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Filed Pursuant to Rule 424(b)(7)
Registration No. 333-172640

PROSPECTUS SUPPLEMENT
(To prospectus dated March 11, 2011)

10,000,000 Shares

noranda

Noranda Aluminum Holding Corporation

Common Stock

The selling stockholders are offering to sell 10,000,000 shares of common stock to the underwriter named below. We will not receive any of the proceeds from the shares of common stock sold by the selling stockholders.

Our common stock is listed on the New York Stock Exchange (the "NYSE") under the symbol "NOR." The last reported closing sale price of our common stock on March 11, 2014 was $4.91 per share.

Investing in our common stock involves risk. See the "Risk Factors" section beginning on page S-4 of this prospectus supplement for a discussion of certain risks you should consider before investing in our common stock.

The underwriter has agreed to purchase the common stock from the selling stockholders at a price of $4.50 per share, resulting in $45.0 million in aggregate proceeds, before expenses, to the selling stockholders.

The underwriter may offer the shares of common stock from time to time to purchasers in one or more transactions directly or through agents, or through brokers in brokerage transactions on the NYSE or to dealers in negotiated transactions or in a combination of such methods of sale, at a fixed price or prices, which may be changed, or at market prices prevailing at the time of sale, at prices related to such prevailing market prices or at negotiated prices. See "Underwriting."

The underwriter has the option to purchase up to 1,500,000 additional shares from the selling stockholders at a price of $4.50 per share within 30 days from the date of this prospectus supplement.

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or determined if this prospectus is truthful or complete. Any representation to the contrary is a criminal offense.

The shares will be ready for delivery on or about March 17, 2014.

The date of this prospectus supplement is March 11, 2014.

Morgan Stanley

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In addition, in recent years, the stock market has experienced significant price and volume fluctuations. This volatility has had a significant impact on the market price of securities issued by many companies, including companies in our industry. The changes frequently appear to occur without regard to the operating performance of the affected companies. Hence, the price of our common stock could fluctuate based upon factors that have little or nothing to do with Noranda, and these fluctuations could materially reduce our share price.

Apollo will continue to be able to substantially influence our company and the outcome of all matters voted upon by our shareholders, and to prevent actions which a shareholder may otherwise view favorably.

After the consummation of this offering, Apollo will beneficially own approximately 33.67% of our common stock assuming that the underwriter does not exercise its option to purchase additional shares. Because it will continue to beneficially own greater than 30% of our common stock, Apollo will retain the right to cause the Board of Directors to nominate to our Board of Directors six Apollo designees. In addition, Apollo will retain the right to cause the Board of Directors to nominate to our Board of Directors five Apollo designees so long as Apollo beneficially owns greater than 20% but less than 30% of our common stock, and four Apollo designees so long as Apollo beneficially owns greater than 10% but less than 20% of our common stock. Thus, Apollo will continue to be able to significantly influence or effectively control our decisions.

The interests of Apollo could conflict with or differ from your interests as a holder of our common stock. For example, the concentration of ownership held by Apollo could delay, defer or prevent a change of control of Noranda or impede a merger, takeover or other business combination that you as a stockholder may otherwise view favorably. Additionally, Apollo is in the business of making or advising on investments in companies and holds, and may from time to time in the future acquire interests in, or provide advice to, businesses that directly or indirectly compete with certain portions of our business or are suppliers or customers of ours. Apollo may also pursue acquisitions that may be complementary to our business, and, as a result, those acquisition opportunities may not be available to us. A sale of a substantial number of shares of stock in the future by funds affiliated with Apollo could cause our stock price to decline.

Any declaration and payment of future dividends to holders of our common stock is limited by restrictive covenants of our debt agreements, and will be at the sole discretion of our Board of Directors and will also depend on many factors.

Any declaration and payment of future dividends to holders of our common stock is limited by restrictive covenants of our debt agreements, and will be at the sole discretion of our Board of Directors and will depend on many factors, including our financial condition, earnings, capital requirements, level of indebtedness, statutory and contractual restrictions applying to the payment of dividends and other considerations that our Board of Directors deems relevant.

The terms of our senior secured credit facilities and the indenture governing Noranda AcquisitionCo's notes may restrict the ability of Noranda HoldCo's subsidiaries to pay dividends to Noranda HoldCo. Given that Noranda HoldCo has no direct operations and no significant assets other than ownership of 100% of the stock of Noranda AcquisitionCo, these restrictions in turn may restrict our ability to pay dividends on our common stock. Furthermore, we are permitted under the terms of our debt agreements to incur additional indebtedness that may further restrict or prohibit the payment of dividends. The agreements governing our current and future indebtedness may not permit us to pay dividends on our common stock. See "Dividend Policy."

Future sales or the possibility of future sales of a substantial amount of our common stock may depress the price of shares of our common stock.

Future sales or the availability for sale of substantial amounts of our common stock in the public market could adversely affect the prevailing market price of our common stock and could impair our ability to raise capital through future sales of equity securities.