distance from volcanism in the Aleutians. Ninkovich and Donn (*1*) show no Quaternary ash in piston cores from the western part of the Aleutian Basin and use this distribution as a basis for their model. They did not, however, note Early and Middle Quaternary ash layers in site 188 located in the same region. Thus, ash distribution in Quaternary piston cores may not necessarily represent a useful standard of reference for ash distribution even through the entire Quaternary if there have been marked changes in volcanic explosivity. Large changes in the rates of volcanism have already been recorded in Late Cenozoic volcanic sequences of Kamchatka (*11*) and in the Aleutian region (*12*).

Ninkovich and Donn question the validity of our conclusions because of poor core recovery. We recognize that caution must be used in interpretations where the record is poor, but they did not note that normalization was used (*2*) to assist in compensating for this effect, even in sites where core recovery is relatively high. While stressing the poor core recovery of many DSDP sites, they also failed to include the most complete sequences in this region (DSDP leg 31). Detailed analyses of the volcanogenic debris were made on these sites by Donnelly (*13*). Furthermore, despite their call for restraint in interpreting the data, they have concluded after this unexplained data rejection that explosive volcanism has been relatively uniform during the Late Cenozoic. Our criticism is related to details of western Pacific volcanic history that they have not considered.

Excellent core recovery was obtained for site 292 near Luzon, Philippine Islands, providing an almost continuous well-dated stratigraphic sequence from the Early Oligocene to the Quaternary. This site has not been under the influence of any significant plate motion (*14*). The quantitative distribution of total volcanogenic debris, including volcanic ash, has been determined by Donnelly (*13*) and clearly shows that the tempo of explosive volcanism of this region has changed greatly during the Neogene and Oligocene (*13*). Although diagenetic alteration of volcanic glass has definitely occurred at some levels (*13*), the volcanic glass is relatively more abundant during periods of high eruptive activity (*13*), based on total volcanogenic debris, and there is a strong similarity between the curve representing total volcanogenic debris in site 292 and a curve we generated based on volcanic glass for the Philippine Basin sites (*15, 16*).

Likewise, excellent Neogene core recovery was obtained for site 296, which is located to the southeast of Japan and is important for the study of rates of volcanism of southern Japan and the Ryukyu Islands (*13*). This site also has not been under the influence of plate motion (*14*). It was also examined in detail by Donnelly (*13*) for total volcanogenic debris and again shows that the tempo of volcanic activity of Japan changed substantially throughout the Neogene (*17*). A hiatus cuts out some of the Middle Miocene at a time when it is known that there was significant activity in the Japanese islands (*18*), in contrast to Ninkovich and Donn's summary of the history of Japanese volcanism, which states that the Middle Miocene was a period of submergence. The sequence at site 296 mirrors ash distributions in site 297, which is 300 km southeast of Kyushu, Japan. In this sequence the greatest concentrations of volcanic ash occur in the latest Early to Middle Miocene and within the Quaternary. These results, as well as the distribution of the volcanic ash, agree with independent analyses of Sugimura and Uyeda (*19*), which showed that the most important pulses of volcanism in Japan were during the early Neogene and the Quaternary, and with the analyses of Karig (*20*), who concluded that geophysical and DSDP sedimentological evidence that the Philippine Sea has undergone tectonically related volcanic pulses along the northern and eastern margins (including the Mariana Islands).

For the Indonesian region, Ninkovich and Donn interpret our curve (*2*) only in terms of plate motion. They refer to the early work of van Bemmelen (*21, 22*) concerning the volcanic history of Indonesia. Van Bemmelen, however, is one of the strongest advocates of episodic volcanism, as shown in his studies of Indonesia (*21–23*). This changing activity is at least partly responsible for the peaks of Neogene activity shown in our work (*2*). Strong supporting evidence for the episodicity of volcanism comes from the terrestrial Neogene volcanic record in areas as widespread as the southwest Pacific, Central America, the Cascade Range of western North America (*15*), and the Lesser Antilles (*24*). For the Indonesian region, an important related study is that of Vallier and Kidd (*25*), who semiquantitatively examined the distribution of volcanic ash (smear slide analyses) in site 213 to the south of Indonesia. They show traces of volcanic ash throughout most of the section, separated by strong maxima during the latest Miocene, within the Early Pliocene, and in the Early Quaternary. The maxima are the same peaks discerned by us (*2*). Despite this, Ninkovich and Donn interpret the curve for site 213 (*25*) as indicating that glass shards have shown "essentially continual production since the beginning of the Late Miocene" (*1*, p. 901). The presence of trace amounts of volcanic debris, including volcanic ash, in DSDP sequences is common (*25*) and of very little value in interpretation. We recognize that in the sites south of Indonesia, the absence of Middle Miocene volcanic ash and the greater amplitude of the Quaternary peak (*26*) are partly related to plate motions, but we also believe that the record contains valuable information on the rates of explosive volcanic activity for this region.

