Alkaline igneous complex hosted gold deposits are a rare, but potentially substantial type of gold deposit. Cripple Creek, Colorado is one of the best known world class alkaline rock gold deposits. While Cripple Creek is one of the largest gold alkaline systems in the world, gold enrichment in these systems is still not well understood. Rattlesnake Hills is a recently discovered alkaline rock gold system located in central Wyoming. Rattlesnake Hills gold mineralization is hosted in alkaline igneous rocks and diatreme breccias, and is currently being explored by Evolving Gold Corp. During the 2008 and 2009 drill seasons, Evolving Gold Corp drilled 93 holes totaling 36,190 meters.

The local geology consists of Archean mica-rich schist basement rocks and 15 Tertiary intrusive bodies with varying lithologies of phonolite to quartz monzodiorite. The age of Rattlesnake Hills alkaline complex is 43-44 Ma. The three largest and most extensively drilled bodies of the alkaline complex: North Stock, South Stock, and Antelope Basin; however, South Stock is not currently being explored. North Stock is dominated by explosive diatreme breccias and porphyritic bodies, both containing gold mineralization. Antelope Basin is a large quartz monzodiorite body that has intruded schist basement and remains a target for gold mineralization. Localized faulting with regional faulting aligning with foliation shows a NW-SE to WNW-ESE trend dipping steeply. These structures provide structural controls for the gold mineralization.

Gold mineralization occurs in at least two styles: high grade gold+carbonate veins and low grade disseminated gold in altered rocks. Evolving Gold Corp has intersected numerous high-grade zones at North Stock and Antelope Basin typically surrounded by a halo of low-grade disseminated gold.

Ore microscopy of 30 thin sections shows the main ore minerals are gold, pyrite, marcasite, chalcopyrite, and sphalerite. Petrographic results show gold occurs in pseudomorphic pyrite after bladed marcasite, blocky marcasite, and pyrite. Gold bearing pyrite and gold bearing marcasite do not occur together; however, nonmineralized marcasite and pyrite can be intergrown, but where there are stringers of the two, marcasite is generally earlier than the pyrite. Gold most commonly is associated with sulfide rich carbonate veins in porphyritic intrusions or “green” potassically altered schist. Based on color variations of gold grains, it is probable that the composition of gold varies from grain to grain with some enriched in copper. There are multiple fluid events in the deposit, making paragenesis difficult to determine.
QEMSCAN analysis of 11 thin sections samples using back scatter imaging produces false-colored images taken across a 20-micron resolution. The main ore minerals are gold, silver, electrum, pyrite, and arsenian pyrite. Gold, silver, and electrum most frequently occur in/with pyrite. The results confirm the petrographic analysis. QEMSCAN images show several features: 1. Strong K-feldspar alteration in all samples, by percent volume ~40-84%, 2. Pyrite with arsenian pyrite rims is associated with muscovite-sericite zones, 3. There are generally two generations of carbonate in veins (in calcite-rich veins early calcite is rimmed by Mg and Fe-bearing calcite, and dolomite-rich veins show early dolomite with late Mg and Fe-bearing dolomite), 4. Pyrite associated with gold mineralization is at the vein contacts with wall rock or is associated with early carbonate generations, 5. Most gold, silver, and electrum grains range from 10-25 μm.

There is a rarity of fluid inclusions throughout the system. Most inclusions are extremely small (1-10 μm) and dark, making inclusion work challenging. Additionally, fluid inclusions are associated with later carbonate generations, which do not carry gold.

Ongoing research includes determining if carbonate veins throughout the system are genetically related and to compare the source of carbonate in these veins.

Rattlesnake Hills is comparable to Cripple Creek, and have several similarities. Both complexes lie along a trend of alkaline complexes that extend from Mexico to Canada. However, Rattlesnake Hills is Eocene in age, and slightly older than Oligocene alkaline complex of Cripple Creek. Rattlesnake Hills and Cripple Creek have similar rock types ranging from diatreme breccias, phonolite, and porphyries. Gold mineralization styles at both complexes occur as high-grade veins with low-grade disseminated halos of mineralization in altered wall rock. Cripple Creek is has less intense potassic alteration, and there are no known zones of tellurides at Rattlesnake Hills.