Pelagic shales show striking differences from shales associated with graywackes in that the slowly accumulating pelagic shales are thinner-bedded, more fissile when compacted, and flaky when weathering. In addition, they tend to be richer in boron, barium, chromium, copper, nickel and vanadium, elements typical of hydrolyzate environments. These elements are removed from the sea in greater quantities because of the slower deposition of pelagic shales, which show a much lower content of magnesium, manganese, and cobalt than shales associated with graywackes. The latter are thicker-bedded, slabby, and more compact, and they contain less organic material. The differences are a result, largely, of the rate of deposition; shales associated with graywackes represent the tail of a turbidity flow.

Graywackes are intermediate in composition between shales on the one hand and sandstones on the other.

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Note

1. The samples were collected by G. V. Middleton, who also determined the mineral composition by point-counting.

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Autonomy of Cytoplasmic Male Sterility in Grafted Scions of Tobacco

Abstract. Negative results were obtained in experiments designed to detect graft transmission to progeny of cytoplasmic male sterility in tobacco, contrary to positive results reported by Frankel in petunia. Attempts to show graft transmission of male fertility also failed. Evidently transmission of cytoplasmic male sterility through a graft union with a fertile individual is not an easily repeatable or else is not a general phenomenon in plants.

Frankel (*1*) has reported graft-induced transmission to progeny of cytoplasmic male sterility in certain cultures of petunia. Because of the considerable theoretical and practical interest attaching to such a demonstration, we have attempted to repeat the work by using cultures of cytoplasmic male sterile tobacco. Although these results are entirely negative, a published note seems desirable to indicate that graft transmission of cytoplasmic determination of male sterility is not a general or easily repeatable phenomenon in plants. The grafting experience of other workers (*2*) with cytoplasmic male sterility in petunias has also failed to demonstrate graft-induction or graft transmission of sterility.

The male sterile tobacco material used in these experiments was derived by pedigree culture from a type selected by Clayton (*3*) after an interspecific cross between *Nicotiana debneyi* as female and *N. tabacum*. Subsequent backcrosses to tobacco reinstated the tobacco genome. The male sterility and split-blossom characters were consistently maintained in recurrent backcrosses, and therefore, by inference, are associated with an autonomous cytoplasmic system, presumably contributed by *N. debneyi*. The behavior shown in repeated crosses is illustrated in Table 1 by cultures 1, 2, and 3. The recurrent fertile parent was an inbred line of Connecticut broadleaf cigar tobacco. The male-sterile family represented by culture 3 was the product of the 14th backcross to tobacco following the original cross with *N. debneyi*.

Table 1. Progeny obtained from grafted and control parents possessing cytoplasmic male sterility or fertility in *Nicotiana tabacum*.

Culture	Family	Parents		Progeny	
		Mating*	Pedigree	Fertile	Sterile
1	5685	U.S. × U.F.	55322-1 × 55 Kup.	0	20
2	5768	U.S. × U.F.	5685-22 × 569-9	0	16
3	5842	U.S. × U.F.	5768-3 × 577-2	0	19
4	S5863	S/F × U.F.	5768-3/577-2 × 577-1	0	55
5	S5859	U.F. Self	5710-3 Self	59	0
6	S5860	F/F Self	5710-4/577-4 Self	57	0
7	S5858	F/S Self	5710-2/5768-1 Self	48	0
8	S5861	F/S × U.F.	5710-2/5768-1 × 5710-3	51	0
9	S5862	U.F. × F/S	5710-3 × 5710-2/5768-1	54	0

* F, male fertile; S, male sterile; U.F., ungrafted fertile; U.S., ungrafted sterile. Graft type is shown as scion/stock. The scion was always used as parent.

Four families of plants were employed in the reciprocal grafting experiments in 1957. These included a male-sterile and a male-fertile broadleaf tobacco (families 5768 and 577), and a male-sterile and a male-fertile Havana seed tobacco (families 5767 and 5710). The ten whip grafts made in the field during the week of 17 Aug. 1957 comprised three sterile on fertile, three fertile on sterile, two fertile on fertile, and two sterile on sterile. These grafts were readily established, and the material was transplanted to the greenhouse in September along with two ungrafted fertiles and two ungrafted steriles.

Self-pollinations and intercrosses of a large number of types are possible if these five sterile and five fertile scions, five sterile and five fertile stocks, and the four ungrafted fertile and sterile controls are employed as parents. Fifty-three of the more significant of these pollination types were made during the period from September 1957 to February 1958, and seed was successfully harvested.

The sterile scions remained sterile and the fertile scions remained fertile in phenotype, irrespective of the stock type to which they were grafted, throughout the period of more than 6 months during which they were observed. This autonomy of scion phenotype is in agreement with the observations of Frankel on petunia grafts (*1*). However, Frankel's tests were interpreted to indicate that the "grafting induced changes in the fertile scion that resulted in the appearance of cytoplasmic sterility in its progeny."

The progeny results for our tobacco material are shown in Table 1 for seven critical pollinations grown as seven families (cultures 3 to 9) in the summer of 1958. Seed from the additional pollinations is still available, but loses much of its interest in the absence of a positive transmission effect. Culture 4, in comparison with 3, shows that male *fertility* is not transmitted from stock through scion to progeny. Culture 6 indicates that the grafting process itself has not induced detected male *sterility*. Cultures 7, 8, and 9, in comparison with cultures 5 and 6, give no indication of any influence of the cytoplasmic male sterile stock on the progeny obtained from the fertile scion. Rather, these data concur in the indication of autonomous control of cytoplasmic male sterility or fertility in these grafted scions of tobacco.

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References and Notes

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