Ninkovich and Donn present a thoughtful discussion of the possible effects of volcanic ash in climatic change. They believe, however, that the Northern Hemisphere ice sheets did not begin to develop until as late as 700,000 years ago. This is contrary to recent oxygen isotopic data, which indicate initial formation about 2.5 million years ago (*27*, pp. 801–807), relatively close to the beginning of increased Quaternary volcanism ($\sim$ 2 million years ago). Strong fluctuations in the size of these ice sheets have occurred since they first formed, although the largest fluctuations may have occurred during the last 700,000 years (*28*). The Antarctic ice cap formed long before this in the Middle Miocene and has since been an essentially permanent feature on the earth's surface (*27*, pp. 743–755; *29*).

In summary, we cannot agree with Ninkovich and Donn's (*1*) conclusion that the existing DSDP data indicate relative uniformity of explosive volcanism during the Middle and Late Cenozoic in the western Pacific and Indonesian regions, or that plate motion is the primary factor controlling the observed distribution of volcanic ash in DSDP sequences of Middle and Late Cenozoic age. On the other hand, ash in the DSDP cores can reflect changing rates of explosive volcanism through the Neogene, although the computed relative amplitudes of the episodes can be expected to change with future adjustments in chronology; future improvement in core recovery and normalization procedures, including adjustment for plate motion; and better knowledge of the effect of diagenetic alteration of volcanic ash layers.

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References and Notes

1. D. Ninkovich and W. L. Donn, *Science* **194**, 899 (1976).
2. J. P. Kennett and R. C. Thunell, *ibid.* **187**, 497 (1975).
3. B. C. Heezen *et al.*, in *Initial Reports of the Deep-Sea Drilling Project* (Government Printing Office, Washington, D.C., 1973), vol. 20, pp. 725–738.
4. R. J. Stewart, *Nature (London)* **258**, 505 (1975).
5. W. C. Pitman, R. L. Larson, E. M. Herron, *Geol. Soc. Am. Map Chart Ser. 6* (1974).
6. J. B. Minster, T. H. Jordan, P. Molnar, E. Haines, *Geophys. J. R. Astron. Soc.* **36**, 541 (1974).
7. The volcanic ash in the oceanic regions we differentiated may be derived from various sources. The assumption that the Middle Miocene ash peak in the Indonesian section is derived from the occurrence of ash in site 212 south of Indonesia is incorrect; it is based on ash in site 292 near Luzon, Philippine Islands.
8. Ninkovich and Donn do not seem consistent in what they consider to be an ash layer or an ash zone. For example, in site 211 they refer to five Quaternary ash layers, and yet in the leg 22 Initial Report two layers and three zones are distinguished. In contrast, they disregard Early Pliocene ash zones (25 to 75 percent ash) in sites 212 and 213.
9. C. C. von der Borch *et al.*, in *Initial Reports of the Deep-Sea Drilling Project* (Government Printing Office, Washington, D.C., 1974), vol. 22, p. 48.
10. J. S. Creager *et al.*, in *ibid.* (1973), vol. 19, pp. 464–465.
11. E. N. Erlich and I. V. Melekestsev, *Mod. Geol.* **3**, 183 (1972).
12. D. W. Scholl, M. S. Marlow, N. S. MacLeod, E. C. Buffington, *Geol. Soc. Am. Bull.* **87**, 547 (1976).
13. T. W. Donnelly, in *Initial Reports of the Deep-Sea Drilling Project* (Government Printing Office, Washington, D.C., 1975), vol. 31, pp. 577–597.
14. D. E. Karig *et al.*, in *ibid.*, pp. 67–79.
15. J. P. Kennett, A. R. McBirney, R. C. Thunell, *J. Volcanol. Geotherm. Res.*, in press.
16. Donnelly (*13*, p. 586) interprets the curve of volcanogenic abundance for site 292 as indicating that the volcanic activity of Luzon in the Oligocene was moderate, rose to a maximum near the Oligocene-Miocene boundary, and decreased in the earliest Miocene. A hiatus prevents evaluation of the Early Miocene, but the Middle Miocene is inferred to be a period of moderate volcanic activity, diminishing toward the Late Miocene and increasing to a probable maximum during the Late Miocene (12 to 7 million years ago). Activity began to increase significantly again during the latest Cenozoic at about 3 million years ago and reached a maximum during the Recent.
17. Donnelly (*13*) interprets the curves for site 296 as indicating a peak in volcanic activity in the late Early Miocene to Middle Miocene, declining toward the Late Miocene; a short-lived less significant peak about 9 million years ago; declining activity through most of the Late Miocene; and sharply increased activity about 5 million years ago. This latest episode can possibly be divided into early and late active phases and a middle somewhat less active phase (*13*).
18. A. Sugimura, personal communication cited by Donnelly (*13*).
19. A. Sugimura and S. Uyeda, *Island Arcs: Japan and Its Environs* (Elsevier, New York, 1973).
20. D. E. Karig, in *Initial Reports of the Deep-Sea Drilling Project* (Government Printing Office, Washington, D.C., 1975), vol. 31, pp. 857–879.
21. R. W. van Bemmelen, *The Geology of Indonesia* (Netherlands Printing Office, The Hague, 1949).
22. ———, *Geol. Mijnbouw* **40**, 399 (1961).
23. Van Bemmelen (*22*) refers to the intense tectonic and volcanic activity during the Middle Miocene of Indonesia, in contrast to the statement of Ninkovich and Donn (*1*) that this was a time of submergence.
24. H. Sigurdsson, personal communication.
25. T. L. Vallier and R. B. Kidd, *Eos*, in press.
26. In site 211 the Initial Reports indicate three ash layers in the Late Pliocene; not one as mentioned in Ninkovich and Donn (*1*). Sites 212 and 213 contain Early Pliocene ash zones not mentioned by Ninkovich and Donn.
27. N. J. Shackleton and J. P. Kennett, in *Initial Reports of the Deep-Sea Drilling Project* (Government Printing Office, Washington, D.C., 1975), vol. 29.
28. J. D. Hays, T. Saito, N. D. Opdyke, L. H. Burckle, *Geol. Soc. Am. Bull.* **80**, 1481 (1969).
29. S. M. Savin, R. G. Douglas, E. G. Stehli, *ibid.* **86**, 1499 (1975).
30. Supported by NSF grant DES74-19370 (Geological Oceanography). We thank N. D. Watkins, T. C. Moore, Jr., and S. Margolis for valuable criticism of the manuscript.

