PALEONTOLOGY

Parsing the Trilobites' Rise and Fall

In Earth's first evolutionary flowering, the Cambrian explosion, the trilobites—hardy, shelled arthropods beloved of fossil hunters everywhere—were big winners, quickly filling many niches on the ocean bottom. But they seemed to miss out on the next evolutionary burst, about 475 million years ago during the Ordovician period. While mollusks, corals, and stationary filter feeders diversified rapidly and laid the foundation for today's seafloor ecosystem, trilobites seemingly slid into a protracted decline. By 250 million years ago, they had disappeared for good.

Now on page 1922 of this issue, paleontologist Jonathan Adrain of London's Natural History Museum and two colleagues report that this widely accepted picture of the trilobites' fate is too simplistic. With a detailed new survey, they show that while one group, or fauna, of trilobites faded precipitously during the Ordovician, the other thrived. A still-mysterious combination of ecology, geographic distribution, and high rates of speciation evidently gave this fauna an evolutionary edge.

Other paleontologists are impressed. "The contrast between the two faunas is amazing," says David Jablonski of the University of Chicago. "You really get the sense of trilobites as a boom-and-bust group." Adds Arnold Miller of the University of Cincinnati: "This is an unassailable data set." But paleontologist Jack Sepkoski of the University of Chicago notes that even the more rapidly diversifying trilobites were laggards compared with other Ordovician organisms.

The new view of trilobite diversity stems from a reanalysis of the literature, led by Adrain. The team identified 945 genera and grouped them into 56 families that share common features, such as unique shell segments and shapes. They were then able to realize for the first time that the trilobites cluster into two major groups of families. Members of one cluster, the Ibex Fauna, dominated the start of the Ordovician but then grew less diverse and vanished at the end-Ordovician mass extinction 440 million years ago. The other cluster, the Whiterock Fauna, tripled their genera in the Ordovician and skimmed through that extinction virtually unscathed; not until 30 million years later did they start to wane.

These differences in rates of evolution are "the most compelling clue to [the faunas'] strikingly disjunct fates," the authors say. Although the Ibex Fauna did not stray far from the Cambrian forms, the Whiterock Fauna rapidly evolved novel shapes and spread into new niches, which may have insulated them from extinction. "Something different about this extinction allowed the more diverse families to survive," says Adrain, noting that diverse families weren't as protected in most other mass extinctions.

PHOTOS: P. HURST / NATURAL HISTORY MUSEUM

Biting the dust? Trilobites from the Ibex Fauna *(bottom)* vanished after the Ordovician period, while those from the Whiterock Fauna *(right)* thrived.

Ecology and geography may also have helped dictate the faunas' fates. Whiterock species preferred middepth environments in the ocean, while their Ibex cousins lived either in shallower or deeper water. And although tropical trilobites, including the Whiterockians, fared well, most high-latitude trilobites perished. No one knows exactly why these differences were important, but the extinction probably involved glaciation—which could have different effects at different latitudes—and the reorganization of ocean currents, adding up to what co-author Richard Fortey of the Natural History Museum calls a "global oceanic crisis."

To disentangle these factors, "we have to get out of the library and back into the field," says co-author Stephen Westrop of the University of Oklahoma, Norman. New fossil finds and studies of ocean conditions may reveal why some trilobites survived while others scuttled into silence on the sea floor.

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EVOLUTIONARY BIOLOGY

Females Pick Good Genes in Frogs, Flies

Finicky females have long mystified both suitors and evolutionary biologists, particularly when the female tends to pick the most flamboyant male, even if he doesn't appear to have any other redeeming qualities. Almost 70 years ago, R. A. Fisher threw up his hands and suggested that such preferences as the peahen's yen for a showy tail are arbitrary—whims that set off an evolutionary race won by the most outlandish male. By the mid-1970s, however, some biologists argued that females are not only finicky but wise. The exaggerated traits, they theorized, are a sign of less obvious "good genes" that will lead to fitter offspring. But testing these ideas has been difficult, as many factors can influence the success of offspring. "There's been a dearth of [good] data," says Richard Howard, a behavioral ecologist at Purdue University in West Lafayette, Indiana.

Now, on page 1928, Allison Welch and her colleagues at the University of Missouri, Columbia, present an elegant series of experiments that demonstrate good genes at work. They report that male tree frogs with long calls—known to be favored by females—sire higher quality young than those with short calls. The work fits well with a handful of other studies analyzing good genes, including a study in stalk-eyed flies that links the long stalks preferred by females to an unusual genetic advantage in males.

Together, these and other studies have convinced skeptics that finicky females are actually choosing good genes, although researchers disagree on whether the effect accounts for most female preferences. "I think the good-genes theory is coming into its own," says Mike Ritchie, an evolutionary geneticist at the University of St. Andrews in Scotland.

Few female tastes seem more whimsical than that of the gray tree frog (*Hyla versicolor*). Male frogs attract mates with calls that last from half a second to 2 seconds per call. Behavioral biologist H. Carl Gerhardt from the University of Missouri, Columbia, found that females head for long calls heard through a loudspeaker, even if the short calls are closer and louder. "They avoid the very short calls," he says.

C. GERHARDT

Frog Don Juan. For gray tree frogs, it's the good genes, not just the long song, that win over the females.

To explore whether the longer call signaled good genes, Welch, a graduate student,