6 Intrusion-related gold deposits
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6.1 Introduction

A broad spectrum of gold mineralization styles is found in the epizonal intrusive environment, and a number of these give rise to world-class gold deposits (Figure 6.1). Here the spectrum is subdivided into: (a) intrusion-hosted stockwork/disseminated deposits of both porphyry and non-porphyry types, the former possessing all the essential geological attributes (especially multidirectional stockworks) of typical porphyry copper and/or molybdenum deposits; (b) skarn and non-skarn replacement deposits in carbonate wallrocks; (c) stockwork, disseminated and replacement deposits in non-carbonate wallrocks; (d) wallrock-hosted breccia pipes; and (e) veins in both intrusions and wallrocks. This spectrum of deposits is transitional upwards to the volcanic-hosted, epithermal gold environment, which is mentioned only briefly in this chapter but discussed at length by Henley (this volume).

This chapter documents the variety of intrusion-related gold deposits, and considers their interrelationships and origin. Major, newly discovered deposits of current economic importance are emphasized throughout (Figure 6.1). Deposits in which gold possesses only by-product status are largely omitted even though the tonnage of contained gold may be large (e.g. Bingham porphyry copper–molybdenum deposit, Utah, USA).

6.2 Geotectonic settings

The majority (at least 85%) of the intrusion-related gold deposits used as examples in this review were generated at Phanerozoic convergent plate margins above zones of active subduction. The convergent margins ranged from primitive through mature island arcs to continental margins. Clearly the overall constitution and thickness of the lithosphere are not fundamental controls of intrusion-related gold deposits, although carbonate-hosted gold mineralization is more widespread in continental-margin arcs than in island arcs because of the restriction of shelf-carbonate sequences to the former (Sillitoe, 1989a). However, linear zones of crustal weakness that underwent repeated reactivation localized some of the deposits; Fortitude and McCoy-Cove (Tables 6.3 and 6.4) in the Battle Mountain-Eureka trend of Nevada, USA (Roberts, 1966), and Tai Parit (Table 6.4) in the Bau trend of Sarawak, East Malaysia (Sillitoe and Bonham, 1990), are typical examples.

In the western Pacific region, overriding plates and their volcano-plutonic arcs were commonly subjected to neutral or extensional stress regimes during mid- to
Figure 6.1 Grade–tonnage plot for representative gold deposits reviewed in this chapter. Data are taken from references listed in Tables 6.1 to 6.7 or from the mining press. The total gold tonnages in Tables 6.1 to 6.7 may be greater than those implied by this figure which for some deposits does not include previous production because the grades are unknown. Numbers: 1 Lepanto, 2 Santo Tomas II, 3 Dizon, 4 Ok Tedi, 5 Cuervo, 6 Marte, 7 Boddington, 8 Zortman-Landusky, 9 Salave, 10 Gilt Edge, 11 Kori Kollo, 12 Fortitude, 13 McCoy, 14 Nickel Plate, 15 Red Dome, 16 Thanksgiving, 17 Barney’s Canyon, 18 Tai Parit, 19 Star Pointer, 20 Ketza River, 21 Cove, 22 Beal, 23 Quesnel River, 24 Equity Silver, 25 Mount Morgan, 26a Porgera (Waruwari), 26b Porgera (Zone VII), 27 Montana Tunnels, 28 Golden Sunlight, 29 Colosseum, 30 Ortiz, 31 Kidston, 32 Mount Leyshon, 33 Chadbourne, 34 Charters Towers, 35 Los Mantos de Punitaqui, 36 Masara.

late-Cainozoic intrusion and gold mineralization, but more rarely overthrusting (e.g. Ok Tedi, Papua New Guinea; Table 6.1) or strike-slip faulting (e.g. Masara, Philippines; Table 6.7) were prevalent (Sillitoe, 1989b). Extensional conditions were commonly accompanied by bimodal magmatism dominated by silicic products (Sillitoe, 1989a, b), and a comparable geotectonic setting may have characterized northern Queensland, Australia, in the Carboniferous when gold deposits (Kidston,