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Use of Correlation Statistics with Rubidium-Strontium Systematics

Although sample correlations are prominently displayed in their data table, Brooks *et al.* (*1*) do not say just how they have used r in deciphering the role of ancient lithosphere in young continental volcanism. What explanation they offer is relegated to reference 20, which records that "the data have been statistically evaluated by (i) calculating the Pearson correlation coefficient . . ., and (ii) testing the slope of the fitted line for significance against zero" [(*1*, p. 1093); see also (*2*)] In the experimental situations in which it is usually considered relevant, a test of the observed regression coefficient, b, against the hypothesis that the parent $\beta = 0$ reduces to a test of r against the hypothesis that $\rho = 0$ (*3*). Clearly, such a test is meaningful only in the event that ρ would indeed be zero in the absence of nonrandom linear association of the variables. As between variables that are ratios with a common or nearly common denominator, the type used both here and in related earlier work (*4*), however, it has been known at least since 1896 (*5*) that ρ will *not* be zero, and it is also implicit in the argument that $\beta \neq 0$ (*6*), in the absence of nonrandom linear association of the variables.

In most discussions of the Sr-Rb procedure for determining geological age the variables are given as $^{87}Sr/^{86}Sr$ and $Rb/^{86}Sr$, a clear example of correlation between two ratios having a common denominator; even if the three terms of the ratios are completely uncorrelated, the ratios will be positively correlated. In the current work the denominator of the second ratio is Sr rather than ^{86}Sr, which complicates but does not mitigate the situation.

It is possible, of course, that the common element bias is negligibly small, but this is a matter requiring demonstration or convincing rationalization in each specific case. That the denominator may perhaps be serving only as a convenient scaling device provides no escape; use of an uncorrelated scaling variable whose variance is sufficiently large will impose strong positive correlation on *any* pair of variables whose negative correlation is less than perfect. That the scaled data cluster closely about a regression line is then merely a consequence of the choice of scaling variable and says nothing about the nature of the relation between the variables being scaled. Given appropriate information about the sample of distribution of Sr it probably would be possible to generate, whether by exact calculation, approximation, or simulation, null values for ρ and β reflecting the common element effect on relations between the ratios of interest; observed correlations and regressions could then be tested against these, rather than against zero. Or if the bias in either proved very small, it could be ignored. The necessary information about Sr is not given in the article by Brooks *et al.*, however, and may not be available. In its absence appropriate null values for ρ cannot be obtained, but it does not follow from this that they are not needed.

By an analysis of covariance it is sometimes possible to test the significance of differences between regression coefficients without regard to correlation (*7*), and a numerical reduction of this type might provide a useful sample description. But a statistical test of the resulting variance ratio would be valid only if it were reasonable to assume that one of the isotope ratios was independent and the other was dependent upon it. The relation of the variables in question, however, is clearly one of interdependence rather than the dependence-independence implicit in standard regression analysis.

The authors' choice of a form of regression analysis suitable for interdependent variables is certainly appropriate, but if they then want to argue along the lines of reference 20 in (*1*), they are obligated both to demonstrate that the particular regression coefficient they use is free of common element bias and to explain just how r measures goodness of fit about their chosen regression line. They seem unaware of either obligation.