feature is obscured by the three, major, through-going, late Mesozoic–early Tertiary elements of the Cordillera, namely (1) the eastern fold and thrust belt, formed largely from the displaced Proterozoic to Jurassic sedimentary prism (or miogeocline) that once fringed the craton, (2) the western accretionary prisms or subduction complexes, and (3) extensive granitic rocks. These impose a superficial simplicity on this 8,000-km-long fold belt. Its intrinsic complexity is reflected by the segmented nature of the Cordillera.

The Alaskan–western Yukon, Canadian–northwestern United States, California-Coloradan, and Mexican segments each have distinctive geologic characteristics different from those of adjoining segments. In part, these differences are due to features formed late in Cordilleran history, such as pervasive, dextral strike-slip faults in Alaska and Canada, and rotations and extensions in the conterminous United States. Other, far more fundamental, differences emerge from stratigraphic analysis of rocks west of the fold and thrust belt.

The western rocks can be divided into more than 40 terranes, each with distinctive laterally persistent stratigraphy which is different from those of neighboring terranes, and each is commonly separated from neighboring terranes by major faults. Each terrane consists of one or more tectonostratigraphic assemblages, interpreted mainly as deposits of volcanic arcs and ocean basins but including some rocks of probable continental origin. In addition, many terranes have paleontologic and paleomagnetic records different from those of coeval, colatitudinal deposits on the craton, so that the western Cordillera is interpreted as a collage of small crustal fragments accreted in different ways and times to the western margin of North America.

The Alaska–western Yukon segment is largely composed of small terranes, many of southerly derivation, each of which apparently remained a discrete entity until accretion late in Mesozoic time. The Canadian–northwestern United States segment is dominated by two large composite terranes made up of smaller fragments, again mainly derived from the south, that coalesced prior to accretion. The inner terrane accreted to the miogeocline in the Jurassic and the outer to the inner in the Cretaceous. Boundaries of the two composite terranes with one another and the miogeocline coincide with the two metamorphic, granitic, and deformational welts that dominate the Canadian Cordillera. Because the times of development of these welts also are the times of accretion, the welts are interpreted as being due largely to collisions of crustal fragments, rather than subduction of oceanic crust with accompanying upper plate magmatism. The California-Coloradan segment reflects successive accretions of small discrete fragments from middle Paleozoic time onward, together with possible removal of terranes, some of which subsequently possibly lodged farther north in the Cordillera. Recent studies in Mexico suggest that it, too, is made up of allochthonous fragments.

From the foregoing, it should be obvious that only the most rigorous and detailed geologic studies will enable us to understand the evolution of such a long-lived mountain belt as the Cordillera. This is only to be expected from the rapidly changing, complex patterns of movement known from recent plate movements.

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Interpretation of Subsurface Hydrocarbon Shows

Hydrocarbons occur in the subsurface in four modes: (1) continuous-phase oil or gas; (2) isolated droplets of oil or gas; (3) dissolved hydrocarbons; and (4) hydrocarbons associated with kerogen-bearing rocks. Any of these modes of occurrence can result in a subsurface hydrocarbon "show." Each type of show has strongly different implications for exploration and must be differentiated as the first step in show interpretation. Only continuous-phase occurrences of oil and gas indicate that a trapped and potentially producible accumulation of hydrocarbons has been discovered. Free oil or gas recovery from the formation, or subsurface hydrocarbon saturations of greater than 50%, indicate a continuous-phase occurrence.

Continuous-phase shows can be interpreted quantitatively. The static hydrocarbon column downdip from a continuous-phase occurrence can be calculated from one well bore if the subsurface oil or gas saturation, capillary properties, hydrocarbon-water interfacial tension, oil density, and water density of the reservoir are known. Producing wells are by definition continuous-phase oil or gas, and estimates of oil-water or gas-water contacts from this type of analysis can be useful in orderly and profitable field development.

Continuous-phase oil or gas can extend either updip or downdip from a commercial reservoir. Continuous-phase shows can also be interpreted quantitatively to determine how large an oil or gas column is required downdip to explain the show. By this method it can be determined whether an exploratory well penetrated the updip waste zone or downdip transition zone of an oil or gas field. Field studies indicate that quantitative interpretation of a noncommercial show can provide reliable estimates of the downdip hydrocarbon column. This type of data can be used in a systematic manner to explore for subtle stratigraphic and combination traps.